Oklahoma
Forest Resource Assessment

2010

The Oklahoma Forest Resource Assessment, 2010

A comprehensive analysis of forest-related conditions, trends, threats and opportunities

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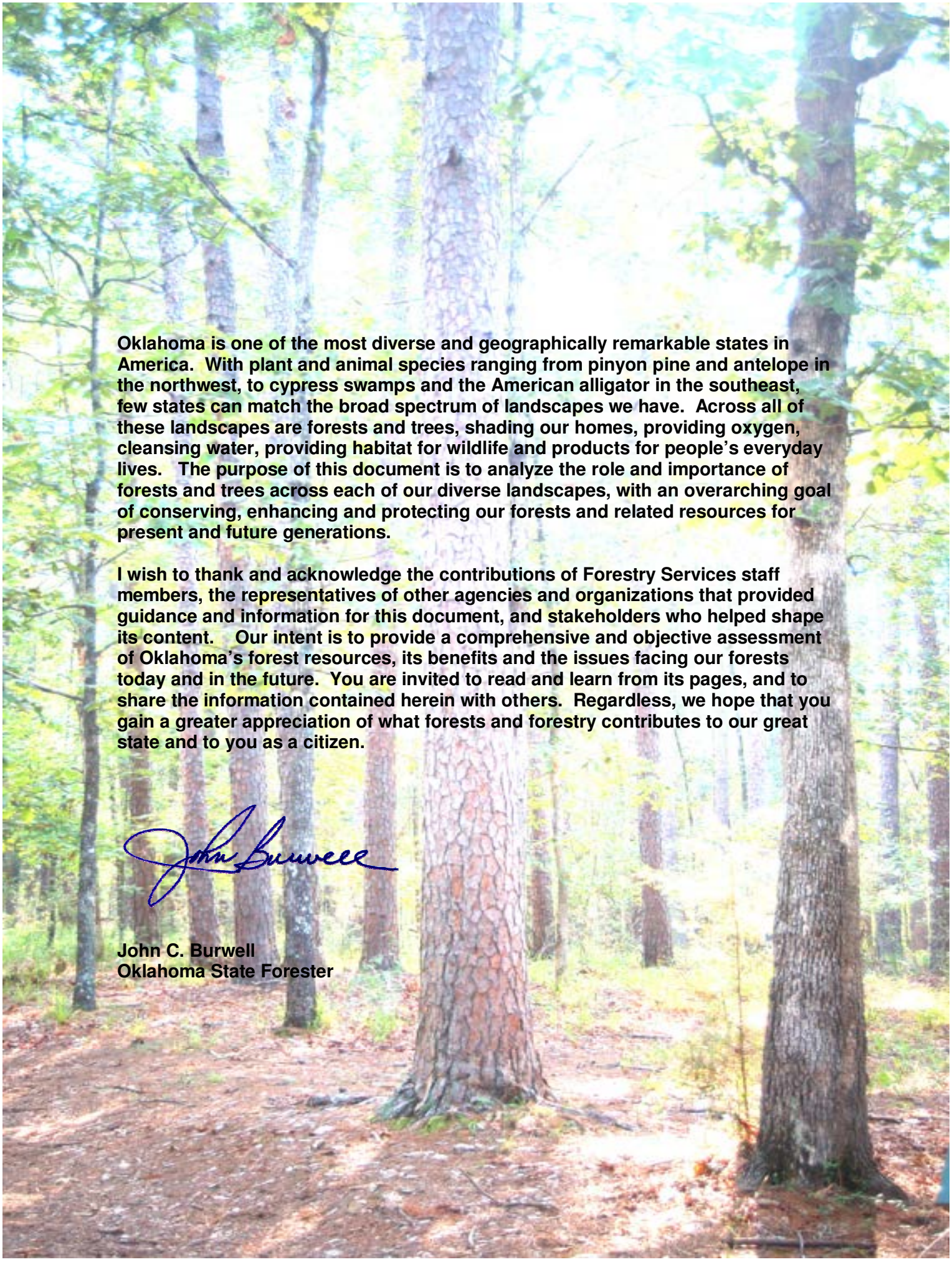

Oklahoma is one of the most diverse and geographically remarkable states in America. With plant and animal species ranging from pinyon pine and antelope in the northwest, to cypress swamps and the American alligator in the southeast, few states can match the broad spectrum of landscapes we have. Across all of these landscapes are forests and trees, shading our homes, providing oxygen, cleansing water, providing habitat for wildlife and products for people's everyday lives. The purpose of this document is to analyze the role and importance of forests and trees across each of our diverse landscapes, with an overarching goal of conserving, enhancing and protecting our forests and related resources for present and future generations.

I wish to thank and acknowledge the contributions of Forestry Services staff members, the representatives of other agencies and organizations that provided guidance and information for this document, and stakeholders who helped shape its content. Our intent is to provide a comprehensive and objective assessment of Oklahoma's forest resources, its benefits and the issues facing our forests today and in the future. You are invited to read and learn from its pages, and to share the information contained herein with others. Regardless, we hope that you gain a greater appreciation of what forests and forestry contributes to our great state and to you as a citizen.

John C. Burwell
Oklahoma State Forester

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Executive Summary

Oklahoma Forestry Services originally assessed the forest resources of the state in the early 1980s. Significant changes in the demands on our forests led Congress to mandate that each state develop a new assessment and a strategic plan to help guide the programs that affect them. The Oklahoma Forest Resource Assessment was developed in response to this mandate.

Oklahoma has a diverse landscape with nine different forest types and ten major ecoregions. Forest types that are commonly associated with states in the northeast, the southeast, the southwest and even the Rocky Mountains are represented across Oklahoma's landscape. Oklahoma exhibits many soil types: limestone, sandstone, and shale soils of the prairie; fertile alluvial soils along rivers and streams; and the distinct red clay soils of western Oklahoma. Oklahoma's climate is continental with mild winters and hot, humid summers and temperatures ranging from 65º F in the southeast to 55º F in the Panhandle. Most of Oklahoma's precipitation occurs in the spring and fall averaging over 50 inches in southeastern Oklahoma to just 18 inches in the northwest. Oklahoma occasionally suffers through extended periods of drought that tend to limit native vegetation communities to a great extent, especially along the western fringes of the eastern and southeastern forest types common to the United States' eastern states.

Oklahoma is usually depicted as a land of wide-open prairies and few trees. People are generally surprised to learn that more than one-fifth of the state's 44 million acres is forested. Oklahoma's landscape is currently covered with approximately 10 million acres of forests compared to a historical figure of 13 million acres. The state's most productive forests, in terms of growth rates, are found in the eastern and southeastern part of the state, but forests with unique and significant values can be found statewide.

The diversity of Oklahoma's landscape presents many natural resource management challenges. Oklahoma's forests are approximately 90% privately owned. Many of these private forestlands, valued for so many resources and different objectives, are being lost to urban and suburban developments and infrastructure; to oil, gas and other mineral exploration and production; and to conversion to croplands and grazing lands. Economic pressures on forest owners, such as escalating land values and estate taxes, often lead to the conversion of rural areas into developed areas that extend into cities and towns. The state's population continues to increase and more people want their own private 5 - 10 acre tract. These pressures contribute to the permanent loss of forested landscapes.

There are also numerous other threats including insects and diseases, invasive species and wildfires that need more progressive strategies to assure the conservation of our forest resources. Oklahoma Forestry Services needs to evaluate the way it delivers its programs to guarantee efficiency and effectiveness of its efforts to serve the public's need for healthy and sustainable forest resources.

As part of the State & Private Forestry (S&PF) Redesign process and required by an amendment to the Cooperative Forestry Assistance Act (CFAA), as enacted in the 2008 Farm Bill, each state is required to complete their State Assessment and Resource Strategy by June 18, 2010. There are three components to the assessment and planning strategy: Statewide Assessment of Forest Resources, Statewide Forest Resource Strategy, and Annual Report on Use of Funds.

Congress is requiring additional accountability on how federal funds are spent and wants assurance that the nation's most important forestlands are being targeted. In response to these increasing demands, the USDA Forest Service, in cooperation with the National Association of State Foresters is in the process of transforming how federally funded S&PF programs are being delivered.

The S&PF Redesign focuses on three State and Private Forestry national priorities: conserve working forests, protect forests from harm, and enhance benefits from trees and forests. The 2008 Farm Bill requires at a minimum that state assessments include:

- An analysis of forest conditions and trends
- Forest related benefits and values

- Threats to the forest resources
- Issues of concern and opportunities for action
- Priority rural and urban forest landscapes
- Multi-State or regional priority areas
- A review of existing statewide natural resource plans

The Oklahoma Forest Resource Assessment was developed by Oklahoma Forestry Services with the help of interested stakeholders. The assessment describes the condition of the forest resources as well as the associated benefits and values. Oklahoma Forestry Services and stakeholders identified six critical forest issues impacting Oklahoma's forests. These issues are described in detail in this assessment and priority forestlands are identified for each issue by geospatial analysis. These priority forestlands identified depict where work and funding should be focused in the state. Strategies to address the high priority forestlands will be discussed in the Oklahoma Forest Resource Strategy. The six critical forest issues identified and described within this assessment are:

- Forest Sustainability and Health
- Wildfire Risk to the Forest Resource
- Forest Economics and Markets
- Water Quality and Availability
- Community Forest Health and Care
- Impacts of Climate Change on Oklahoma's Forests

Several statewide and regional natural resource plans were used in developing this Statewide Forest Resource Assessment including the 2005 Oklahoma Comprehensive Wildlife Conservation Strategy, The Oklahoma Forest Legacy Plan, The Nature Conservancy – Ecoregional Plans, the 2007 Oklahoma Comprehensive Outdoor Recreation Plan and the 1980 Oklahoma Forest Resource Issues Assessment.

Forest Resource Conditions, Benefits, and Threats

Oklahoma's forests are more diverse than most states because it lays within a transition zone for climate and vegetative cover within the United States. Eastern Oklahoma's forests consist of tall oak, hickory, and pine trees; central Oklahoma's forests consist mostly of shorter oak and bottomland hardwood trees; and western Oklahoma's forests are mostly upland oaks, bottomland hardwood, juniper and urban trees. The temperature and annual precipitation are significantly different between the northwest and southeast corners of the state, which make an obvious difference in the type of vegetation that grows as well as biodiversity found. All of the forests provide Oklahomans with numerous benefits and values such as wood products, job opportunities, economic growth, wildlife habitats, clean air and water, and recreation. These benefits and values provided by the forests are threatened by many factors and could be lost if forests are not sustainably managed.

Forest Resource Conditions

In this statewide assessment of Oklahoma's forest resources, nine different forest types occurring within 10 diverse ecoregions are described. Forests are found throughout the state but most occur in the central and eastern regions. Variations in soils, climate, and topography play a major role in the type and size of the state's trees and vegetation. Some of the oldest trees found in the state range from only 10 to 30 feet tall. Oklahoma's forests have a rich history and have recovered well from the excessive timber harvesting of the early settlers. Oklahoma's forests cover approximately 23 percent of the landscape and the vast majority of the forests are owned by private landowners.

Oklahoma's Topography, Climate, and Natural Resources

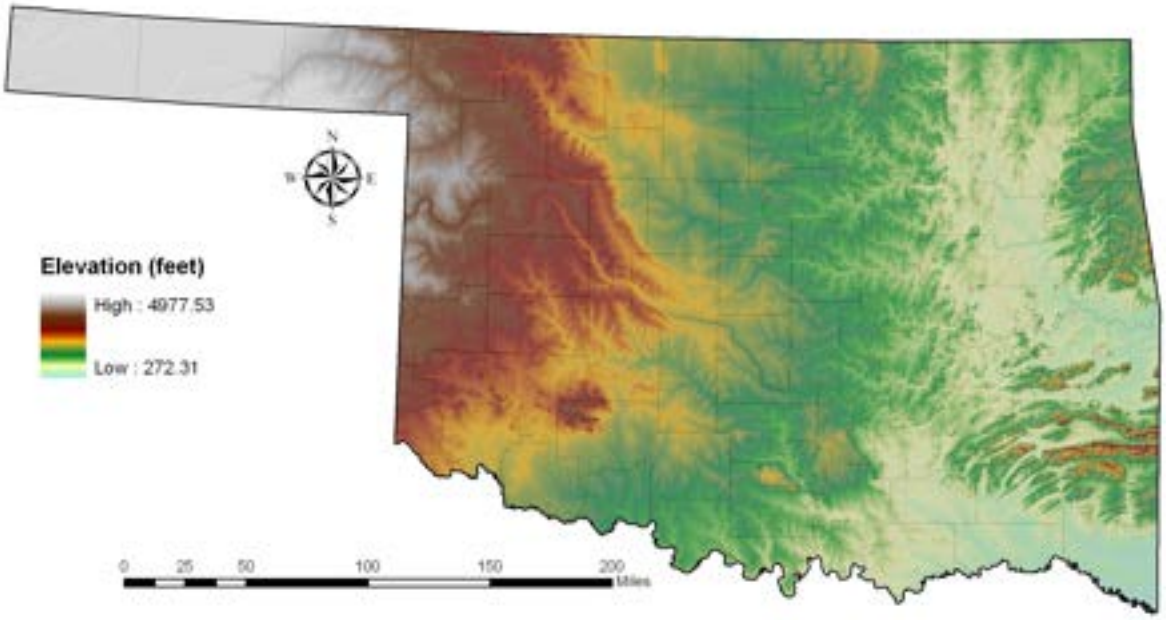
The climate and topographic features of Oklahoma are summarized within this section by Derek Arndt, with the Oklahoma Climatological Survey. Oklahoma is located in the southern Great Plains. Of the 50 states, it ranks 20th in size, with an area of 43,954,560 acres, over 800,000 acres of which are covered by water and approximately 10,000,000 acres are covered by forests. The terrain is mostly plains, varying from nearly flat in the west to rolling in the central and near east, with a general slope upward from east to west.

Topographic Features

The plains are broken by scattered hilly areas, covered by small oak trees, where most points are 600 feet or less above the adjacent countryside. These hilly areas include the Wichita Mountains in the southwest, and the Arbuckle Mountains in the south-central. The Ouachita Mountains, where pine – hardwood forests grow, dominate much of the southeast, with peaks that rise as much as 2,000 feet above the base. Extreme east central Oklahoma features the mountains of the Arkansas River Valley, which rise several hundred feet above the plains.

Extreme northeastern counties are part of the Ozark Plateau, which is marked by steep, rocky river valleys between large areas of hills and rolling plains covered with large hickory and oak trees. The western tip of the panhandle features part of the Black Mesa complex, a fractured terrain featuring large mesas overlooking seasonal creeks and riverbeds. Near Black Mesa State Park is the only area of the state where native pinyon pine and ponderosa pine forests and woodlands are found. Elevations run from 287 feet above sea level where the Little River exits in southeastern Oklahoma to 4,973 feet on the Black Mesa near the New Mexico border.

Figure 1: *Map of Oklahoma elevations*



The state's elevation is simply a clip of the USGS Digital Elevation Model (DEM), which overlays a virtual hillshade of the same data, at 40% transparency.

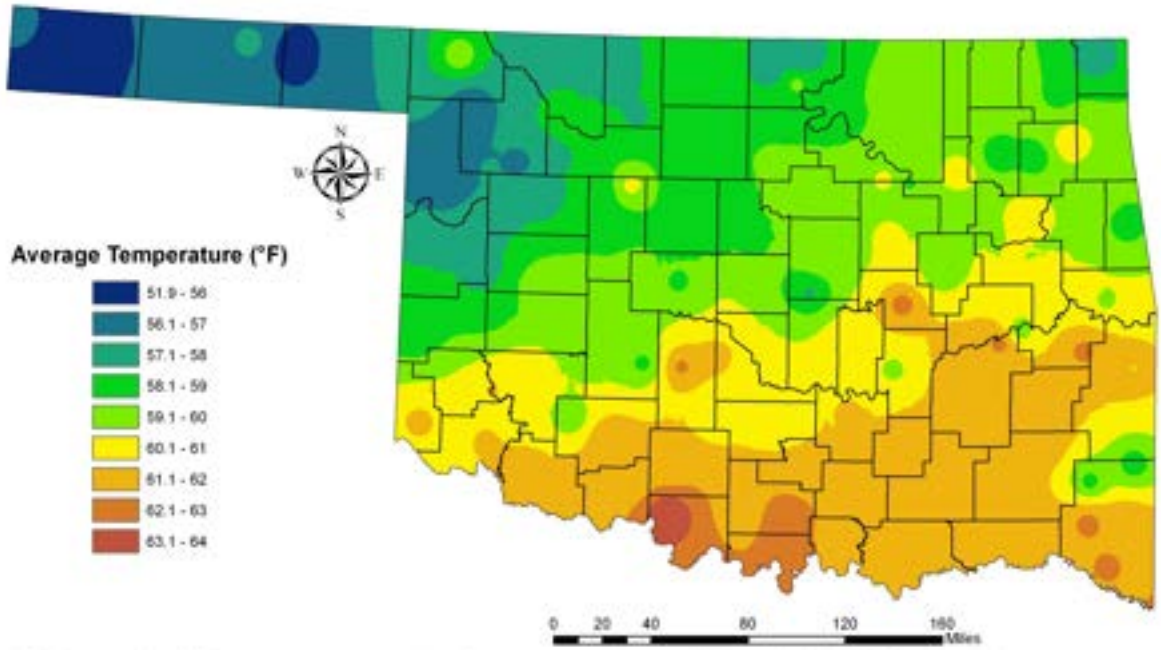
Oklahoma lies entirely within the drainage basin of the Mississippi River. The two main rivers in the state are the Arkansas, which drains the northern two-thirds of the state and the Red, which drains the southern third and serves as the state's southern border. Principal tributaries of the Arkansas are the Verdigris, Grand (Neosho), Illinois, Cimarron, Canadian, and North Canadian. The Washita and Kiamichi serve as the Red's principal tributaries in Oklahoma, with the Little River flowing into the Red after it crosses into Arkansas. Along the main rivers and tributaries is where the bottomland hardwood forests can be found. The hardwood species growing in the bottomland hardwood forests differ from east to west.

Climatic Features

The climate of Oklahoma is continental, as is all the Great Plains Region. Warm, moist air moving northward from the Gulf of Mexico often exerts much influence, particularly over the southern and eastern portions of the state, where humidity, cloudiness and precipitation are resultantly greater than in western and northern sections. Summers are long and usually quite hot. Winters are shorter and less rigorous than those of the more northern Plains states. Periods of extreme cold are infrequent, and those lasting more than a few days are rare.

The mean temperature over the state ranges from 62° F along the Red River to about 58° F along the northern border. It then decreases westward to 56° F in Cimarron County. The number of days reaching or exceeding temperatures of 90° F ranges from 60-65 days per year in the northern corners of the state, about 115 days in the southwest, and 85 days in the southeast. Temperatures of 100° F or higher occur, frequently during some years, from May through September, and very rarely in April and October. Years without 100° F temperatures are rare, ranging from about one of every seven years in the eastern half of the state to somewhat rarer in the west.

Figure 2: *Map of Average Temperature across Oklahoma*



The Average Annual Temperature map was produced from temperature data spanning from 1971 to 2000. One hundred and seventeen Mesonet stations within the State of Oklahoma, Arkansas's Texarkana weather station, and Colorado's Trinidad Airport weather station were used to interpolate a continuous raster covering the entire state. Inverse Distance Weighting (IDW) was used as the interpolation method.

The average length of the growing season, or freeze-free period, is at a maximum of about 225-230 days in the southern tier of counties and in the Arkansas River valley downstream of Tulsa. The general northwest-to-southeast gradient is interrupted in the Ouachita Mountains, where growing seasons are three to four weeks shorter compared to surrounding areas. Frozen soil is not a major problem, nor much of a deterrent to seasonal activities. Its occurrence is rather infrequent, of very limited depth, and of brief duration. The average depth that frost penetrates the soil ranges from less than three inches in the southeastern corner of the state to more than ten inches in the northwestern reaches.

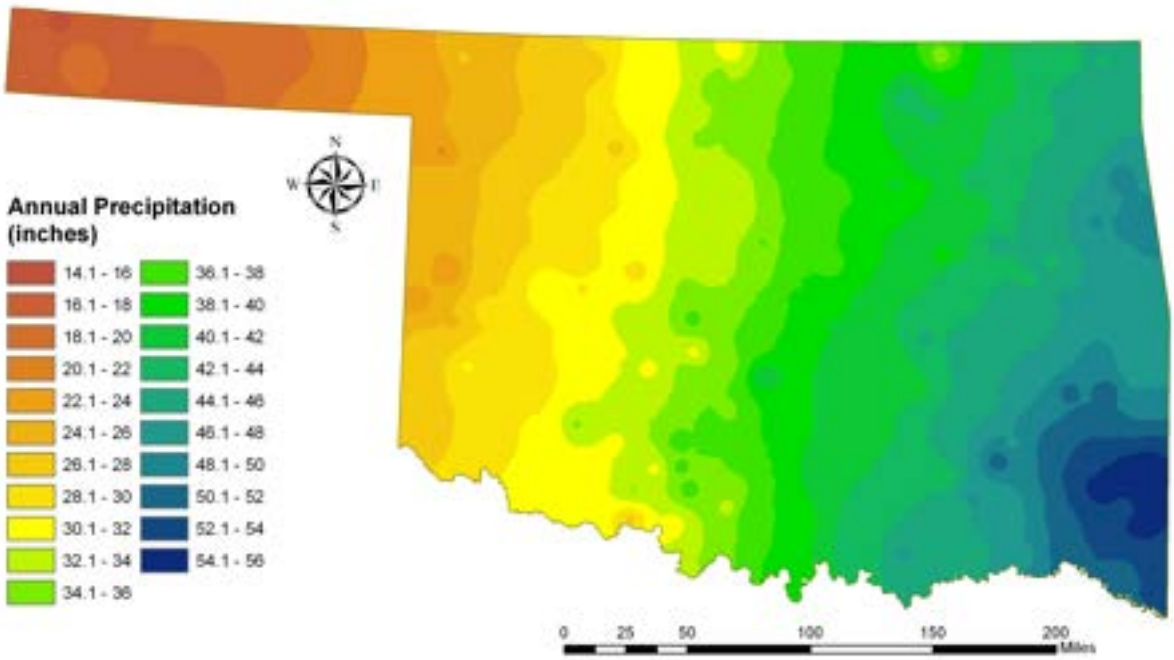
The dominant feature of the spatial distribution of rainfall is a sharp decrease in rainfall from east to west. Although precipitation is quite variable on a year-to-year basis, average annual precipitation ranges from about 16 inches in the far western panhandle to about 56 inches in the far southeast. The climatological maximum for precipitation comes in late spring for almost all of the state east of the panhandle. On average, May brings more precipitation than any other month across 90% of Oklahoma. A significant secondary maximum of precipitation exists during early autumn for most of the state. This secondary peak typically occurs in September and is more pronounced in the eastern third of the state. Excessive rainfall occurs at times and has been recorded to amount to ten inches or more in 24 hours.

The winter precipitation gradient of annual snowfall is nearly opposite that of precipitation, in that it increases from less than two inches in the extreme southeast to nearly 30 inches in the western panhandle. Locations in southeast Oklahoma have gone several years between snowfall events, while northwestern Oklahoma typically records several snow events in one winter. Snowfall remaining on the ground for more than a few days is an uncommon occurrence in northwestern Oklahoma, quite rare in central Oklahoma, and almost unheard of in the southeast. Freezing rain is a distinct wintertime hazard for Oklahoma and the state has suffered from significant ice storm damage in the past ten years.

Floods and droughts both are a recurring part of Oklahoma's climate cycle. Floods of major rivers and tributaries may occur during any season, but they occur with greatest frequency during

those spring and autumn months associated with the greatest rainfall. Flash flooding of creeks and minor streams remains a serious threat, especially in urban and suburban areas, where development and removal of vegetation have increased stormwater runoff.

Figure 3: *Map of Average Annual Precipitation across Oklahoma*



The Average Annual Precipitation map was produced from precipitation data spanning from 1971 to 2000. One hundred and ninety-nine Mesonet stations within the state of Oklahoma, Arkansas's Texarkana weather station, and Colorado's Trinidad Airport weather station were used to interpolate a continuous raster covering the entire state. Inverse Distance Weighting (IDW) was used as the interpolation method.

Almost all of Oklahoma's usable surface water comes from precipitation that falls within the state's borders. Western Oklahoma tends to be more susceptible to drought because precipitation there tends to be more variable and marginal for dryland farm applications. Drought episodes can last from a few months to several years. Those that last a few months can elevate wildfire danger and impact municipal water use. Multi-season and multi-year episodes can severely impact large reservoirs, streamflow, and groundwater. The agricultural impact of drought is increasingly mitigated on a farm-by-farm and year-by-year basis through irrigation of crops, mostly with water from aquifers. This practice dominates much of the panhandle and some of the rest of western Oklahoma.

Other climatic features Oklahoma is known for are the prevailing winds, severe thunderstorms, hail, and tornados.

Natural Resources

Oklahoma's natural resources such as soils, vegetation, mineral resources, and wildlife create high biodiversity and provide great values and benefits to the state. The many natural resources found within the state collectively create and identify the diverse and unique landscape. This section helps depict the overall picture of Oklahoma's landscape but also covers a few of the requirements for the Forest Legacy Program.

Soils

Oklahoma's major soil associations are grouped by Major Land Resource Areas (MLRA) and/or geographic regions. Geology, topography, climate, plants, animals, and time play a major factor in soil formation. Color, texture, size and shape of soil aggregates, kind and amount of rock

fragments, distribution of plant roots, pH, and other features are used to characterize soils. After a soil is described and its properties are determined, soil scientists assign the soil to one of 12 taxonomic orders and/or one of many suborders. There are seven of the 12 taxonomic orders represented on the map below: Entisols, Mollisols, Aridsols, Alfisols, Inceptisols, Vertisols and Ultisols. Alfisols and Ultisols are the most abundant soil taxonomic orders in Oklahoma's forests.

In western Oklahoma, the Canadian Plains and Valleys MLRA contains brown, loamy soils developed on sandstone escarpments, basalt, and associated foot slopes under mid and short grasses. The High Plains and Breaks soils consist of dark-colored loams and clay loams under mid to short grasses. In the Central Rolling Red Plains MLRA, there are brown to light-brown loams and sands with clay-loam to sand under mid grasses, small oaks, cedars, and shrubs.

Figure 4: *Oklahoma Soils*

Source: Oklahoma Geological Survey, 2008

In central Oklahoma, the Central Rolling Red Prairies contains dark and loamy soils with clayey to loamy subsoils developed on Permian shales, mudstones, sandstones, and alluvial deposits under tall grasses and some small oak trees. Soils of the Cross Timbers are light colored, sandy, with reddish subsoils under mostly post oak, blackjack oak, and some hickory forests with prairie openings. The Bluestem Hills and Cherokee Plains contain deep-colored soils mostly with clay subsoils under tall grasses and few trees. The Grand Prairie – Arbuckle Mountains MLRAs are dark and loamy to clayey subsoils beneath small oaks, cedars, shrubs, and some mid grasses.

In eastern Oklahoma, the Ozark Highlands-Boston Mountains have brown to light-brown silty soils with reddish clay subsoils under oak-hickory-pine forests and some tall grasses. The Ouachita Mountains are light colored, acid, sandy, and loamy with clayey subsoils also under oak-hickory-pine forests. Arkansas Ridge and Valley soils are loamy, rocky, and well drained. Coastal Plain soils are light colored, acid, and sandy with clay-loam to clay subsoils under oak-pine (east) and oak-hickory (west) forests.

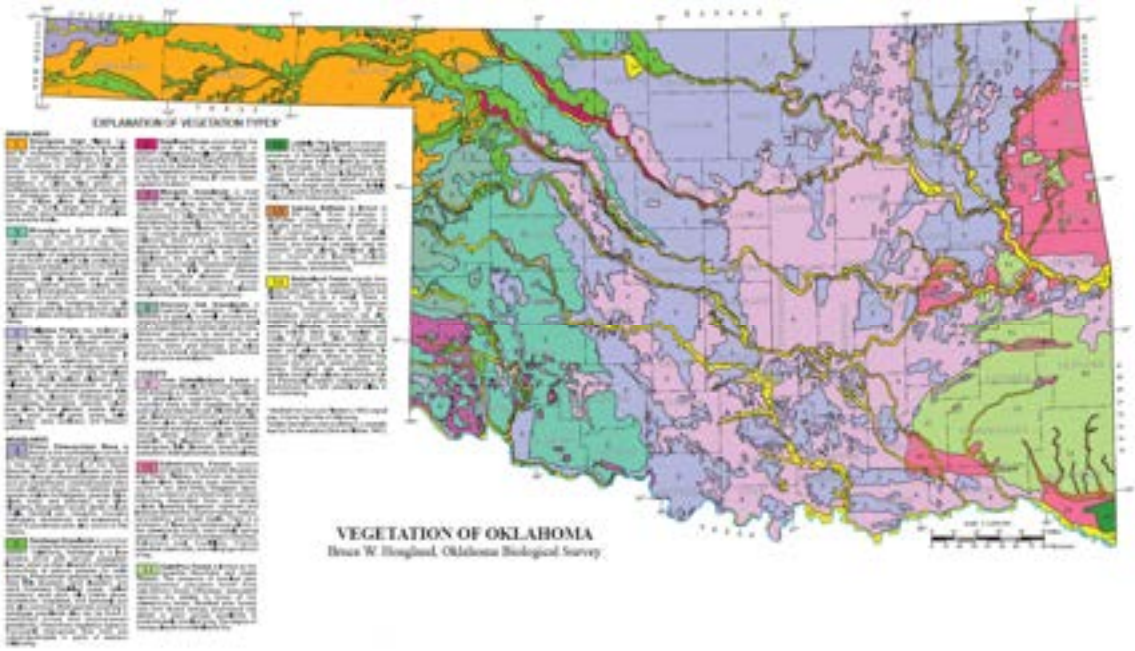
Detailed information for each major soil type in published by the NRCS in soil surveys for most of the 77 Oklahoma counties.

Vegetation

In 1943, L.G. Duck and James B. Fletcher and a team of researchers used aerial photography, soil maps, and extensive field surveys to map the distribution of major vegetation types across Oklahoma. This map is considered a potential vegetation map and shows the general location of

vegetation types across the state. The boundary between grasslands and forest vegetation is dynamic and continuously changing because of extended droughts as well as human influences. The map is called *A Game Type Map of Oklahoma* and was published over 50 years ago therefore some of the vegetation types have expanded or decreased in size. This Forest Resource Assessment does break down the forest types to a more detailed level than the forest types depicted on the map below.

Figure 5: *Oklahoma Vegetative Cover, Duck and Fletcher 1943*

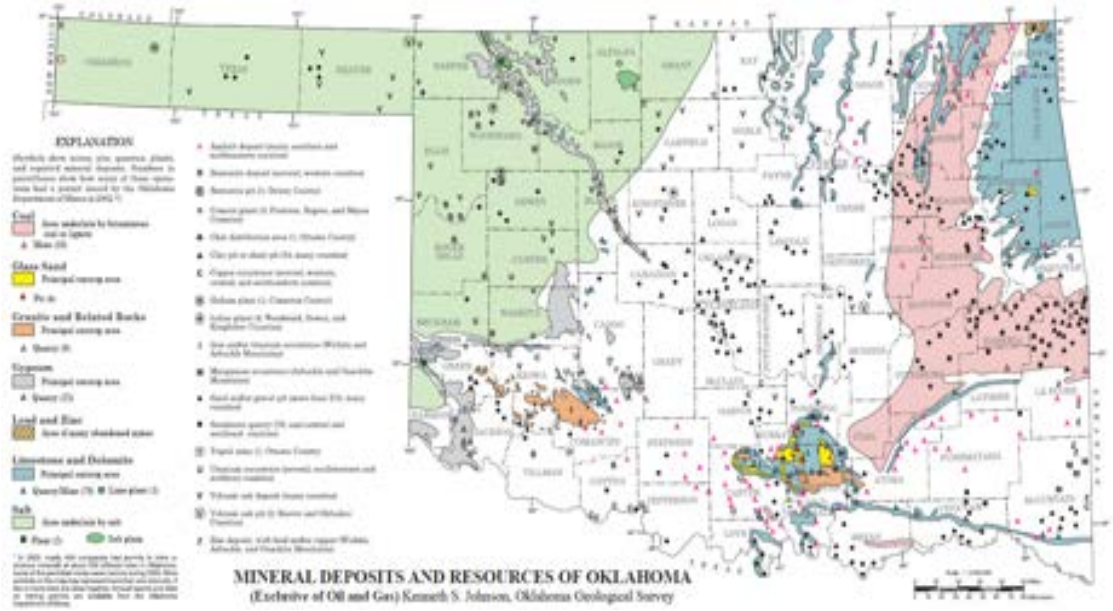


Source: Oklahoma Geological Survey, 2008

Mineral Resources

Oklahoma's mineral resources include: nonfuel minerals such as limestone, gypsum, salt, clays, iodine, sand and gravel and native stone; coal; and petroleum (crude oil and natural gas). These mineral resources are found statewide and there are many of these minerals found beneath the 9 different forest types. In recent years, the mineral industry has been the state's greatest source of revenue. In 2004, the combined value of petroleum, coal, and nonfuel minerals produced in Oklahoma was about $12 billion; it reached a high of $13 billion in 1982 and 1984.

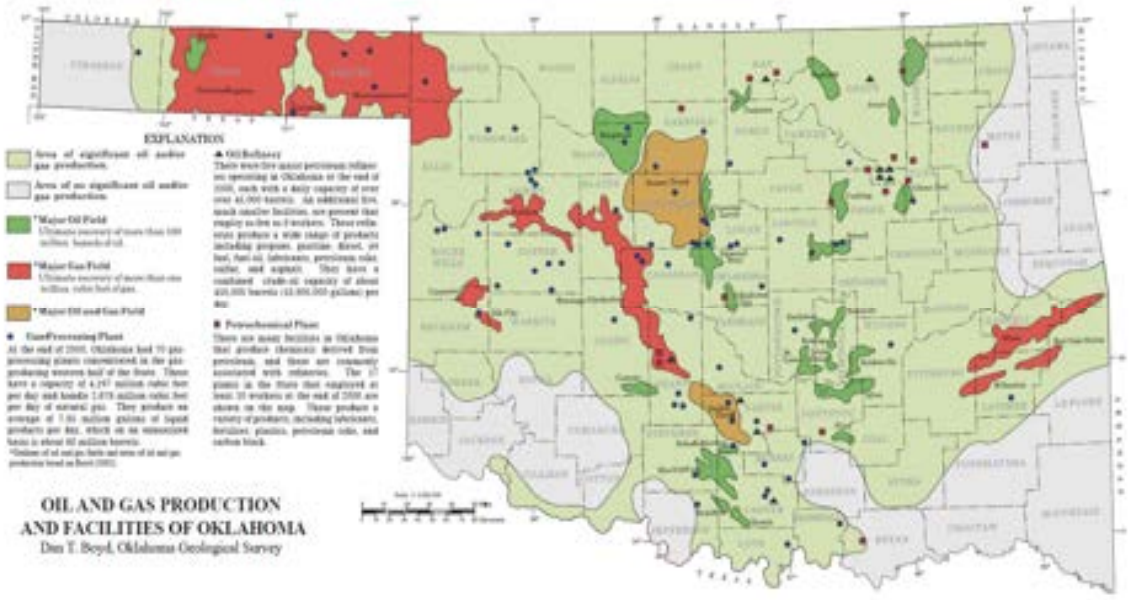
Figure 6: Oklahoma *Mineral Resources*



Source: Oklahoma Geological Survey, 2008

Although Oklahoma petroleum production accounts for about 95% of Oklahoma's annual mineral output, nonfuel minerals and coal represent a significant part of the State's current economy and an important source of future wealth. The total estimated value of nonfuel-mineral and coal production during 2004 was $558 million. Some of the leading commodities produced included: crushed stone, Portland cement, construction sand and gravel, coal, industrial sand and gravel, gypsum, and iodine. Other commodities produced in Oklahoma include clays and shale, salt, lime, granite, rhyolite, dolomite, sandstone, volcanic ash, and tripoli. Oklahoma ranked first in U.S. production of gypsum and iodine (Oklahoma is the only producer of iodine in the U.S.); second in tripoli production; fourth in feldspar; seventh in common clays; and eighth in industrial sand and gravel.

Figure 7: *Oklahoma Oil and Gas Production*



Source: Oklahoma Geological Survey, 2008

Wildlife

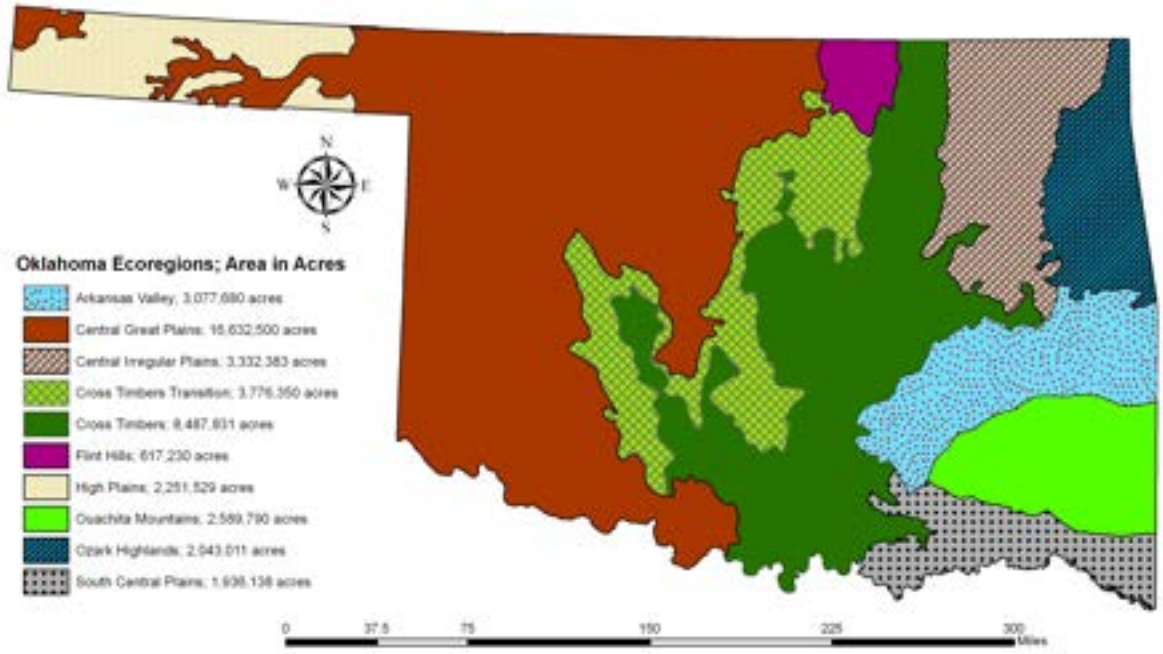
Another natural resource is wildlife and a wide variety of wildlife species are found across Oklahoma. A large number of these wildlife species live within forested habitats. According to the Oklahoma Comprehensive Wildlife Conservation Strategy (Action Plan), there are about 240 wildlife species of conservation need throughout the state. Oklahoma wildlife species and the Wildlife Action Plan are discussed in more detail throughout this forest resource assessment.

There are numerous threatened and endangered species that are protected under the U.S. Endangered Species Act. The forests of Oklahoma provide many of these threatened and endangered species with habitat that often need special forest management. Threatened and endangered species should be considered when conducting any forest management activities otherwise these species habitats could be lost forever. The major threatened and endangered species found in Oklahoma are discussed in Appendix C of this document. For more information, contact the University of Oklahoma - Oklahoma Biological Survey or the U.S. Fish and Wildlife Service.

Oklahoma Ecoregions

Oklahoma lies at the crossroads of major ecological divisions (humid temperate versus dry domains per Bailey), resulting in one of the largest natural diversities of any state. An ecoregion is an ecologically and geographically defined area that is characterized by its biodiversity, flora, fauna and ecosystems. Each ecoregion is distinct from that of other ecoregions. A recent refinement of the state's ecoregions, by Oklahoma Forestry Services for the purposes of this Assessment, was completed in 2009 which identified 10 diverse ecoregions, more than any other state except Texas. Oklahoma has an extremely diverse landscape which is described in detail in each of the ecoregion descriptions below. Forest types that are commonly associated with states in the northeast, the southeast, the southwest and even the Rocky Mountains are represented here. This tremendous diversity in Oklahoma's forests creates opportunities and challenges to identify areas that are more than just uncommon, but which have truly special environmental attributes.

Figure 8: *The Ecoregions of Oklahoma*



This map of Oklahoma Ecoregions was produced after much deliberation by combining EPA Ecoregions at levels III and IV. Of the Level III dataset, the Southwestern Tablelands was dissolved into the Great Central Plains, as were the Boston Mountains into the Ozark Highlands, and the East Central Texas Plains into the South Central Plains. From the Level IV dataset, the Cross Timbers Transition zone was recruited and displaced a portion of the Central Great Plains.

The High Plains Ecoregion

The High Plains ecoregion consists of smooth to irregular, semiarid plains that are studded with playas and stock ponds, widely mantled by loess or sand, and underlain by semiconsolidated sand and gravel deposits. Elevations range from 2,400 to 4,800 feet, and are highest in the west. Precipitation increases eastward, averages only 17 to 20 inches annually, and is erratic. Natural vegetation is mostly short grass prairie, but sagebrush–bluestem prairie is native on scattered sand plains and sand hills. Overall, natural vegetation is distinct from the mixed grass and tall grass prairies of moister ecoregions to the east. Trees are generally limited to the urban areas and the main water courses, and include cottonwood, willow, mulberry, hackberry and elm where soil moisture is sufficient. Riparian forest regeneration is often problematic due to drawdown of the water table from crop irrigation and changes in flood frequency, and cottonwoods along the Beaver River near Guymon struggle to survive.

Today, cropland (mostly winter wheat and grain sorghum) is extensive. Rangeland (widely overgrazed) is found in areas that are too sandy or steep for farming. Both cropland and rangeland require proper management to limit wind erosion. Groundwater irrigation, drawing down the Ogallala Aquifer, has become increasingly common in recent decades. This has caused many streams to go dry, some to the point that no defined channels remain. The remaining streams and pools are shallow and have sandy substrates. Conditions in these intermittent streams are intensely stressful for many species of fish. As a result, both the diversity and richness of fish species are lower than in any other ecoregion in Oklahoma. The most common fishes found are the red shiner and the plains killifish.

The Central Great Plains Ecoregion

The central Great Plains ecoregion is largely underlain by red, Permian-age sedimentary rocks and includes scattered hills, breaks, salt plains, low mountains (Wichita Mountains), gypsum karst, sandy flats, and sand dunes. Landform diversity is greater and elevations are lower than in the High Plains. Mean annual rainfall increases eastward, and varies from about 22 to 38 inches. Growing season increases towards the south. The upland natural vegetation in this dry-subhumid area is mostly mixed grass prairie, but mesquite–buffalograss and shinnery oak are native. The oak savannah and Cross Timbers forests are scattered on the eastern fringes of this ecoregion and a small amount of pinyon pine and ponderosa pine can be found in the far northwest corner of the panhandle. Common tree or shrub species found include mesquite, several species of juniper and oaks. Along the area's major river systems, tree species include oak, elm, ash, cottonwood, willow, hackberry, mulberry, walnut and others. Live oak extends from Texas up into Quartz Mountain State Park. The eastern boundary of this coincides with the eastern limit of America's winter wheat belt. Cropland is extensive; main crops are wheat, alfalfa, and grain sorghum. In addition, soybeans are grown in the east, where rainfall is greatest, and cotton occurs, especially on irrigated, nearly flat land in the south. Rangeland and grassland are found in more rugged areas and are being invaded by eastern redcedar. Extensive oil and gas fields occur. Typically, after heavy rains, stream flows increase and are laden with suspended sediment. Streams draining rangeland carry less sediment load than those that are downstream of cropland. Flow stops or nearly stops in the summer, but scattered pools endure and serve as summer refuges for aquatic fauna.

Numerous streams have been channelized and/or impounded resulting in the loss of riparian forest, unnatural flow regimes, entrenchment, bank erosion, substrate alteration, and fauna modification. Also, the invasion of salt cedar on riparian areas is threatening native forest types as well as water flow regimes. The plains killifish occurs in large numbers in some streams. The most common minnows include the red shiner, sand shiner, suckermouth minnow, and the plains minnow; the common but threatened Arkansas River shiner also occurs. Slenderhead darters are also widespread. Freckled madtoms and isolated pockets of orangethroat and dusky darters do occur. The Red River pupfish is found in pools and backwaters of sandy-bottomed streams and rivers where temperature, salinity, and alkalinity are high.

During the 1930s and 1940s, thousands of miles of shelterbelts were planted in this ecoregion under President Roosevelt's Prairie States Forestry Project. The program's very first shelterbelt in the nation was planted near Mangum in Greer County in 1935.

The Cross Timbers Transition Ecoregion

The Cross Timbers Transition ecoregion consists of rough plains that are covered by prairie grasses, eastern redcedar, scattered post oak-blackjack oaks, and elms. Terrain and vegetation are transitional between the less rugged, grass-covered ecoregions to the west and the hilly, oak forest to the east. Since the early 19th century, both the abundance of upland trees and the number of tree species have greatly increased due, in part, to fire suppression. During the same period, natural riparian forests and wetlands have been degraded or lost due to channelization and land use changes. Today, land use is a mixture of rangeland and cropland.

The Flint Hills Ecoregion

The Flint Hills ecoregion includes the western edge of tall grass prairie and is dominated mostly by mixed prairie grasses and scattered oak savannahs. The topography is rolling plains, but steep bluffs occur in some valleys. Vegetation is characterized by alternating prairies, groves and strips of trees, more commonly found along water courses. The upland forest is dominated by oak and hickory, with cottonwood, willow and elm occurring along streams or on better soils. Eastern redcedar is encroaching onto range and forestlands where fire has been excluded. This ecoregion is used primarily for grazing. Cropland is restricted to river valleys and stone-free uplands. Mean annual precipitation is 38 to 42 inches. Springs are common enough to increase summer base flow in some streams.

The Cross Timbers Ecoregion

The Cross Timbers ecoregion was once part of the Gulf Coastal Plains. The region's topography is generally flat to rolling hills. The vegetation is a mix of forests, prairie and savannah, and is a transition zone between the pine forests of the eastern ecoregions and the prairies of the drier, western ecoregions. The region is known for the "Cross Timbers," a large scrubby forest dominated by post oak and blackjack oak and tall grass prairie. Hickories become more common in the eastern fringes of this area. Riparian forests along streams support American elm, hackberry, pecan, and other deciduous species. In this region, the Caddo Canyons, located in Canadian and Caddo counties, are products of deep erosion into Permian sandstone. The resulting micro-environment sustains populations of Caddo Maple (*Acer saccharum)* and other deciduous forest species (Hoagland, 2000). Eastern redcedar and Ashe juniper are the dominant evergreen species, and are encroaching onto range and forestlands due to the lack of fire and increase in passive or "recreational" land ownership. Ashe juniper dominates the rugged Arbuckle Mountains. The utilization of eastern redcedar is increasing as the species and forest products industry develops, but is considered an invasive pest by most people. A localized population of Seaside Alder (*Alnus maritima*) occurs along Tishomingo and Blue Rivers and other streams within Johnston and Pontotoc counties in far southern Oklahoma (Little). Its only other occurrence is in Delaware and Maryland. Gully erosion is common on abused soils.

A mix of savannah, forest, and prairie is native to the low hills, cuestas, ridges, and plains, and separates the forests of eastern ecoregions from the prairies of drier, western ecoregions. The boundary between the Cross Timbers and the nearly treeless Central Great Plains coincides with the western limit of many mammals and insects. Post oak–blackjack oak forests and savannahs are native on porous, course-textured soils derived from sandstone; the percentage of blackjack oak increases westward. Tall grasses are native on fine-textured, moisture deficient soils derived from limestone, shale, or marl. Today, forest, rangeland, pastureland, and several extensive, but declining, oil fields occur. Abandoned, depleted farmland is common. The remaining cropland is largely restricted to valleys near channelized streams whose degraded habitat supports very poor assemblages of aquatic fauna.

Two types of streams are common. The first is characterized by a mixture of shaded riffles, runs, and pools that have gravel or cobble substrates. The second stream type has lower gradients and is found downstream of the first; it is characterized by wide, shallow, sand-choked channels. In the summer, surficial flow is often absent from wide, sandy, lower reaches. Erratic stream flow has led to the construction of many reservoirs. Generally, stream conditions are more stressful for fish than in eastern Oklahoma, but less rigorous than in the west. Common minnows include the red, sand, and redfin shiners and the suckermouth minnow. The redfin and orangethroat darters, smallmouth buffalo, river carpsucker, black and golden redhorses, and channel and flathead catfishes occur in many streams.

The South Central Plains Ecoregion

The South Central Plains ecoregion is an irregular, forested plain cut by shallow valleys and underlain by poorly-consolidated deposits. Mean annual rainfall in this humid region varies from 45 to 55 inches, and increases eastward. It is dominated by medium-tall to tall forests of broadleaf deciduous and needle leaf evergreen trees. Lying along the western edge of the southern coniferous forest, loblolly pine dominates the wetter soils of the floodplain while shortleaf pine is native to the uplands. Common associates include oak, hickory, sweetgum, blackgum, red maple, flowering dogwood and winged elm. Summer flow in many small streams is limited or nonexistent, but enduring, deep pools usually occur. Species richness markedly increases towards the east as more fauna from the Mississippi Valley are encountered. In addition, downstream influences of the Ouachita Mountains on aquatic flora and fauna occur. Sunfishes, catfishes, gars, crappies, grass pickerels, orangebelly darters, and bigeye, ribbon, striped, and redfin shiners are common. Redhorses and creek chubsuckers are numerous in small and medium size streams. The smallmouth bass is an important game species.

In southern McCurtain County, bottomland and wetland forests, oxbow lakes and cypress swamps occur. The southern oak-pine forest of southeastern Oklahoma is the most valuable forest for commercial use. In addition to their commercial value, these forests also provide some of the best wildlife habitat and high quality water resources. The region's forests also provide outstanding scenic values, supporting a strong hunting and fishing, and tourism industry.

The Ouachita Mountains Ecoregion

The Ouachita Mountains ecoregion supports oak-hickory and pine forests. The forested low mountains are characteristically underlain by folded, sedimentary rocks of Paleozoic age. The mean annual rainfall in this humid ecoregion is 43 to 57 inches. This ecoregion remains mostly forested, but pastureland and hayland occur in wider valleys. Logging and recreation are major land uses.

The primary overstory species include southern red oak, black oak, white oak and hickories. The western fringes of the southeastern pine forest constitute nearly half of the forest cover, with shortleaf dominating the uplands. Extensive pine plantations consist primarily of the faster-growing loblolly pines. The drier sites are dominated by oak, hickory and shortleaf pine. The tallest mountains support a variety of tree species, including cove hardwoods and stunted oaks where extremes of temperature and precipitation limit growth. A variety of hardwood species dominate the bottomlands along rivers and streams. Most streams have gravel, cobble, boulder, or bedrock substrates but a few have sandy bottoms. Common fishes include the longear and green sunfishes, yellow bullhead, brook silverside, blackstripe and blackspotted topminnows, largemouth bass, smallmouth bass, redfin darter, suckers, and the bigeye, Ouachita Mountain, and ribbon shiners. Orangebelly darters, grass pickerels, and tadpole madtoms are also found. The Red-cockaded woodpecker is an endangered species found in this region.

The forests of the region also support a well-developed forest products industry, diverse wildlife habitats and the highest quality water in the state. The region's forests also provide outstanding scenic values, supporting a strong tourism industry.

The Arkansas Valley Ecoregion

The Arkansas Valley ecoregion separates the Ozark Plateau from the Ouachita Mountains. It is characteristically transitional and diverse. Plains, hills, floodplains, terraces, and scattered mountains all occur; the terrain is distinct from nearby ecoregions. A mix of prairie, oak forest, oak–pine forest, and oak–hickory forest is native on uplands. Bottomland hardwood forest is native on floodplains and low terraces. Bottomland hardwood forests of elm, sycamore, oak, maple, ash, pecan, sweetgum and walnut dominate the floodplains unless cleared for croplands and pasture. Shortleaf pine is the native evergreen species, although loblolly pine is more frequently planted. Today, steep slopes are forested and used for timber, grazing, or recreation. Gently sloping uplands are used as pastureland or hayland. Cropland or pastureland occurs on most bottomlands. Other main land uses include poultry farming, coal mining, and natural gas production. Land use tends to be the primary factor influencing stream quality. Coal mining is an important land use, and surface and water quality impacts are common.

Fish communities usually contain many sensitive species; a sunfish- and minnow-dominated community exists along with large numbers of darters and catfishes. Common fishes include the bigeye, steelcolor, and redfin shiners, the orangethroat and redfin darters, and suckers including the creek chubsucker, golden and black redhorses, river carpsucker, spotted sucker, and smallmouth buffalo. Summer flow in small streams is often limited or nonexistent.

The Ozark Highlands Ecoregion

The Ozark Highlands ecoregion is a level to highly dissected plateau composed of flat-lying, cherty limestone and dominated by the oak-hickory forest type. Mean annual rainfall in this humid ecoregion is 41 to 49 inches. The forests are medium-tall to tall, and become savannah-like in parts of the region. Dominant species include post oak, white oak, red oak, black oak, bitternut hickory and shagbark hickory. On better soils, black walnut, pecan, elm, sycamore, ash and other species occur. Hickory becomes less common in the western parts of the area. The extension of this forest into Oklahoma is unusual because it contains sugar maple, beech and basswood, species more commonly found much farther east. Today, rugged areas are forested and nearly level sites are pastureland or hayland. The main land uses are logging, recreation, and especially, poultry and livestock farming. Rapid suburbanization, intensive grazing, and fields receiving waste from poultry farms have significantly increased fecal coliform, phosphorus, and nitrite-nitrate concentrations in receiving waters.

A well-developed forest industry taps the resource for a variety of products, including hardwood lumber, railroad ties, pallets, and specialty products. Protection of water quality, scenic views and wildlife habitat are important considerations for forestry activities. Several high quality and designated scenic rivers occur in the area and support a large recreational industry, and numerous man-made reservoirs provide drinking water and recreational opportunities for Tulsa and surrounding communities. Karst features are common and numerous caves support a variety of rare species such as Gray and Ozark Big-eared bats, and the Ozark cavefish.

Both habitat diversity and species richness are high, and sensitive fish species are common. Minnows, sunfishes, and darters are plentiful. The banded sculpin and slender madtom occur in small streams, especially where aquatic macrophytes are present, and the southern redbelly dace inhabits headwaters. The shadow bass is nearly limited to the region. Other common fishes include the orangethroat darter, stippled darter, greenside darter, fantail darter, northern hogsucker, white sucker, Ozark minnow, cardinal shiner, and bigeye shiner. The most important game species is the smallmouth bass.

The Central Irregular Plains

The Central Irregular Plains ecoregion is a belt of prairie that separates the Cross Timbers from the Boston Mountains and the Ozark Highlands. Interbedded Pennsylvanian-age shale, sandstone, limestone, and coal occur; the alternating

hard-soft strata dip westward, forming nearly flat to irregular plains, low hills, and east-facing cuestas. It is dominated by tall grass prairie with forests of post oak, blackjack oak, and black hickory native to rocky hilltops. The topography is rolling plains, but steep bluffs occur in some valleys. Today, this ecoregion is a mix of rangeland, grassland, forest and farmland; cropland is most extensive on nearly level plains. Cottonwood, willow, pecan, sycamore, hackberry, oaks and elm dominate the riparian forests along streams. Eastern redcedar is encroaching onto range and forestlands where fire has been excluded.

Rivers and streams typically have low gradients, slowly moving water, muddy banks, and meander in wide valleys. Stream substrates and habitats vary from a high quality, variable mix of conditions to silt- and mud-choked channels. Runoff from bituminous coal mining has degraded water quality and affected aquatic biota in a few streams. The redfin shiner, suckermouth minnow, redfin and orangethroat darters, smallmouth buffalo, river carpsucker, black and golden redhorses, spotted suckers, yellow and black bullheads, and flathead catfish occur.

A Little History about Oklahoma's Forests

In the early 1800s, all of current Oklahoma except the panhandle (No Man's Land) was Indian Territory. Several tribes of the Plains Indians occupied parts of this region. These lands were where the Five Civilized Tribes from the southeastern United States were forced to relocate. In 1890, the land the Indians were occupying was reduced again to the eastern portion of the current State of Oklahoma and the western portion was known as the Territory of Oklahoma. Between the years of 1889 and 1895, the government opened the western portions of the territory, Oklahoma Territory, to settlers by holding six land runs. On November 16, 1907, Oklahoma Territory and Indian Territory were combined to establish the 46th state, Oklahoma.

History of Eastern and Central Oklahoma Forests

A land survey was conducted during the years of 1895 to 1898, by the United States Geological Survey, on the lands of the Cherokees, Creeks, Seminoles, Choctaws, and Chickasaws. The Indian lands of the Quapaw Agency, in the far northeast corner, were not included in the survey because many of the lands had long since been subdivided. There is a report which includes general descriptions of all the townships and ranges found within the Indian Territories. The descriptions include types of tree species found, site types, and sawmill locations. The lands occupied by the Five Civilized Tribes contained an area of 19,622,000 acres which is approximately 45 percent of the current land acreage of Oklahoma. This land survey, conducted more than 100 years ago, determined there were 12,112,000 forested acres within the Indian Territory. Figure 9 is a map of this region based upon this survey.

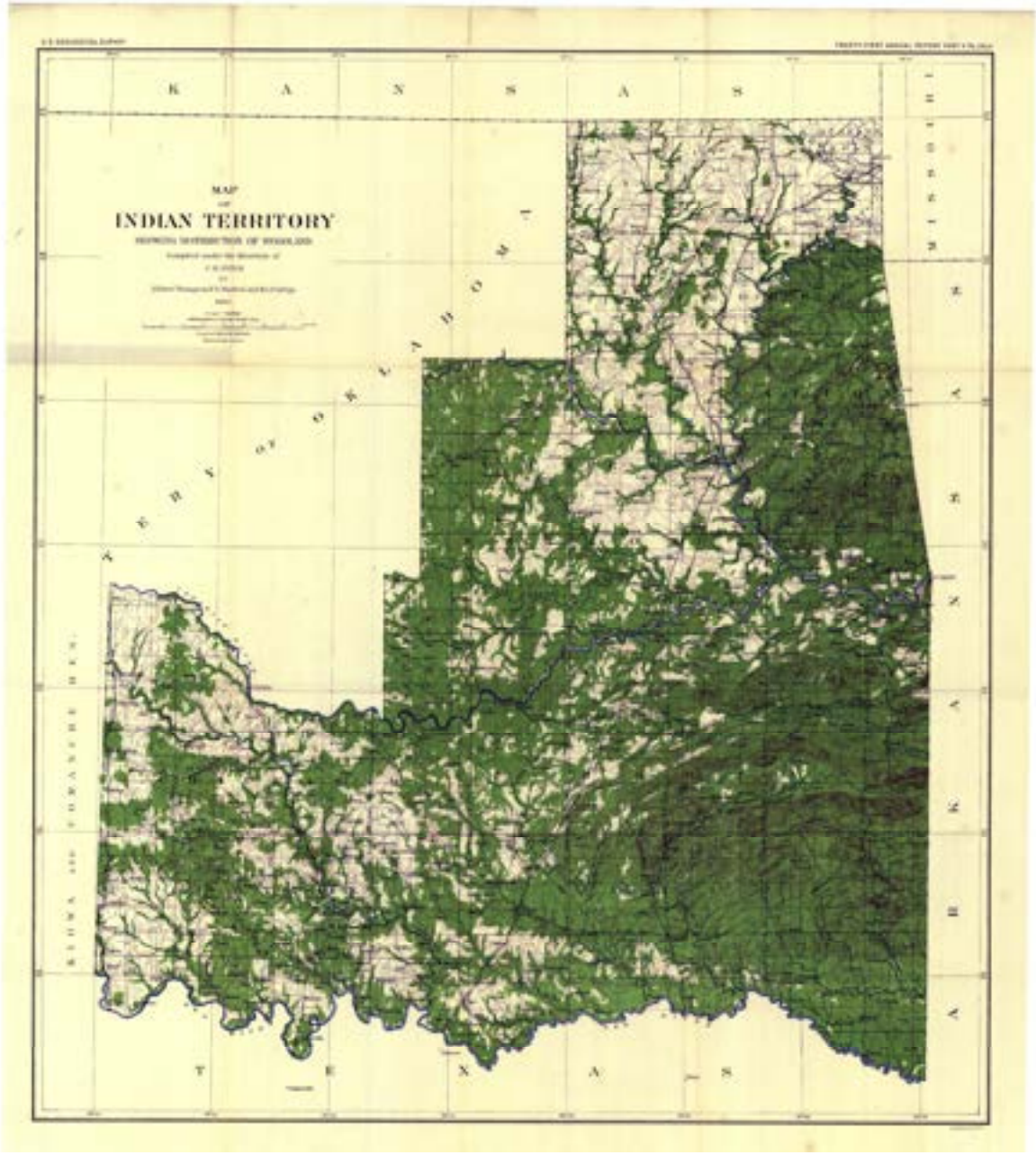
Native Americans occupied most of Oklahoma originally some 10,000 to 20,000 years ago. These tribes brought some agriculture and burning to the area, as noted by Spanish and French explorers and traders who visited the region as early as the mid 1500s. Subsequently, many eastern tribes were forced to relocate to the Indian Territory around the 1820s by numerous routes, the most famous being the Cherokee "Trail of Tears." Oklahoma's forests were shaped to a great extent by the activities of these early people.

European settlement began to increase in the region following the Civil War (1861-1865). By the 1930s less than 200,000 acres of virgin forest in eastern Oklahoma remained. Although sawmilling came to Oklahoma with European settlers, likely around 1880, it was the Dierks family that actually brought modern forestry to the Territory very early in the 20th Century.

Peter Henry Dierks immigrated to the United States from Germany in 1852, and settled in Iowa, where he took up farming. By the early 1880s, two of his sons, John and Herman, had left farming and entered the lumber business. The Dierks brothers expanded their operations with railroads as settlement moved west. By 1896, the Dierks operated 15 retail lumberyards in Iowa and Nebraska. As demands for lumber increased throughout the region, their search for new supplies of wood intensified.

By this time, small sawmills were already infiltrating Indian Territory, where a perceived "unending supply" of trees provided lumber, timbers, railroad crossties, barrel staves, and other essential products. Surveyors of the U.S. Geological Survey actually noted the locations of many of these mills when they surveyed the Territory in the late 1890s.

Figure 9: *Historic Map of Eastern and Parts of Central Oklahoma's Forests*



Source: Woodlands of Indian Territory, C.H. Fitch, 1899. The icon illustrates the area of Oklahoma represented.

As wood supplies dwindled in the Midwest, brothers Hans and Herman Dierks learned of vast, unharvested timberlands in Indian Territory. In 1898, they became involved with a lumber planing mill at Petros, a small village near present-day Heavener, Oklahoma. In 1900, they purchased a sawmill with dry kilns, a planer, and five miles of logging railroad at DeQueen, Arkansas, and began to harvest trees from the area and process lumber for their retail lumberyards that soon numbered twenty.

Soon after, the Dierks Lumber & Coal Company expanded its operations into Indian Territory, where it operated as the Choctaw Lumber Company. In 1903, they purchased their first tract of land in the Territory, near Valliant. In 1907, a Dierks survey crew traveled about 8 miles northeast from Valliant for the purpose of locating the site for a new large sawmill to be built at Bismark (later renamed Wright City). By 1910, the sawmill at Bismark was up and running. Felling trees in the forest and cutting them into logs was hard work, accomplished with axes, a two-man crosscut saw and two strong backs. To move the logs from the woods to the mill, Dierks extended railroads and temporary spur lines into the forest. Teams of oxen (up until 1921) and, later on, mules pulled the loaded wagons to the nearest siding.

As the timber harvest moved farther away from the mills, the daily commute for the workers grew excessive. Dierks developed the concept for a roving camp that would house the workers in the forest but which could be moved when timber had been cut out. The "traveling timber town" idea was born. A town consisted of about 200 homes for 800 workers, and included a school, church, water tower, the company store, and even a movie theater. Between 1910 and 1968, Dierks' timber towns were set up in ten locations in Oklahoma, including seven different sites for the Post Office at Clebit.

On "moving day" houses were cut in half and loaded onto railcars (trucks were used later) for transfer and reassembly at the next town. Initially, Dierks' timber harvesting philosophy mirrored large companies elsewhere – get all merchantable trees from the woods to the mill as efficiently as possible, and don't worry about the future. However, in 1915 the Company significantly changed its philosophy, and began to leave seed trees to reforest their lands. By the early 1920s, Dierks had begun a fire control program with observation towers, fire wardens, and telephone lines. They began hiring professional foresters in the 1920s, and worked closely with the Oklahoma Forest Commission (now Oklahoma Forestry Services) established in 1925. The Commission strengthened the wildfire control program and began programs in seedling production and education that helped restore the State's forests.

For more than 60 years, Dierks remained the largest forest industry in Oklahoma, managing 1.8 million acres of timberland and operating six large sawmills in the Oklahoma – Arkansas region. The Weyerhaeuser Company purchased the lands and operations of the Dierks Forests, Inc. in 1969, and started a new chapter in Oklahoma's colorful forest history.

Another man in Oklahoma's forest history was Elbert Little, Jr., who studied several forest sites in southeast Oklahoma over a 60 year period and described the burned out and cutover woods he first witnessed in 1930 as "almost worthless for any purpose and it would be some time before it was of any value."

By the 1980s, when Little revisited the area, he reversed his earlier position about the worthlessness of the land. He wrote that he wished he owned some of it. "The progress in management of southeastern Oklahoma's forest lands is far greater than anyone would have predicted a half century ago," he wrote. "The changes, mostly beneficial, are beyond anyone's imaginations or dreams."

There are still some forest tracts and trees spread throughout Oklahoma that are said to be the last of the remaining "virgin forests" in the South. Most of these tracts can be found in central Oklahoma within the post oak-blackjack oak forest type, commonly known as the "Cross Timbers." The Cross Timbers is one of the least disturbed forest types left in the eastern United States. Thousands of ancient post oaks can still be found within this forest type. Many public and private land managers and owners do not realize that ancient forests survive across the rugged terrain of the Southern Plains, because the Cross Timbers do not satisfy the stereotype for ancient forests. People are fixated on ancient forests being like the giant redwoods or massive hardwoods. The Cross Timbers are drought stressed forests, populated by low stature, slow growing trees, many of which predate not only statehood, but also the birth of the United States. Thousands of 200- to 400- year old post oaks survive as well as redcedar trees over 500 years old have also been found on fire-protected blufflines (Stahle).

Washington Irving traversed the northeast parts of the Cross Timbers in Oklahoma back in the autumn of 1832. Irving described the Cross Timbers as "rough country of rolling hills, covered with scattered tracts of post oak and blackjack oak; with some intervening valleys." His travels through the forests were, "like struggling through forests of cast iron." Irving did proclaim, "The whole tract may present a pleasant aspect in the fresh time of the year, when the ground is covered with herbage; when the trees are in their green leaf, and the glens are enlivened by running streams." But unfortunately they were traveling during late October when the "herbage was parched; the foliage of the scrubby forests was withered; the whole woodland prospect, as far as the eye could reach, had a brown and arid hue." He even described the streams as being dried up (Irving 1835).

History of Western Oklahoma Forests

Western Oklahoma, along with most prairie states, from Texas to Canada, has always had few forests, except along the waterways, on ridges, and in canyons. During the late 1800s and early 1900s, many people, accustomed to the protection and shelter of forests were moving to western Oklahoma. In the early to mid 1900s, times were hard across much of the United States especially the prairie states. These states were experiencing drought and dust storms. Many people abandoned their lands as crops failed and moved to California. However some pioneer families made an effort to establish trees for protective purposes. Americans from eastern states and immigrants from forested regions of Northern Europe joined American settlers moving west in planting trees for security and protection. The Great Depression of the 1930s set the stage for "the greatest afforestation program the world has known" when the Forest Service was given the task of planting shelterbelts from Texas to Canada in a zone a hundred miles wide.

The venture, known as the Prairie States Forestry Project or the Shelterbelt Project, resulted in the planting of millions of trees between 1934 and 1942.

In Oklahoma alone, about 20 million trees were planted in 3,000 miles of shelterbelts, on over 5,000 farms. The very first shelterbelt planted under this program was near Mangum, Oklahoma, in 1935. Many of these shelterbelts and windbreaks still exist throughout the prairie states. The millions of trees planted in the depression thirties stand as a monument to President Franklin D. Roosevelt, who originated the idea of the project. Farmers across this region still plant trees to help protect their farmland from erosion, wind, and blowing snow.

Oklahoma's Diverse Forest Types

As defined by the USDA Forest Service and the Oklahoma Forestry Code, forestland is land at least 10% stocked by forest trees of any size (whether of commercial or non-commercial species) or formerly having such tree cover and not currently developed for non-forest uses, with a minimum area classification of 1 acre. Oklahoma's forests are diverse and provide numerous values and benefits to the state. The trees found throughout Oklahoma's forests range from less than 10 feet tall to greater than 100 feet tall. Some of the smallest trees in the state are actually part of the last ancient forests found in the south.

Elbert Little's *Forest Trees of Oklahoma* book describes 164 tree species found in the state, of which 143 are native and 21 introduced. There are about 14 rare trees that can be found only in small areas or a single county within the state. Some of these trees include seaside alders in Johnston and Pontotoc counties, Caddo maple in Caddo and Canadian counties, Texas ash and short-lobe oak in the northern Arbuckle Mountains, and little walnut and Texas live oak in the Wichita Mountains. These rare trees as well as a variety of other forest trees grow throughout the state and make up nine different forest types. The nine different forest types that exist in Oklahoma are described in more detail throughout this section.

- **Shortleaf Pine Forest Type**
- **Loblolly Pine Forest Type**
- **Oak – Hickory Forest Type**
- **Oak – Pine Forest Type**
- **Post Oak – Blackjack Oak Forest Type**
- **Bottomland Hardwood Forest Type**
- **Pinyon Pine – Juniper Forest Type**
- **Eastern Redcedar Forest Type**
- **Community Forest Type**

Shortleaf Pine Forest Type

In pure softwood forest types, the softwood component stocking needs to be greater than 50%.

Shortleaf pine is the most wide-spread of any pine in the southeastern United States appearing in 22 states. This fire-dependent forest type was once more common on the Gulf Coastal Plain soils found in the southeast counties of the state, but shortleaf pine trees have been replaced on good sites by loblolly pine plantations or land use has been changed to agriculture.

This forest type is now found on some of the more rugged relief of the state where it is more competitive on drier sites with thin, rocky, and nutrient deficient soils. Throughout the region understory vegetation is now dominated by woody species, and once-common grasses and forbs are scarce.

Shortleaf pine forests also provide habitat to a variety of wildlife species. Shortleaf pine seeds are an important food source for birds and small mammals. Deer browse on seedlings. Stands of seedlings and saplings provide cover for bobwhite quail and wild turkey. Old-growth shortleaf pine provide habitat for cavity dwellers such as the endangered Red-Cockaded Woodpecker. The shortleaf pine forest type does provide quality lumber but is not as commonly planted because it is a slower growing tree than loblolly pine.

Table 1: *Shortleaf Pine Forest Type*

Dominant Species	Primary Associates	Sites
Shortleaf Pine	White oak, southern red oak, black oak, hickory, post oak, blackjack oak, blackgum, red maple	low, well drained ridges to rocky, dry, south slopes, and the better drained spur ridges on the north slopes and also on old fields

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Loblolly Pine Forest Type (Native/Plantation)

In pure softwood forest types, the softwood component stocking needs to be greater than 50%.

This forest type is extensive and occurs naturally on the Coastal Plain across the southeastern United States. Loblolly pine forest type is native to the southeastern corner of Oklahoma, but extensive planting has extended the range throughout eastern Oklahoma.

This forest type occurs on a variety of soils, both uplands with good drainage and on somewhat poorly drained flatwoods. Wherever a seed source has been available loblolly pine has colonized abandoned fields, areas laid bare by severe cutting or fire, and even badly eroded sites. Abundant but not excessive soil moisture is required for good growth of loblolly pine. Loblolly pine is only moderately tolerant of shade and can suffer from hardwood root competition.

This forest type tends to merge with shortleaf pine as well as oak-pine forest types on drier sites. Since this forest type is mostly found where soil moisture is favorable, the associated undergrowth is rich in species and in numbers. Understory trees include sweetgum, black cherry, flowering dogwood, American holly, sassafras, hawthorn, and fringetree. Characteristic shrubs and vines are beautyberry, yaupon, poison ivy, greenbriers, blackberries, and grape. Dense young stands support only sparse herbaceous vegetation, but as stands open up many such plants appear, among them bluestem and panicums.

Loblolly pine is the most commonly planted tree for timber harvest because it is fast growing and produces quality lumber and fiber. This lumber and fiber is used for many products including paper, furniture and home construction.

Table 2: *Loblolly Pine Forest Type*

Dominant Species	Primary Associates	Sites
Loblolly Pine	Sweetgum, southern red oak, post oak, blackjack oak, blackgum	upland soils with abundant moisture but good drainage, and on poorly drained depressions

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Oak-Hickory Forest Type

In the hardwood forest types, the softwood component stocking needs to be less than 25%.

The oak-hickory forest type is located largely in the northeastern portion of the state and includes the highlands referred to by most writers as the Ozark Mountains.

Major vegetational trends from east to west include an increasing importance of oaks, particularly post oak, and a reduction in canopy tree species diversity. Mesic sites and vegetation are more restricted in the western part of the range, particularly with decreased precipitation and increased incidence of drought and fire. Pines increase in importance from north to south. Oak-hickory merges with oak-pine as you go south and as you go west, it grades into post oak-blackjack oak forest (Cross Timbers).

There are many different hardwood tree species that are associated with this forest type including blackjack oak, post oak, white oak, red oak, pin oak, black oak, hickory, and winged elm. The ground cover is composed of a mixture of huckleberry, coralberry, sassafras, big bluestem, spice bush, bladdernut, hazelnut, bloodroot, and grape.

Wildlife is abundant in this forest type including some rare species. Karst areas can be found in this forest type, which contain numerous sink holes, springs and streams that drain into subterranean caverns or caves. Many highly specialized and sensitive fish and wildlife species such as bats, amphibians, fish, and crustaceans spend all or part of their life in these unique and sensitive habitats. Federally listed species that occur in karst habitats of northeastern Oklahoma include the endangered Ozark big-eared bat, gray bat, and Indiana bat, and the threatened Ozark cavefish.

Table 3: *Oak-Hickory Forest Type*

Dominant Species	Primary Associates	Sites
White oak/red oak/hickory	Pin oak, northern pin oak, chinkapin oak, black oak, dwarf chinkapin oak, American elm, bur oak, white ash, sugar maple, red maple, walnut, basswood, locust, beech, sweetgum, blackgum, dogwood	wide variety of well drained upland soils
White oak	Black oak, northern red oak, bur oak, hickory, white ash	scattered patches on uplands, loamy soils but on drier sites than white oak/red oak/hickory group
Northern red oak	Black oak	spotty distribution on ridge crests and north slopes in mountains but also found on rolling land, slopes and benches on loamy soil
Sassafras/persimmon	Elm, eastern redcedar, hickory, ash, sugar maple, oaks	abandoned farmlands and old fields
Sweetgum	Red maple, white ash, green ash, other moist site hardwoods	generally occupies moist, lower slopes
Bur oak	Northern pin oak, black oak, chinkapin oak, eastern redcedar, shagbark hickory, black walnut, eastern cottonwood, white ash, American elm, swamp white oak, honey locust, American basswood	drier uplands to moist bottomlands with drier uplands more common in the northern part of the range and the moist bottomlands more common in the southern part of the range
Black walnut	white ash, black cherry, basswood, beech, sugar maple, oaks, hickory	coves and well drained bottoms
Black locust	Many species of hardwood and hard pines may occur with in mixture.	may occur on any well-drained soil but best on dry sites, often in old fields
Chestnut oak/black oak/scarlet oak	Northern red oak, southern red oak, post oak, white oak, shagbark hickory, pignut hickory, blackgum, sweetgum, red maple, shortleaf pine	dry upland sites on thin-soiled rocky outcrops in dry ridges and slopes
Mixed upland hardwoods	Ohio buckeye, Texas buckeye, red buckeye, American hornbeam, American chestnut, eastern redbud, flowering dogwood, hawthorn spp., cockspur hawthorn, downy hawthorn, downy hawthorn, fleshy hawthorn, dwarf hawthorn, honey locust, Kentucky coffeetree, osage-orange, all mulberries, blackgum, southern red oak, shingle oak, laurel oak, water oak, live oak, willow oak, black locust	wide variety of upland sites

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Oak-Pine Forest Type

In the hardwood/softwood forest types, the softwood component stocking needs to be 25-49%.

This forest type occurs mostly in east central Oklahoma and is found sporadically throughout the shortleaf pine, loblolly pine, and oak-hickory forest types. The dominate stocking of this forest type is shortleaf pine, loblolly pine, and a variety of oak species such as post oak, northern and southern red oak, and white oak. This forest type is essentially a transition zone between the pine forest types and the upland oak forest types.

It frequently exhibits an uneven aged condition in which the pine is significantly older than the hardwood component and is of a relatively narrow age class. Only on drier sites and where the canopy is severely reduced are enough pine saplings found to indicate that the pine component is replacing itself. The frequency of occurrence of pine trees in the overstory is steadily decreasing because of its greater age and less regeneration in the understory.

This forest type is usually found on coarse textured, well drained, and often shallow and droughty soils. Some common understory vegetation includes flowering dogwood, persimmon, blueberries, greenbrier, Virginia creeper, honeysuckle, viburnums, trumpet vine, blackberries, and blackhaw.

Table 4: *Oak-Pine Forest Type*

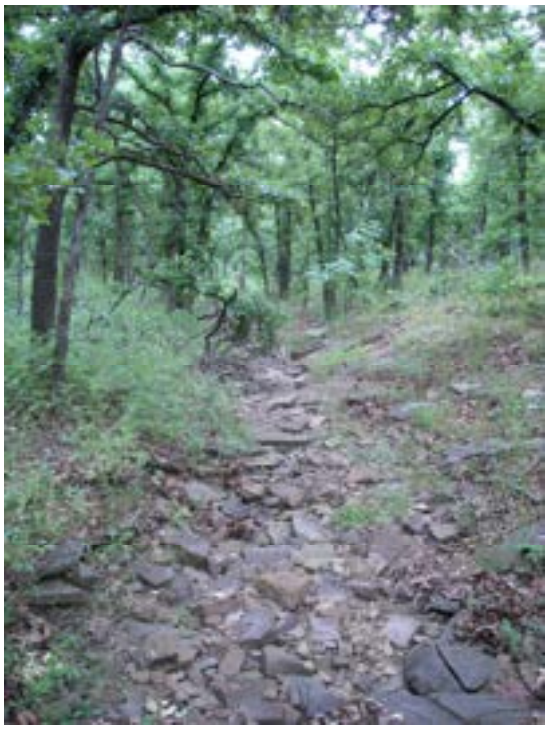
Dominant Species	Primary Associates	Sites
Shortleaf pine/oak	Oaks (generally include white, blackjack, black, post, and southern red), hickory, blackgum, sweetgum	generally in dry, low ridges, flats, and south slopes
Loblolly pine/hardwood	Wide variety of moist and wet site hardwoods including blackgum, sweetgum, red maple, white and green ash, American elm. On drier sites, associates include southern and northern red oak, white oak, post oak, persimmon, hickory.	usually moist to very moist though not wet all year, but also on drier sites

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Post Oak – Blackjack Oak Forest Type (Cross Timbers)
In the hardwood forest types, the softwood component stocking needs to be less than 25%.

The post oak – blackjack oak forest type, commonly known as the Cross Timbers, is a complex mosaic of upland deciduous forest, savanna, and glade communities that spreads across most of central Oklahoma continuing into Kansas and Texas. The overstory is largely composed of post oak, blackjack oak, and black hickory with the percent of blackjack oak increasing in the composition as one moves west. The understory is made up of a mixture of native grasses including switch, Indian, little bluestem, big bluestem, and other species depending upon the site.

The Cross Timbers earned its name from settlers who found much of the thick forests impassable as Oklahoma Territory was opened for settlement. American writer Washington Irving passed through in 1832 and wrote of the "vexations of flesh and spirit" that set upon the travelers who he said felt as if they were "struggling through forests of cast iron."



Cross Timbers serves as habitat for large populations of mammals and birds. Much of this can be attributed to the area's combination of ecological characteristics provided by heavily forested areas and prairies. One of the largest and most common is the white-tailed deer and includes small species like bobwhite quail and cottontail rabbit.

Since this forest type is essentially noncommercial for timber production, it has never experienced large scale industrial logging. Large tracts of old growth post oak and blackjack oak forests are found spread throughout central Oklahoma with trees as old as 200 to 400 years. The trees in this forest type average only 15 to 40 feet in height and 10 to 20 inches in diameter.

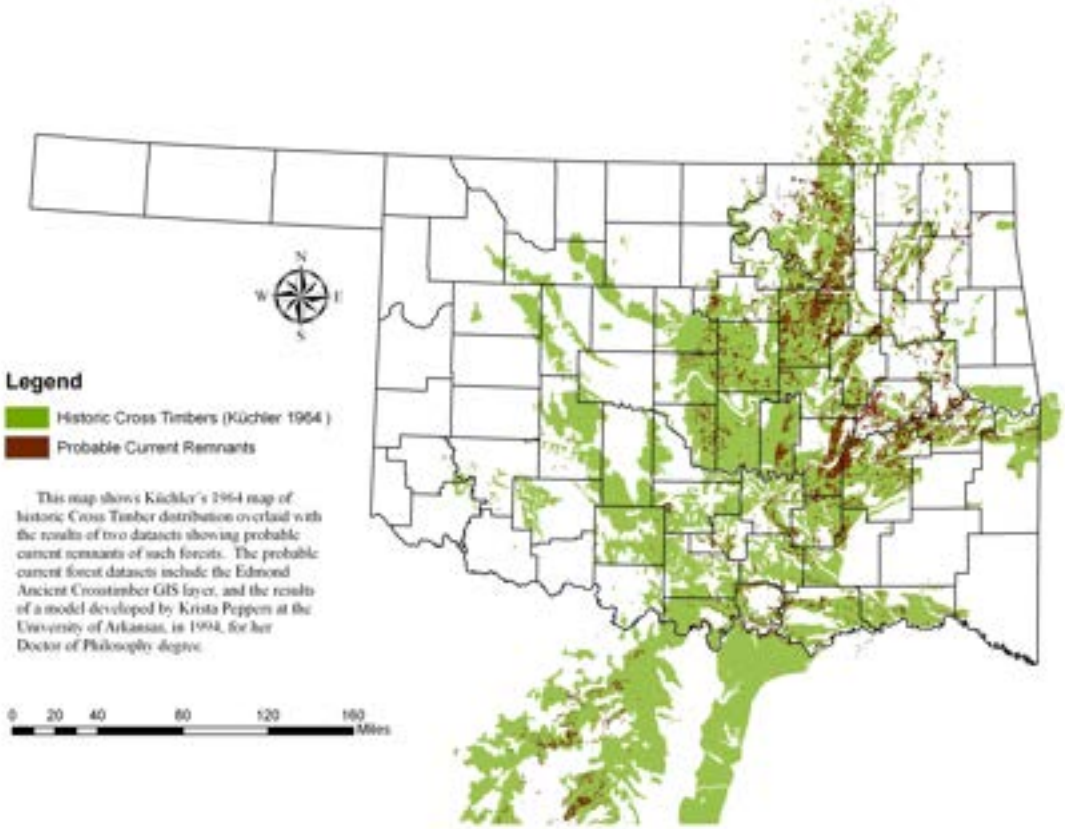
The Cross Timbers are often underappreciated because these small stature trees do not fit the stereotypical view of what a forest looks like. Some research has been conducted in the Cross Timbers, but overall failure to understand the ancient Cross Timbers is contributing to the ongoing destruction and fragmentation of this forest type which is a major threat to biodiversity, water quality, and recreational values.

Table 5: *Post oak – Blackjack oak Forest Type*

Dominant Species	Primary Associates	Sites
Post Oak/Blackjack Oak (includes dwarf post oak)	Black oak, hickory, southern red oak, white oak, scarlet oak, shingle oak, live oak, shortleaf pine, blackgum, red maple, winged elm, hackberry, chinkapin oak, shumard oak, dogwood, eastern redcedar	dry uplands and ridges

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Figure 10: *Map of Cross Timbers (post oak – blackjack oak forest type) and Probable Old Growth Tracts*



Bottomland Hardwood Forest Type

The Bottomland Hardwood forests occur on broad river and stream floodplains across the state. Oklahoma's bottomland hardwoods have been heavily cut over and cleared for agricultural uses. Because their wood is valuable and easy to transport along waterways, these trees were among the first forests cut in Oklahoma. Man-made lakes have flooded many uncut areas.

These forests vary widely in composition from east to west because of differences in rainfall and other factors. Both the amount of growth and the number of plant species increase from west to east along the principal east-west streams. More mesic conditions are present in extreme eastern Oklahoma due to the increase in rainfall, the low altitude of about 400 feet and the comparatively high humidity. Under these favorable conditions the vegetation shows an increased growth rate and increased number of herb, vine, and shrub and tree species.

The surface of this type varies from the flat bottomlands to the steep canyon-like valleys and differs from the other timbered types of the state in that most of the bottom soils are extremely fertile and deep, being alluvial in origin. In some areas saline deposits are present, particularly associated with the Cimarron, Salt Fork of the Arkansas and Salt Fork of Red River.

Bottomland forests offer some of the better game habitat condition in Oklahoma and are capable of supporting many different species. The more common game species are bobwhite quail, squirrel, cottontail rabbit, turkey and deer.

Table 6: *Bottomland Hardwood Forest Type*

Dominant Species	Primary Associates	Sites
OAK/GUM/CYPRESS Group		
Swamp chestnut oak/cherrybark oak	Shumard oak, delta post oak, white ash, hickory, white oak, blackgum, sweetgum, southern red oak, post oak, American elm, winged elm, beech	within alluvial flood plains of major rivers, on all ridges in the terraces, and on the best fine sandy loam soils on the highest first bottom ridges
Sweetgum/Nuttall oak/willow oak	American holly, green ash, American elm, pecan, cottonwood, red maple, honeylocust, persimmon	very wet
Overcup oak/water hickory (includes shellbark hickory)	Pin oak, willow oak, American elm, green ash, hackberry, persimmon, red maple	In south within alluvial flood plains in low, poorly drained flats with clay soils, also in sloughs and lowest backwater basins and low ridges with heavy soils that are subject to late spring inundation
Sweetbay/swamp tupelo/red maple	Blackgum, gum bumelia, waterlocust, all magnolias, red maple, water-elm, loblolly pine, American elm, other moist-site hardwoods	very moist but seldom wet all year--shallow ponds, muck swamps, along smaller creeks in Coastal Plain (rare in the Northeast)
ELM/ASH/COTTONWOOD Group		
River birch/sycamore	Red maple, black willow, and other moist-site hardwoods	moist soils at edges of creeks and rivers
Cottonwood	Willow, white ash, green ash, and sycamore	streambanks where bare, moist soil is available
Willow (includes peachleaf and black willow)	Cottonwood, green ash, sycamore, pecan, American elm, red maple, and boxelder	streambanks where bare, moist soil is available
Sycamore/pecan/American elm (includes slippery and rock elm)	Sweetgum, green ash, hackberry, silver maple, cottonwood, willow, boxelder, river birch	bottomlands, alluvial flood plains of major rivers
Sugarberry/hackberry/elm/ green ash (includes American, winged, cedar, slippery, and rock elm)	Boxelder, pecan, blackgum, persimmon, honeylocust, red maple, hackberry	low ridges and flats in flood plains
Silver maple/American elm	Sweetgum, pin oak, swamp white oak, eastern cottonwood, sycamore, green ash, other moist-site hardwoods	primarily on well-drained moist sites along river bottoms and floodplains, and beside lakes and larger streams
Cottonwood/Willow (includes peachleaf and black willow)	White ash, green ash, sycamore, American elm, red maple, boxelder	streambanks where bare, moist soil is available

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Pinyon Pine – Juniper Forest Type (parts are Woodlands with 5% cover)

The pinyon pine-juniper forest type covers approximately 2,000 acres of land in the extreme northwest corner of the Panhandle. These savannah-like forests contain several species of western junipers, the easternmost extension of pinyon pine and scattered remnant stands of ponderosa pine. This forest type more often occurs as woodland because trees are short and crowns rarely touch. The woodland is typified by pinyons, although one or several species of juniper often dominate the stand. This forest type is found throughout the southwestern United States.

The common associates with this forest type are pinyon pine, ponderosa pine, one-seed juniper, Rocky Mountain juniper, Mohr's oak, and Gambel's oak. These trees are found on rocky mesas and are very short reaching no more than 20 feet in height. The common understory found includes wheatgrass, blue grama, cholla cactus, and sage brush.

Table 7: *Pinyon Pine – Juniper Forest Type*

Dominant Species	Primary Associates	Sites
Juniper woodland (Includes Pinchot juniper, redberry juniper, Ashe juniper, California juniper, alligator juniper, Utah juniper, oneseed juniper. Pinyon pine is NOT present)	Various woodland oaks, ponderosa pine	low elevation with low annual precipitation
Pinyon-juniper woodland (Includes all pinyons and all junipers except Rocky Mountain and western juniper. Must have pinyon present)	Various woodland oaks, ponderosa pine	low elevations with low annual precipitation

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Eastern Redcedar Forest Type

Eastern redcedar is the most widely distributed conifer of tree size in the eastern United States, occurring in every state east of the 100th meridian. Eastern redcedar grows on a wide variety of soils, ranging from dry rock outcroppings to wet, swampy land. It is most frequently associated with thin soils derived from limestone and dolomite where rock outcroppings are common.

The eastern redcedar forests develop with few, if any, associated tree species. Hardy prairie grasses and periodic wildfires once relegated cedars to the more remote limestone outcrops and protected canyons but now passive land management, over-grazing livestock and suppressing wildfires have transformed much of Oklahoma into ideal conditions for eastern redcedar. As a result the occurrence of this forest type has increased over the past thirty years.

Wildlife utilization of this forest type is limited. Seeds are eaten in large quantities by birds and small mammals and thus dispersed. Passage through the digestive tract of a bird or other animal probably hastens germination. Large mammals such as deer only utilize this forest habitat as limited cover and will only browse eastern redcedar during the harshest winters.

Redcedar has many commercial uses and many groups have been researching utilization opportunities. Eastern redcedar logs are valuable and utilized but many markets have been slow to establish. A number of sawmills have opened across the state to utilize the products these trees provide, which include: cedar oil, litter box chips, mulch, lumber, rustic furniture, fence posts and insect repellent.

Table 8: *Eastern Redcedar Forest Type*

Dominant Species	Primary Associates	Sites
Eastern Redcedar	Gray birch, red maple, shortleaf pine, oak	usually dry uplands and abandoned fields on limestone outcrops and other shallow soils but can grow well on good sites.
Eastern redcedar/hardwood	Oak, hickory, walnut, ash, locust, dogwood, blackgum, hackberry, winged elm, shortleaf pine	usually dry uplands and abandoned fields

Source: USDA Forest Service: Oklahoma Forest Inventory and Analysis Data

Community Forest Type (Urban)

The community forest type is made up of all the trees in our cities and towns found along streets, highways, in parks, in yards, on school campuses, etc. For example, all the trees within Oklahoma City's boundaries make up a community forest. The trees in communities, just like the trees in rural forested areas, provide wildlife habitat, clean air, clean water, aesthetics, and recreation. A community forest is a working ecosystem like other forest types; it just has more human influence. The trees in this forest type might not be harvested for timber but they do have value that is often overlooked.

Table 9: *Community Forest Type*

Dominant Species	Primary Associates	Sites
Wide variety of native and non-native tree species (This forest type changes often because of human influence)	Wide variety of native and non-native tree species	Urban areas (cities, towns, communities)

Distribution and Abundance of Forests

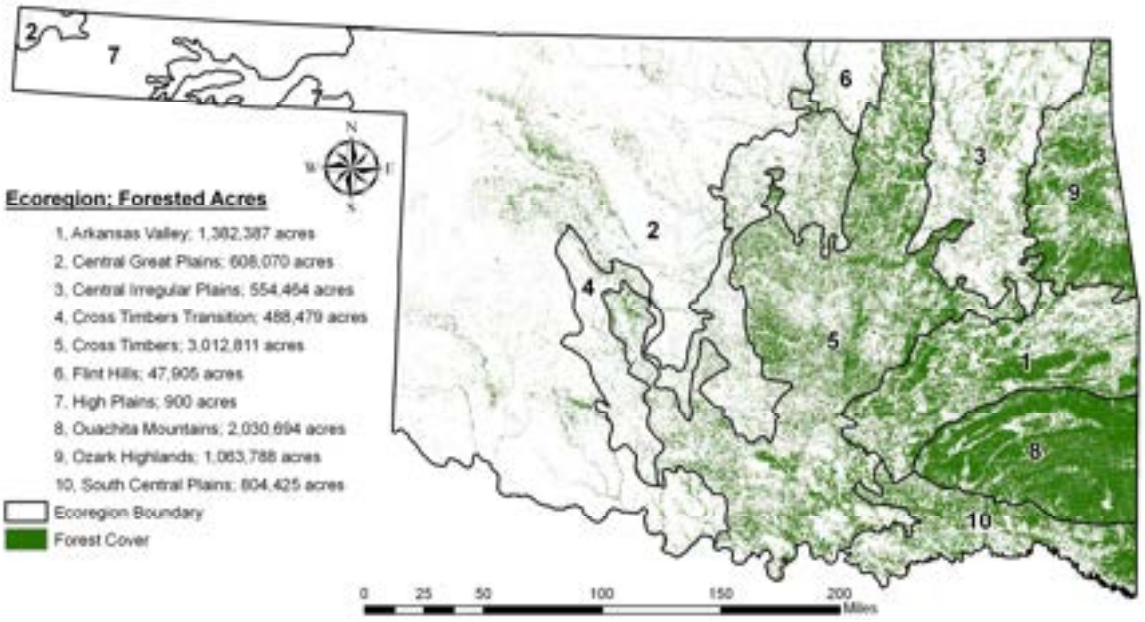
For many individuals unfamiliar with our state, Oklahoma is often perceived as a vast treeless prairie. This impression is far from the actual with approximately 23 percent of the state covered in forests. This amounts to approximately 10 million (9,998,602) acres of rural and urban forestland (Figure 11). Oklahoma's forestland ownerships are separated into three major groups: private, federal, and state and local government. Oklahoma's forests are approximately 90% privately owned.

Oklahoma's forestlands can be divided into three classes.

Classes of Forestlands:

- Productive forestland – forestland capable of producing in excess of 20 cubic feet per acre per year and not legally withdrawn from timber production, with a minimum area classification of 1 acre. Not always classified as commercial forests.
- Unproductive forestland – forestland incapable of producing 20 cubic feet per acre per year, with a minimum area classification of 1 acre.
- Woodlands – land where stocking cannot be determined, at least 5 percent crown cover by trees of any size or had at least 5 percent cover in the past. Very few areas are classified as woodlands.

Figure 11: *Oklahoma Forestland Cover Map*



Oklahoma Forestlands dataset was extracted from the 2001 National Land Cover Dataset (NLCD) and includes classes 41, 42, 43, and 90 for the entire state; shrub/scrub class 52 was deleted from both the Central Great Plains and the High Plains ecoregions to alleviate confusion of forest with actual scrub.

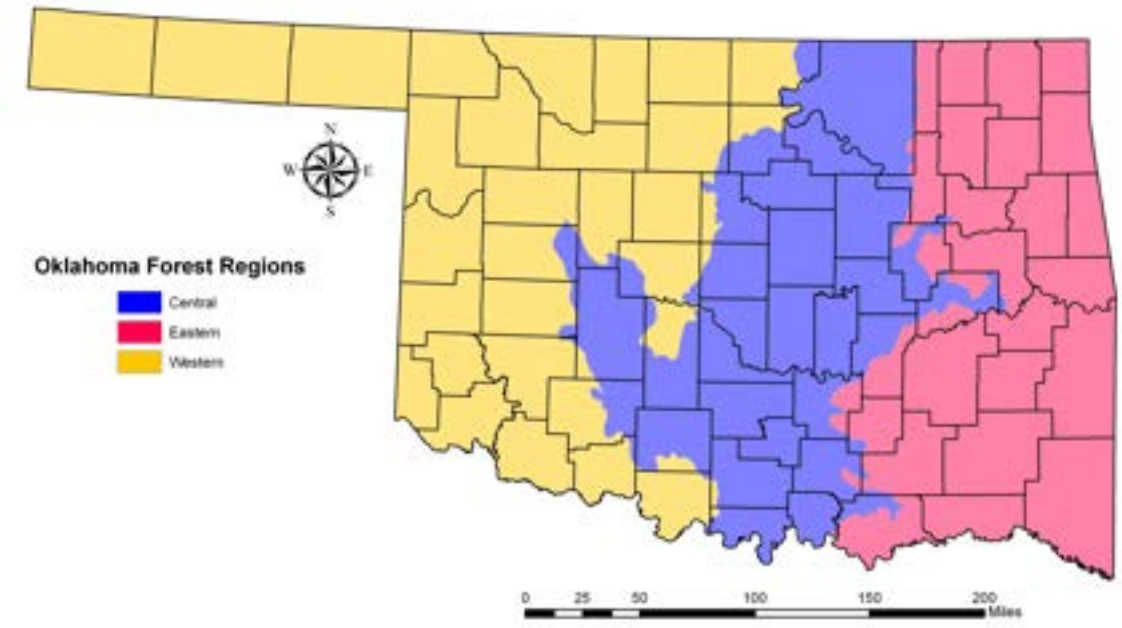
It should be noted that in order to describe Oklahoma's forest resources, Oklahoma Forestry Services (OFS) conducted a geographic information system (GIS) based analysis of the forests and other vegetation for the entire state using databases available through the state's most recent GAP (Gap Analysis Program) project, state and federal databases and commercially available aerial imagery. Typically a state would be able to use data provided by USDA Forest Service Forest Inventory and Analysis (FIA) to accomplish this.

Unfortunately as of the writing of this assessment, Oklahoma's FIA data is not complete. Presently, data available is limited to the 18 eastern counties (see map at left) which have been inventoried since 1936. In 2008, the FIA program began surveying the entire state. This inventory calls for collecting data for the 18 eastern counties on a 5 year cycle and the remaining 59 counties located in the central and western portions of the state on a 10 year cycle. The entire state will be inventoried for the first time in history by 2018. Descriptions contained in the main portion of this document are based mostly upon the OFS analysis. Some FIA data for the eastern side of the state can be found throughout this assessment document.

According to the current data from the FIA, there are approximately 5.1 million acres of productive forestlands all located in eastern Oklahoma. The remaining 4.8 million acres of forestland, spread throughout the state, are currently classified as non-productive forests, woodlands and reserved lands. While the state's traditional forest industry is based primarily in the eastern counties, sawmills and industries which use wood as a primary input are located across the state.

To illustrate and describe the distribution and abundance of the forest resources in Oklahoma, the state was divided into three major forest regions, the Eastern, Central, and Western regions (Figure 12).

Figure 12: *Forest Regions of Oklahoma*



Eastern Forest Region of Oklahoma

Approximately 58% of the state's forests are found in the eastern region. The eastern forest region of Oklahoma is the most diverse region of the state. This region consists of 5 different ecoregions with 8 forest types spread throughout. The eastern region is where the most productive forestland exists and where most of the tree planting for forestry purposes occurs. These forests contain the largest tracts of oak, hickory, and pine trees which support the largest portion of the state's timber industry. There are many small mills spread across the state, but the large manufacturing facilities are located within this region. The Ouachita and Ozark mountains are found in this region as well as the only national forest in Oklahoma, Ouachita National Forest, which is located in the southeast portion. Community forests are also found throughout this region.

***Total Land Acres*:** 12,979,002
***Forested Acres*:** 5,836,208

***Counties*:** Adair, Atoka, Bryan, Cherokee, Choctaw, Coal, Craig, Creek, Delaware, Haskell, Hughes, Johnston, Latimer, Le Flore, Marshall, Mayes, McCurtain, McIntosh, Muskogee, Nowata, Okmulgee, Osage, Ottawa, Pittsburg, Pontotoc, Pushmataha, Rogers, Sequoyah, Tulsa, Wagoner, Washington

Major Urban Areas (Population over 20,000):
Tulsa, Broken Arrow, Muskogee, Bartlesville

Table 10: *Eastern region total forested acres and included forest types.*

Eastern Forest Region of Oklahoma											
Ecoregions within Eastern Region	**Forest Types within Ecoregions**									**Acres**	
	Shortleaf Pine	Loblolly Pine	Oak-Hickory	Oak-Pine	Post Oak - Blackjack Oak	Bottomland Hardwoods	Pinyon Pine - Juniper	Eastern Redcedar	Community (Urban)	**Total Acres**	**Total Forested Acres**
Arkansas Valley	x	x	x	x	x	x		x	x	3,077,680	1,382,837
Central Irregular Plains	x		x	x	x	x		x	x	3,332,383	554,464
Ouachita Mountains	x	x	x	x	x	x		x	x	2,589,790	2,030,694
Ozark Highlands			x		x	x		x	x	2,043,011	1,063,788
South Central Plains	x	x	x	x	x	x		x	x	1,936,138	804,425
Entire Eastern Region	x	x	x	x	x	x		x	x	**12,979,002**	**5,836,208**

Source: Forest type locations determined by 2009 OFS Analysis and the 2005 OK GAP Analysis

Eastern Region Wood Product Output and Use (18 eastern counties, FIA units)

Table 11 includes outputs of industrial products from primary wood-using facilities (Figure 13) in eastern Oklahoma. Medium density fiberboard, insulating board, and hardboard plants were included in the survey conducted to generate the output numbers and currently eastern Oklahoma is the only region in the state with available data for timber product outputs. The map shows the general locations of the primary forest product producers throughout the eastern region.

Figure 13: *Map of Primary Wood Product Producer Facilities in Eastern Oklahoma, 2010*

Table 11: *Output of industrial products by product and species group, Eastern Oklahoma 2002 and 2005*

Products and species group	Year		
	2002	2005	Change
	thousand cubic feet		*percent*
Saw logs			
Softwood	57,304	54,691	-4.6
Hardwood	6,653	6,803	2.3
Total	63,957	61,494	-3.9
Veneer logs and other industrial[a]			
Softwood	12,906	21,119	63.6
Hardwood	0	13	
Total	12,906	21,132	63.7
Pulpwood[b]			
Softwood	27,706	19,626	-29.2
Hardwood	21,212	16,983	-19.9
Total	48,918	36,609	-25.2
All industrial			
Softwood	97,916	95,436	-2.5
Hardwood	27,865	23,799	-14.6
Total	125,781	119,235	-5.2

Note: No timber product output study was conducted in 2007.

[a] Includes poles, posts, composite panels, mulch, firewood, log homes, charcoal, and all other industrial products.
[b] Includes roundwood delivered to nonpulpmills, then chipped and sold to pulpmills (3,707,000 cubic feet in 2002 and 3,707,000 cubic feet in 2005)

Source: USFS – The South's Timber Industry – An Assessment of Timber Product Output and Use, 2007.

Eastern Region Community Forests

The western edge of US eastern forest cover crosses into the eastern third of Oklahoma and is abundant with a variety of hardwoods and softwoods that include a mixture of oaks, hickories, pines and elms. The forests cover the rolling hills from the hilltops to the valleys. During settlement, communities in this part of the state often had to clear trees for home sites and farms. Trees continue to play important functions in eastern communities including the improvement of the environment, aesthetics, and the quality of living.

In Oklahoma, some communities are utilizing forestry and environmental tools and programs to manage their community forests. Out of the 189 communities (municipalities) in the eastern region, 6 are currently recognized as a Tree City USA. A major impact to a community's forest is the maintenance of infrastructure such as roads and powerlines and proper planning and use of forest management are important to maintaining community trees and forests. Five utility companies that serve the majority of Oklahoma residents are recognized as a Tree Line USA utility company.

Five communities, in the eastern region, have Community Wildfire Protection Plans (CWPP). These 5 communities are Stilwell, Allen, Atoka, Bokchito, and Yuba. The cities of Atoka, Bokchito, Stilwell, and Yuba were all ranked high hazard rating for wildfires. Allen is ranked at a moderate wildfire hazard rating. There are many communities within the eastern forest region that should address wildfire hazards by developing a plan to be more prepared for wildfire events. CWPPs will be addressed more in the State Forest Resource Strategy and more information about the CWPP program can be found in Appendix B.

Wildlife Species of Greatest Conservation Need that Inhabit the Eastern Region

Forests provide many wildlife species with major habitat requirements – food, cover, water and space. When forests are disturbed, such as by timber harvest, natural disaster, wildfires or other event, the quantity, quality, and distribution of these habitat features will change. As a result, certain wildlife will be favored in forests at different stages of succession. Wildlife may be associated with forests at a particular successional stage because of types and amounts of habitat that are provided. Most wildlife species need a variety of forest successional stages to thrive therefore managing forests to provide different stages of growth helps provide more diversity.

The eastern forest region is the most diverse region of the state and provides habitat to many different wildlife species. A wide variety of wildlife species depend on at least one of the 8 forest types found throughout this region therefore forest management is a key component in providing biodiversity throughout eastern Oklahoma.

The 2005 Oklahoma Comprehensive Wildlife Conservation Strategy organized the priority wildlife species of greatest conservation need by forested habitats within the eastern region. Below the forested habitats are listed including the priority wildlife species and the conservation issues associated with each habitat as defined by the Oklahoma Department of Wildlife Conservation (ODWC). There are only six of the eight forest types described and some forest types were combined because of some differences in the Oklahoma Wildlife Conservation Strategy and this forest resource assessment.

Oak – Hickory Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Ringed Salamander	Rich Mountain Salamander
Kiamichi Slimy Salamander	Ouachita Dusky Salamander
Four-toed Salamander	Ozark Salamander
Cerulean Warbler	Hooded Warbler
Kentucky Warbler	Wood Thrush
Worm-eating Warbler	Whip-poor-will
Rich Mountain Slitmouth Snail	Spotted Skunk
Gray Bat	Ozark Big-eared Bat

Some Conservation Issues Identified by ODWC:

- Incomplete data concerning the abundances and population trends of species of greatest conservation need.
- Fragmentation of habitat by roads, vacation homes and pipelines
- Conversion of habitat to residential use, pine plantations and improved pasture
- Exotic and/or invasive species including *Sericea lespedeza*, Autumn Olive, Chinese Privet and Japanese Honeysuckles have become established in hardwood forests and are displacing native understory vegetation and altering native plant communities and habitat conditions.
- Altered/unnatural forest age structure that is a result of many forest stands being comprised of dense, even-aged second growth forest that followed widespread timber harvesting in the early 1900s. These stands have poor structural diversity compared to historic uneven-aged forests and have a reduced understory.

Shortleaf Pine and Oak-Pine Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:

Bachman's Sparrow	Brown-headed Nuthatch
Red-cockaded Woodpecker	Northern Bobwhite
Prairie Warbler	Diana Fritillary
Red-headed Woodpecker	

Some Conservation Issues Identified by ODWC:

- Incomplete data regarding the abundances and population trends of species of greatest conservation need.
- Much of this habitat type currently exists as even-aged forest. This change appears to be a result of historic large-scale timber harvest that occurred during the late 1800s and early 1900s.
- Because changes in vegetation structure have occurred gradually, many landowners are not aware of changes and do not see them as a problem.
- Exotic herbaceous plant species such as *Sericea lespedeza* have become established outside of cultivation and appear to displace native plants, which in turn alters the habitat conditions.
- In local areas, heavy cattle grazing within Shortleaf Pine/Oak forests may reduce the abundance and diversity of understory vegetation, contribute to erosion on steep slopes and enhance the spread of undesirable exotic vegetation.
- Loss and fragmentation of habitat has occurred as a result of the conversion of Shortleaf Pine/Oak forests to other land uses – primarily commercial pine plantations and rangeland.
- The fragmentation of habitat is increasing due to increasing numbers of second home developments, cabins, and ranchettes; expanding infrastructure including roads, utility lines, and pipelines, and fragmentation of land ownership (i.e., more individuals owning smaller tracts of land).

Loblolly Pine and Oak-Pine Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:

Mole Salamander	Sequoyah Slimy Salamander
American Woodcock	Brown-headed Nuthatch
Kentucky Warbler	Warbler
Diana Fritillary	Northern Long-eared Myotis
Seminole Bat	Rafinesque's Big-eared Bat

Some Conservation Issues Identified by ODWC:

- Data are incomplete regarding the abundance and population trends for species of greatest conservation need.
- Forest structure has been altered relative to its historic condition. Much of this habitat type currently exists as even-aged forest as a result of historic logging.
- Habitat loss and fragmentation has occurred as a result of the conversion of loblolly pine/oak forest to other land uses such as loblolly pine plantations and pastures that are planted to exotic grasses.
- Habitat has been fragmented as a result of secondary home development, roads, and other infrastructure.

- Several exotic plant species including Sericea lespedeza, Chinese Privet and Japanese Honeysuckle have become established outside of cultivation and appear to be displacing native plants and altering habitat.

Shortleaf Pine and Oak- Hickory Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:

Brown-headed Nuthatch	Kentucky Warbler
Whip-poor-will	Northern Long-eared Myotis
Diana Fritillary	American Burying Beetle

Combined with

Post Oak – Blackjack Oak Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Harris's Sparrow	Bachman's Sparrow
Prairie Warbler	Blue-winged Warbler
Kentucky Warbler	Painted Bunting
Northern Bobwhite	Red-headed Woodpecker
American Burying Beetle	Ozark Big-eared Bat
Northern Long-eared Myotis	Eastern Spotted Skunk

Some Conservation Issues Identified by ODWC:

- Data are incomplete regarding the distributions, abundances and population trends of species of greatest conservation need.
- Much of this habitat type currently exists as even-aged forest as a result of it being second-growth forest that developed following a period of widespread regional timber harvest that occurred during the late 1800s or early 1900s.
- The combination of even-aged stands and decades of fire suppression appear to be responsible for greater tree densities than probably occurred historically. The lack of periodic fire and dense forest canopy conditions appears to have reduced understory vegetation and may reduce the successful recruitment of shortleaf pines and some species of oaks in the future. In oak-dominated forests, the occurrence of eastern redcedar has increased and this appears to be related to the loss of historic fire regimes.
- Loss of habitat and habitat fragmentation has occurred as a result of the conversion of pine-oak-hickory forests to other land uses- primarily pine plantations and rangeland.
- Habitat fragmentation is increasing due to increasing numbers of secondary homes, cabins, and ranchettes, and due to expanding infrastructure including roads, utility lines, and pipelines. Fragmentation of land ownership is another trend, with more individuals owning smaller tracts of land.
- Several exotic species such as Sericea lespedeza and Japanese Honeysuckle have become established outside of cultivation and appear to displace native plants and to alter the habitat conditions for wildlife species of conservation need.

Bottomland Hardwood Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Sequoyah Slimy Salamander	Ringed Salamander
Mole Salamander	Crawfish Frog
Bird-voiced Treefrog	Cerulean Warbler
Hooded Warbler	Kentucky Warbler
Wood Thrush	Prothonotary Warbler
Swainson's Warbler	Rusty Blackbird
Golden Mouse	Rafinesque's Big-eared Bat
Gray Bat	Southeastern Myotis
Long-eared Myotis	Swamp Rabbit
Louisiana Milksnake	Western Mudsnake
Western Chicken Turtle	Ouachita Dusky Salamander
Many-ribbed Salamander	Grotto Salamander
Oklahoma Salamander	Louisiana Watherthrush
Northern Long-eared Myotis	Ozark Big-eared Bat
Alligator Snapping Turtle	Mississippi Map Turtle
Ouachita Map Turtle	Razor-backed Musk Turtle

Some Conservation Issues Identified by ODWC:

- Incomplete data regarding the distribution, abundance and population trends for species of greatest conservation need.
- Habitat loss and modification as a result of altered patterns of seasonal flooding due to stream and river channel modifications and impoundments. Reservoir construction and stream channelization projects have reduced the frequency and magnitude of flooding which is necessary to maintain bottomland

hardwood forests. In some areas, channel modifications have resulted in deep incised stream channels and created a disconnection between the streams and their bottomland forests.

- Vernal pools and seasonally flooded wetlands within bottomland forests have been lost or degraded as a result of sedimentation and/or reduction in periodic flooding, resulting in losses of important breeding areas for a diversity of amphibians and feeding areas for waterfowl.
- Fragmentation and loss of bottomland hardwood communities as a result of the conversion of these forests to crop fields, pine plantations, and improved pastures.
- Fragmentation of forest tracts as a result of infrastructure development (e.g. roads, utility lines, and pipelines)
- Some bottomland forest stands are comprised of dense, even-aged second growth forest as a result of widespread timber harvest in the early 1900s. These forests have a reduced structural diversity and limited understory vegetation compared to historic uneven-aged forests. Sustained shading may limit the recruitment of oak species in favor of more shade tolerant species over time.
- Exotic and/or invasive plant species including Sericea lespedeza, Autumn Olive, Chinese Privet and Japanese Honeysuckle have become established and appear to be displacing native understory plants.
- Feral hogs may be causing substantial ecological damage to vernal pools and wetlands within bottomland forests and may compete with native wildlife for food.

Threatened and Endangered Species found in the Eastern Region

The following are the major threatened and endangered species found within the eastern forest region:

Endangered
American burying beetle (*Nicrophorus americanus*)
Gray Bat (*Myotis grisescens*)
Indiana bat (*Myotis sodalis*)
Interior least tern (*Sterna antillarum*)
Ouachita rock pocketbook mussel (*Arkansia wheeleri*)
Ozark Big-eared bat (*Corynorhinus [=Plecotus] townsendii ingens*)
Red-cockaded woodpecker (*Picoides borealis*)
Whooping Crane (*Grus Americana*)

Threatened
American alligator (*Alligator mississippiensis*)
Arkansas River Shiner (*Notropis girardi*)
Eastern prairie fringed orchid (*Platanthera leucophaea*)
Leopard darter (*Percina pantherina*)
Neosho madtom (*Noturus placidus*)
Ozark cavefish (*Amblyopsis rosae*)
Piping plover (*Charadrius melodus*)
Western prairie fringed orchid (*Platanthera praeclara*)

Monitored Species
American Peregrine falcon (*Falco peregrinus anatum*): Status: Recently Recovered
Bald Eagle (*Haliaeetus leucocephalus*): Status: Delisted

Central Forest Region of Oklahoma

The central forest region is not as diverse as the eastern region but does have some extremely unique features. This region is made up of 3 ecoregions and 7 different forest types. Approximately 35% of the state's forests are within the central forest region.

The predominant forest type found in the central forest region is the post oak – blackjack oak forest type, commonly known as the Cross Timbers Forest. This forest type is a complex mosaic of upland deciduous forest, savanna, and glade communities that highlight the broad ecotone between the eastern forests and the western grasslands. Because the Cross Timbers forest type is essentially noncommercial for timber production, it has never experienced large-scale industrial logging. The Cross Timbers growing on level terrain have been widely cleared for agriculture, but undisturbed tracts of ancient Cross Timbers are still frequently present on steep, rocky terrain where timber removal for farming or grazing was not economically justified. Studies have demonstrated that ancient forests dominated by 200- to 400- year old post oak trees survive in literally hundreds of Cross Timbers tracts. It is estimated that approximately 1,088,000 acres of ancient post oak forests may survive in Oklahoma alone. There are also other forest types that spread across this region such as the bottomland hardwood forests, eastern redcedar forests, oak-pine forests, oak-hickory forests, and small amounts of shortleaf pine forests.

This region is the most populated region of the state and where the larger community forests exist. The Arbuckle Mountains fall within this region.

Total Land Acres: 12,881,411
Forested Acres: 3,549,195

Counties: Atoka, Bryan, Blaine, Caddo, Canadian, Carter, Cleveland, Coal, Comanche, Cotton, Creek, Custer, Dewey, Garfield, Garvin, Grady, Haskell, Hughes, Jefferson, Johnston, Kay, Kiowa, Lincoln, Logan, Love, Marshall, McClain, McIntosh, Murray, Muskogee, Noble, Okfuskee, Oklahoma, Okmulgee, Osage, Pawnee, Payne, Pittsburg, Pontotoc, Pottawatomie, Seminole, Stephens, Tulsa, Wagoner, Washington, Washita

Major Urban Areas (Population over 20,000): Oklahoma City, Norman, Edmond, Midwest City, Moore, Stillwater, Shawnee, Ardmore, Duncan, Del City, Bethany

Table 12: *Central region total forested acres and included forest types.*

Central Forest Region of Oklahoma											
Ecoregions within the Central Region	Forest Types within Ecoregions									Acres	
	Shortleaf Pine	Loblolly Pine	Oak-Hickory	Oak-Pine	Post Oak - Blackjack Oak	Bottomland Hardwoods	Pinyon Pine - Juniper	Eastern Redcedar	Community Forests	Total Acres	Total Forested Acres
Cross Timbers	x		x	x	x	x		x	x	8,487,831	3,012,811
Cross Timbers Transition					x	x		x	x	3,776,350	488,479
Flint Hills					x	x		x	x	617,230	47,905
Entire Central Region	x		x	x	x	x		x	x	**12,881,411**	**3,549,195**

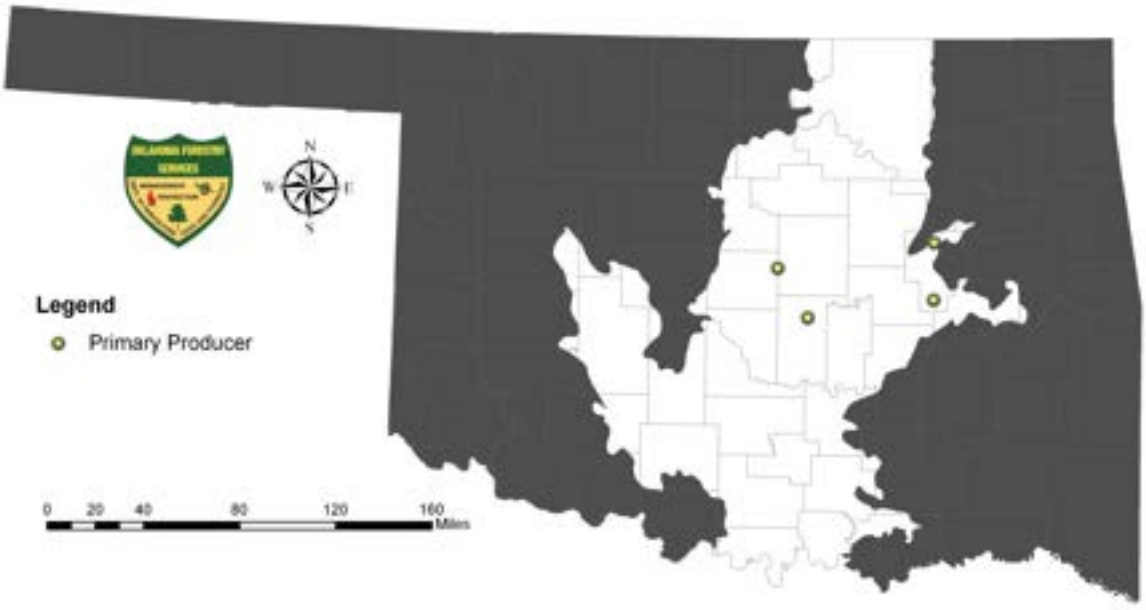
Source: Forest type locations determined by 2009 OFS Analysis and the 2005 OK GAP Analysis

Central Region Wood Product Output and Use

The central region of Oklahoma currently has no available data for timber product output and use, but Figure 14 shows where the known primary wood using mills are located. The U.S. Forest Service – Forest Inventory and Analysis Program is currently surveying this area and more data will be available at a later date.

There are many management challenges in this region compared to the eastern region because very few markets exist and the forest types are underappreciated.

Figure 14: *Map of Primary Wood Product Producer Facilities in Central Oklahoma, 2010*



Central Community Forest

Predominant forest cover in the central region communities consists of post and blackjack oak. Natural forests occur along the sides of the rolling hills into the valleys and canyons and along the natural waterways. Trees were planted during settlement for shade and a food source with that turning to aesthetics and other environmental benefits as these communities grew. Out of the 227 communities (municipalities) in the central region, 14 are currently recognized as a Tree City USA.

In the central forest region, out of 227 communities, there are no communities that have a Community Wildfire Protection Plan (CWPP). There are many communities within the central forest region that should address wildfire hazards by developing a plan to be more prepared for wildfire events. CWPPs will be addressed more in the State Forest Resource Strategy and more information about the CWPP program can be found in Appendix B.

Wildlife Species of Greatest Conservation Need that Inhabit the Central Region

As mentioned in the eastern forest region section, forests provide many wildlife species with major habitat requirements – food, cover, water and space. A wide variety of wildlife species depend on at least one of the 7 forest types found throughout this region therefore forest management is a key component in providing biodiversity throughout central Oklahoma.

The Oklahoma Comprehensive Wildlife Conservation Strategy organized the priority wildlife species of greatest conservation need by forested habitats within the central region. Below the forested habitats are listed including the priority wildlife species and the conservation issues associated with each habitat as defined by the Oklahoma Department of Wildlife Conservation. There are only four out of the seven forest types described in this section because of some differences between the Oklahoma Wildlife Conservation Strategy and this forest resource assessment.

Post Oak – Blackjack Oak and Oak-Hickory Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:

Painted Bunting	Northern Bobwhite
Harris's Sparrow	Red-headed Woodpecker
Northern Scarlet Snake	Crawfish Frog

Some Conservation Issues Identified by ODWC:

- Data are incomplete for the abundances and population trends of species of greatest conservation need.
- Cross Timbers forests are being fragmented by urbanization, conversion to tame pastureland, road construction, oil and gas development, and utility/pipeline right of ways.
- The loss or reduction in the frequency of fires has allowed for a proliferation of eastern redcedar and has made some forest tracts denser than they were historically.
- Increased canopy closure in many areas has resulted in a reduction in native understory vegetation. In some tracts this has been made worse by heavy cattle grazing and the introduction of exotic forbs.
- Habitat structure and composition are being influenced by invasive and/or exotic species.

Post Oak – Blackjack Oak and Eastern Redcedar Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:

Black-capped Vireo	Painted Bunting
Northern Bobwhite	Harris's Sparrow
Texas Horned Lizard	

Some Conservation Issues Identified by ODWC:

- Incomplete data concerning the abundances and population trends for species of greatest conservation need.
- Habitat loss and fragmentation as a result of conversion of this forest type to tame pasture grasses such as Bermuda grass and Lovegrass
- Fragmentation of the habitat by urbanization, home construction and infrastructure construction (e.g. roads, pipelines, utility lines).
- Heavy grazing, coupled with the loss of periodic fire, has altered the diversity of herbaceous vegetation and encouraged an increase in the abundance of eastern redcedar.

Bottomland Hardwood Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Kentucky Warbler	Hooded Warbler
American Woodcock	Prothonotary Warbler
Rusty Blackbird	Crawfish Frog
Swamp Rabbit	Bell's Vireo
Louisiana Waterthrush	Red-headed Woodpecker
Eastern River Cooter	Ouachita Map Turtle
Mississippi Map Turtle	

Some Conservation Issues Identified by ODWC:

- Incomplete data regarding the abundance and population trends of priority species of greatest conservation need.
- Habitat loss and fragmentation as a result of the conversion of bottomland forest to improved pasture and cropland, and the construction of infrastructure (e.g. roads, homes, utility line right of ways, natural gas wells, and pipelines).
- Unnatural stand age structure: many bottomland hardwood forest stands are even-age regrowth stands that developed following historic clear cutting. These regrowth forests often have dense canopies and mid-stories, poor structural diversity, and poorly developed understory vegetation.
- Altered flooding regimes that have resulted from the construction of impoundments and/ or the channelization of streams. In many watersheds these have created a dramatic disconnection between the riparian forests/bottomland forests and their streams due to the channelization and incision of streams leading to a reduction in periodic flooding or soil saturation in the bottomland forest zone.

Threatened and Endangered Species Found in the Central Region

The following are the major threatened and endangered species found in the central forest region:

Endangered
American burying beetle (*Nicrophorus americanus*)
Black-capped vireo (*Vireo atricapilla*)
Interior least tern (*Sterna antillarum*)
Whooping Crane (*Grus Americana*)

Threatened
Arkansas River Shiner (*Notropis girardi*)
Piping plover (*Charadrius melodus*)

Monitored Species
American Peregrine falcon (*Falco peregrinus anatum*) Status: Recently Recovered
Bald Eagle (*Haliaeetus leucocephalus*) Status: Delisted

Western Forest Region of Oklahoma

The western forest region is predominantly grasslands containing less then 7% of the state's forests. There are 2 ecoregions with 5 different forest types sparsely spread throughout the region. Post oak – blackjack oak forests are found along the eastern edge of this region while community forest can be found in most of the urban areas. Eastern redcedar forests are native to canyons and ridges but have encroached onto unmanaged grasslands and some riparian forests. The majority of the forests in this region are bottomland hardwoods found along the rivers and tributaries, but many have been degraded or lost to cropland or rangeland. A unique forest found only in Cimarron County is the Pinyon Pine – Juniper forest type. This forest type consists of small stature pinyon pine, one-seed juniper, and ponderosa pine. The Black Mesa Nature Preserve, located in the northwestern corner of Cimarron County, features the highest elevation, 4,973 feet, in the state.

Total Land Acres: 18,884,029
Forested Acres: 608,970

Counties: Alfalfa, Beaver, Beckham, Blaine, Caddo, Canadian, Carter, Cimarron, Cleveland, Comanche, Cotton, Custer, Dewey, Ellis, Garfield, Grady, Grant, Greer, Harmon, Harper, Jackson, Jefferson, Kay, Kingfisher, Kiowa, Logan, Love, Major, McClain, Noble, Oklahoma, Osage, Pawnee, Roger Mills, Stephens, Texas, Tillman, Washita, Woods, Woodward

Major Urban Areas (Population over 20,000): Lawton, Enid, Ponca City, Altus, Yukon

Table 13: *Western region total forested acres and included forest types.*

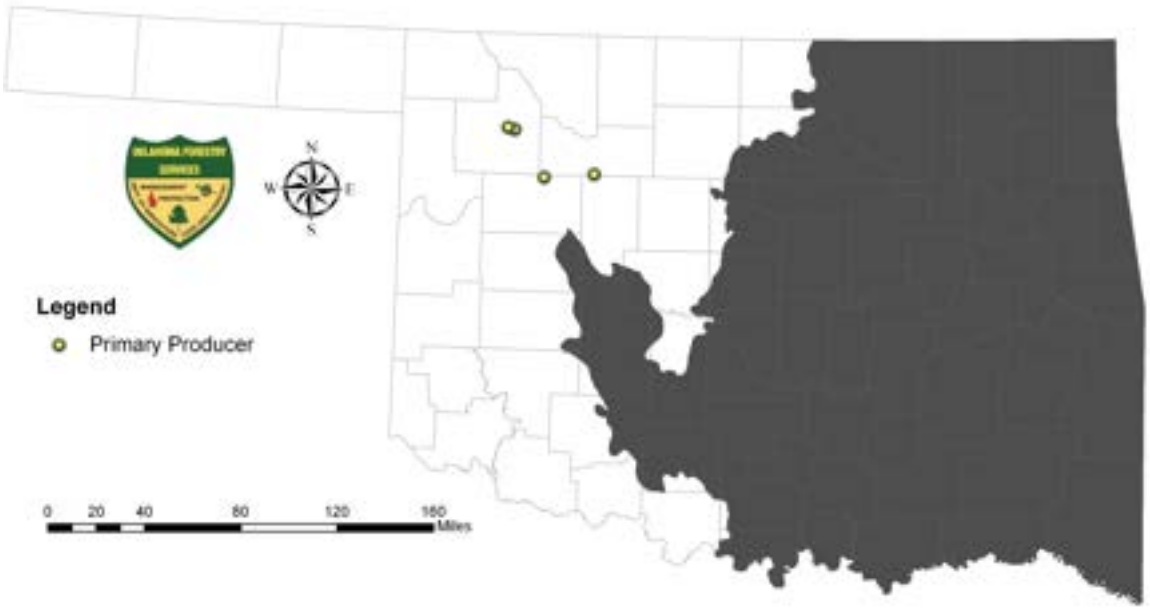
Western Forest Region of Oklahoma											
Ecoregions within the Western Region	Forest Types within Ecoregions									Acres	
	Shortleaf Pine	Loblolly Pine	Oak-Hickory	Oak-Pine	Post Oak - Blackjack Oak	Bottomland Hardwoods	Pinyon Pine - Juniper	Eastern Redcedar	Community (Urban)	Total Acres	Total Forested Acres
Central Great Plains					x	x	x	x	x	16,632,500	608,070
High Plains						x			x	2,251,529	900
Entire Western Region					x	x	x	x	x	**18,884,029**	**608,970**

Source: Forest type locations determined by 2009 OFS Analysis and the 2005 OK GAP Analysis

Western Region Wood Product Output and Use

The western region of Oklahoma currently has no available data for timber product output. Figure 15 shows where the known primary wood using mills are located. The U.S. Forest Service – Forest Inventory and Analysis Program is currently surveying this area and data will be available at a later date.

Figure 15: *Map of Primary Wood Product Producer Facilities in Western Oklahoma, 2010*



Western Community Forests

The community forests of western Oklahoma are among the arid grasslands and are more open in their environment. Native trees mainly exist along canyon walls, valleys, and along riparian corridors. Trees in communities were generally planted during settlement periods to provide for shade during hot summer months and provide a food source on the prairie. Communities continue planting trees today to support the environment, beautification and quality of living needs. Out of the 183 communities (municipalities) in the western region, 5 are currently recognized as a Tree City USA.

In the western forest region, out of 183 communities, only one has a Community Wildfire Protection Plan (CWPP). The city of Temple is the only community that has developed a CWPP within this region and their community is rated moderate to wildfire hazards. There are many communities within the western forest region that should address wildfire hazards by developing a plan to be more prepared for wildfire events. CWPPs will be addressed more in the State Forest Resource Strategy and more information about the CWPP program can be found in Appendix B.

Wildlife Species of Greatest Conservation Need that Inhabit the Western Region

This region of the state has the fewest forested acres but there are still some wildlife species that depend on the 5 forest types in this region for habitat. In western Oklahoma, wildlife habitats are often degraded or lost because of land conversion to non-forest uses especially around the riparian forest areas.

The Oklahoma Comprehensive Wildlife Conservation Strategy organized the priority wildlife species of greatest conservation need by forested habitats within the western region. Below the forested habitats are listed including the priority wildlife species and the conservation issues

associated with each habitat as defined by the Oklahoma Department of Wildlife Conservation. There are only four out of the five forest types described in this section because of differences between the Oklahoma Wildlife Conservation Strategy and this forest resource assessment.

Pinyon Pine - Juniper Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Juniper Titmouse	Lewis's Woodpecker
Pinyon Jay	Colorado Chipmunk
Desert Shrew	Western Big-eared Bat
Ringtail	Checkered Whiptail
Texas Horned Lizard	

Some Conservation Issues Identified by ODWC:

- Incomplete data regarding the abundance and population trend of priority species of greatest conservation need.
- Fragmentation of forest tracts as a result of infrastructure construction.
- Fire suppression and heavy grazing pressure have resulted in an increase in juniper density and reduction in herbaceous ground cover and deciduous shrub cover.

Bottomland Hardwood Forest Habitat Type

Priority Wildlife Species of Greatest Conservation Need:

Bullock's Oriole	Red-headed Woodpecker
Bell's Vireo	Western Big-eared Bat
Cassin's Sparrow	Bell's Vireo
Painted Bunting	Northern Bobwhite
Lesser Prairie Chicken	Harris's Sparrow
Texas Horned Lizard	Texas Long-nosed Snake

Some Conservation Issues Identified by ODWC:

- Riparian forest habitat has been negatively affected by altered patterns of water flow and diminished surface flows as a result of dewatering for irrigation and the construction of impoundments
- Invasive and/or exotic species such as salt cedar have encroached upon riparian areas and affected habitat structure and composition.
- Heavy grazing in riparian areas has affected vegetation structure and habitat quality.
- Fragmentation of habitat as a result of infrastructure construction and conversion to crop fields and improved pasture.

Post Oak – Blackjack Oak and Eastern Redcedar Forest Habitat Types

Priority Wildlife Species of Greatest Conservation Need:
Harris's Sparrow
Northern Bobwhite
Painted Bunting
Red-headed Woodpecker

Some Conservation Issues Identified by ODWC:

- Habitat loss and fragmentation as a result of conversion of some tracts to exotic pasture grasses (e.g., Bermuda grass and lovegrass) which do not provide habitat for most wildlife species.
- Fragmentation of forests by urbanization, road construction, utility and pipeline right of ways.
- Invasive and exotic plants that alter habitat structure and composition (e.g. Sericea lespedeza, exotic grass).
- Loss of the natural fire regimes and heavy grazing have allowed for increases in the abundance of eastern redcedar and/or increased tree densities.

Threatened and Endangered Species Found in the Western Region

The following are the major threatened and endangered species found in the western forest region:

Endangered
Black-capped vireo (*Vireo atricapilla*)
Interior least tern (*Sterna antillarum*)

Threatened
Arkansas River Shiner (*Notropis girardi*)
Piping plover (*Charadrius melodus*)

Monitored Species
American Peregrine falcon (*Falco peregrinus anatum*) Status: Recently Recovered
Bald Eagle (*Haliaeetus leucocephalus*) Status: Delisted

Forest Ownership

Oklahoma's population in 2000 was 3,450,640 and the latest estimates for 2008 show an increase of 5.6% to 3,642,361. The increase in population is putting pressures on Oklahoma's forests and natural resources. In 2008, it was estimated that 2,324,829 people lived in urban areas with approximately 1.3 million people living in rural areas which have both increased since 1980. There are approximately 44 million acres of land in Oklahoma and the majority of the land is privately owned. A large percentage of the 10 million acres of forestland, in both rural and urban areas, are under pressure of conversion to non-forest uses.

Oklahoma's forestlands are characterized by private ownership. In fact, almost 90 percent of the forested acreage in Oklahoma is in the hands of the private sector. Large privately owned forest tracts continue to be fragmented and the number of ownerships continues to increase. More landowners with smaller tracts of forestland complicate the management of forests statewide.

Private Forestland Ownership

There are approximately 40 million acres of private land and roughly 8.5 million acres are forested. The tribal lands are included in the acreage of privately owned lands.

The USDA Forest Service's National Woodland Owner Survey is conducted to improve the understanding of who owns the forests of the United States, why they own them, how they use them, and what they intend to do with them. Sixty-five private landowners from eastern Oklahoma participated in the survey between 2002 and 2006. Below are a few of the results from the survey:

The landowners' top five reasons for owning the forestland are:

1. Pass land on to heirs
2. Part of farm or ranch
3. Beauty/scenery
4. Hunting or fishing
5. Privacy

The landowners were also asked what their important concerns are with their forestland. The top five concerns are:

1. Keeping land intact for heirs
2. Insects or plant diseases
3. Misuse of forestland
4. Fire
5. Wind or ice storms

When asked what they have planned for the next five years on their forestland, the top five responses were:

1. Leave it as is – no activity
2. Harvest firewood
3. Minimal activity
4. Harvest sawlogs or pulpwood
5. Transfer to heirs

A special note concerning Tribal Lands:

Oklahoma is home to thirty-nine Native American tribes. Thirty-seven are federally recognized as sovereign nations and another has applied for federal recognition. According to the 2000 Census, Oklahoma is home to a population of more than 380,000 tribal members. The Cherokee Nation, located in Tahlequah, is the second largest tribe in the United States with over 222,000 members. Oklahoma's smallest tribe is the Modoc Tribe, headquartered in Miami, which has an estimated

membership of 200. The state is served by two regional offices of the Bureau of Indian Affairs, located in Muskogee and Anadarko.

Historically, the area that is now Oklahoma was home to five tribes – the Osage, Caddo, Kiowa, Comanche, and Wichita. All other tribes were removed from their ancestral homelands to Oklahoma during the period known as the "Indian Removal."

Oklahoma tribes are substantial landowners. For example, the Cherokee Nation is the beneficial owner of over 65,000 acres of tribal trust lands in northeastern Oklahoma, including an intact portion of its original reservation and tens of thousands of acres of trust lands within its treaty boundaries reacquired under the Oklahoma Indian Welfare Act of 1936 and the Indian Reorganization Act of 1934.

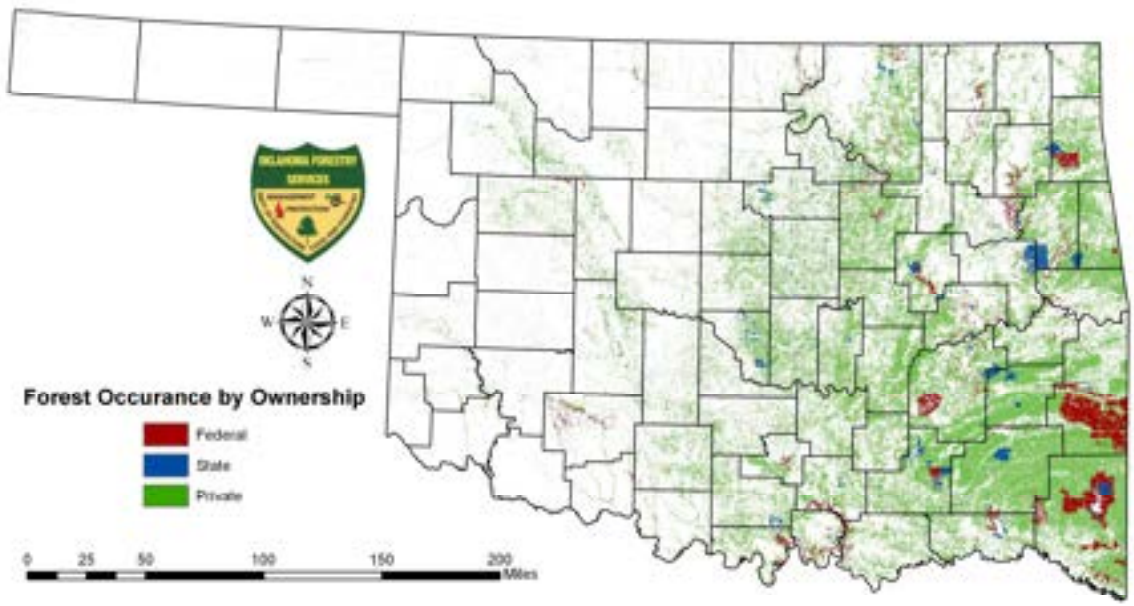
State and Local Government Forestland Ownership

State and local governments own over 1 million acres across the state and less than half of this land is forested. There are numerous city parks that make up parts of the community forests within the state. Oklahoma has 50 state parks that reflect the beauty and diversity of the state's forests and landscape.

Federal Forestland Ownership

There are over 1 million acres of federal land in Oklahoma and over 700,000 acres are forested. There is one national forest owned and managed by the USDA Forest Service located in southeastern Oklahoma. The USDA Forest Service also own and manage two National Grasslands in western Oklahoma, Black Kettle and Rita Blanca, which contain some small tracts of upland and bottomland hardwood forests. There are a few lands under the ownership of the Bureau of Indian Affairs but the majority of tribal lands are privately owned.

Figure 16: *Map of Forestland Ownerships*



Oklahoma Forestlands by Ownership was created by merging a raster of forest distribution with a raster of each federal, state, and private land. The resulting merges were then color-coded for visibility.

The USDA - FS Forest Inventory and Analysis (FIA) program surveyed the eastern 18 counties and is currently surveying the central and western counties. The FIA crews collect data on forest types and forest ownership and the table below outlines the ownership of the timberland or productive forests in the eastern 18 counties (refer to map on page 38). Currently the best data

for Oklahoma only includes the eastern counties but by 2018 the entire state will be inventoried completely for the first time and the numbers in the table below will likely change.

Table 14: *Eastern Oklahoma, Area of Timberland (productive forest land) by Ownership Group*

Area of timberland by forest-type and ownership group, East Oklahoma, 2008						
Forest-type	All ownerships	U.S. Forest Service	Other federal	State and local government	Forest industry	Nonindustrial private
		thousand acres				
Softwood types (Pines and other softwoods)	1096.8	159.2	51.1	28.9	350.6	507.0
Hardwood types (oak, elm, ash, hickory, etc.)	3971.0	98.3	244.0	135.2	214.8	3278.6
Nonstocked	35.3	0.0	1.4	0.0	2.9	31.0
All groups	5103.1	257.5	296.5	164.1	568.3	3816.6

Source: Forest Inventory and Analysis Data for East Oklahoma, 2008

Table 15: *Oklahoma Land Ownership Patterns*

Ownership of Property	Acreage by agency	Total acreage	Forested acreage	Percentage forested
Private properties	>	**41,018,167**	**8,881,771**	**21.65%**
The Nature Conservancy	38,371			
Indian lands	1,391,949			
Other private owners	39,587,847			
Federal government	>	**1,290,336**	**754,801**	**58.50%**
Army Corps of Engineers	531,536			
Bureau of Indian Affairs	41,150			
Bureau of Land Management	320			
Bureau of Reclamation	49,575			
Department of Defense	148,323			
National Park Service	7,005			
U.S. Fish and Wildlife Service	118,619			
U.S. Forest Service	383,243			
Other federal agencies	10,565			
State and local government	>	**1,152,291**	**326,230**	**28.31%**
Grand River Dam Authority	82			
Dept. of Wildlife Conservation	300,046			
Tourism and Recreation Dept.	33,436			
School Land Office	772,784			
State Regents, other state agencies	17,761			
Local government	28,182			
Water		**493,766**	**35,800**	**7.25%**
State Totals		**43,954,560**	**9,998,602**	**22.75%**

Source: 2007 Statewide Comprehensive Outdoor Recreation Plan – Oklahoma Tourism and Recreation Department and Oklahoma Forestry Services for forested acres (This is currently the best data available on land and forestland ownership, data is subject to change).

Public Benefits from Oklahoma's Forest Resources

There are many public benefits and values provided by the state's forests. Some of the benefits provided are obvious but some tend to be overlooked and underappreciated by Oklahomans. The following section describes the many benefits and values Oklahoma's forests and trees provide to the state. It is important for Oklahoma natural resource agencies and organizations to work together to manage our forests and other natural resources so we can continue to enjoy the many benefits and values our diverse landscape provides.

Forest Products (Renewable Resource) and Landowner Income:

Forest products bring a considerable amount of jobs and money into the state's economy. The best thing about forest products is that trees are a renewable and sustainable resource (unlike coal, oil, and natural gas). Forests can continue to be regenerated for present and future generations.

Forest products include:

- Timber (lumber for construction, flooring, molding, paneling)
- Pulp and paper

- Decorative products (vines, flowers, holiday season greenery)
- Herbal and medicinal products
- Edible products (fruits, nuts, honey, berries, mushrooms, etc.)
- Other non-timber products (specialty charcoal)
- Energy (biomass)

The traditional source of income for forest landowners is timber, but most of the forest products above can bring in some income but the markets are not as stable. Another value or form of income that comes from forest and trees is property value. Property values can be affected positively or negatively by the presence of certain trees. The Council of Tree and Landscape Appraisers (CTLA) developed techniques recognized by courts and insurance companies to assess the contribution of trees to residential property value. Tree values vary from case to case.

Table 16: *Oklahoma manufacturing facilities and value of shipments*

Oklahoma Forest and Paper Industry		
Manufacturing Facilities	**# of facilities**	**Value of Industry Shipments**
Sawmills, Millwork, Treating	6	-
Engineered Wood and Panel Products	2	-
Other Wood Products	4	-
Total Wood Products	**12**	**$452,227,000**
Pulp, Paper, & Paperboard Mills	7	-
Converted Paper Products	35	-
Paper Manufacturing	**42**	**$2,269,266,000**
Total All Segments	**54**	**$2,721,493,000**

Source: American Forest and Paper Association, 2007

Forest related jobs: The forest and paper industry in Oklahoma provides over 10,000 people with employment with an annual payroll income of over 513 million dollars. The value of industry shipments totals over 2.7 billion dollars.

Table 17: *Oklahoma Forest and Paper Industry Employment and Annual Payroll Income*

Oklahoma Wood-Related Sectors		
Sectors	**Employment**	**Annual Payroll Income**
Forestry & Logging	895	$31,562,000
Wood Products	4,075	$176,234,000
Pulp & Paper	2,943	$205,063,000
Furniture	2,788	$100,377,000
Total	10,701	$513,236,000

Source: US Forest Service. Economic Impacts of Wood Related Sectors Report, 2010.

Wildlife Habitat (Source: Oklahoma Wildlife Action Plan)**:** Existing native habitats support locally healthy populations of migrating shore-birds and songbirds, such as Oklahoma's state bird, the Scissor-tailed Flycatcher. The forests support rich communities of songbirds, salamanders, deer, turkey, quail, squirrel and bats. Oklahoma's rivers support an impressive diversity of fish and freshwater mussels unique to eastern regions of the country and many of these species rely on riparian forests to moderate water temperatures and provide other elements of habitat. Small forest openings provide wildlife with early sucessional habitat needed by many species of wildlife. In the prairies of Oklahoma, globally rare species are found such as the Texas horned Lizard, the Loggerhead Shrike, and other prairie icons like the Black-tailed Prairie Dog, Long-billed Curlew, and Lesser Prairie Chicken.

Forests are critical to many threatened and endangered species. The Oklahoma Wildlife Action Plan applies a habitat-based approach to address the state's 250 priority wildlife species. The wide variety of wildlife provide for excellent hunting and fishing opportunities as well as wildlife observation.

Recreation (Source: Statewide Oklahoma Comprehensive Outdoor Recreation Plan – 2007)**:** Outdoor recreation has seen a huge growth over the past 20 years and this trend is expected to continue. The most common outdoor recreation activities in which people indicated they participate were day hiking, fishing, and horseback riding. Many people enjoy getting away from all the commotion of daily life and spending time in "nature" around trees and wildlife. Some of the recreational activities include hunting, fishing, trail use, camping, parks,

water sports, etc. Oklahoma's forest diversity offers plenty of opportunity to enjoy a variety of fall foliage.

Hunting and fishing: In Oklahoma, hunting and fishing are recreational activities enjoyed by many residents as well as out of state visitors. In 2006, there were over half a million licensed anglers and hunters that generated approximately 17.5 million dollars in revenue (National Assembly of Sportsmen's Caucuses). There is a wide variety of habitats for aquatic and wildlife species throughout Oklahoma. Many landowners manage their forestland to attract wildlife for hunting purposes or to provide quality aquatic habitats for fishing.

Game species found within Oklahoma's forestlands include: bear, migratory game birds, deer, elk, furbearers, quail, pheasant, squirrel, rabbit, turkey, etc. There are set dates for each hunting season and a hunting license is required to hunt within the state. Oklahoma's abundant water resources host 176 species of fish. Some of the sportsmen favorites include: crappie, blue catfish, bluegill, brown trout, channel catfish, smallmouth bass, largemouth bass, striped bass, white bass, etc. There are many guidelines and regulations to follow to ensure safety and fun during a successful hunt or fishing adventure. There are over eighty wildlife management areas and other public lands managed for hunting and fishing purposes. Oklahoma Department of Wildlife Conservation is the best agency to contact about hunting and fishing opportunities.

Wetlands: Oklahoma is not typically considered to be a state in which wetlands are a major feature; however, there are approximately 733,000 acres in freshwater wetlands. Oklahoma supports many distinct types of wetlands, such as playa lakes, riparian wetlands, swamps, bogs, marshes, oxbow lakes, closed depressions, and cypress swamps (Oklahoma Conservation Commission, 2007).

Oklahoma ranks among the top ten states in the nation with over 60,000 acres enrolled in the Wetlands Reserve Program (NRCS, 2007). The Wetlands Reserve Program (WRP) is a voluntary program offering private landowners the opportunity to protect, restore, and enhance wetlands on their property. In parts of the state, the management of WRP lands consists of planting native tree species for wetland restoration purposes. In Oklahoma, as in many areas of the country, wetlands have been drained for agricultural uses. In the U.S., approximately 67 percent (nearly 2 million acres) of wetlands were removed from the landscape over the past 200 years. Both on a nationwide basis and in Oklahoma, bottomland hardwood forests have been hard hit. Properly managed wetlands provide excellent wildlife habitat especially for waterfowl. Wetlands can be a wonderful relaxing place to go to observe a variety of wildlife species.

Trails: About 40% of the population reports regular use of trails. Oklahoma reports approximately 600 miles of trails, almost entirely confined within single management jurisdictions, except for a few exceptions around the Tulsa area. There are many trails, across Oklahoma, which have a variety of uses such as hiking, backpacking, mountain biking, equestrian, and off road vehicles. Trail users in Oklahoma were surveyed and the top 2 reasons for recreational activity on trails are to enjoy nature and observe the scenic beauty.

The 2001 Oklahoma Recreational Trails plan concluded that the demand for trails is increasing and diversity of trail users is increasing. Trails are important considerations in community

development as alternative transportation routes, green space, and linkages, properties that stimulate the local economy and properties that improve quality of life.

Parks: There are 50 state parks that provide excellent recreational opportunities in the forests. The state parks provide hiking and equestrian trails, canoeing, fishing, camping, cabins, etc. There are many recreational opportunities available at the state parks to get outside and enjoy nature and Oklahoma's diverse forest types.

Surface water and recreation: The forests and trees surrounding Oklahoma surface water (lakes, rivers, ponds, etc.) provide scenic beauty and quality water. Recreational activities on lakes and rivers are extremely popular. People enjoy canoeing, fishing, swimming, boating, and water sports on the abundant surface waters across the State.

Carbon sequestration: Carbon sequestration is the process through which carbon dioxide (CO_2) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage, and roots) and soils. The term "sinks" is also used to refer to forests, croplands, and grazing lands, and their ability to sequester carbon. Agriculture and forestry activities can also release CO_2 into the atmosphere. Therefore a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period. Planting trees to convert historic forest land back to forest cover is an activity that can increase carbon storage (US EPA).

Air Quality: Trees are air cleaning "machines." Forests and trees remove many pollutants from the atmosphere, including nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), carbon monoxide (CO) and carbon dioxide (CO2). (See above carbon sequestration)

Clean Water: Forests protect water quality by slowing runoff, stabilizing soils, preventing erosion and floods, and filtering pollutants. Forest health of lands surrounding water supplies is vital to the integrity of water supply systems.

Energy savings: Trees can provide energy savings to homes and businesses both in urban and rural areas. Trees planted properly around a home can keep a house cooler in the summer and warmer in the winter. Planting windbreaks and snow fences can also cut energy costs by adding a barrier from these hazardous weather events.

Quality of life: Studies have shown that viewing trees can offer important physical and psychological benefits like lowering blood pressure, slowing heart rate, and promoting a sense of well-being. Viewing or being in nature has been shown to alleviate mental fatigue, heighten attention and focus, and lower levels of aggression. Forests and trees are important to society and help ensure Oklahoma residents' well-being and quality of life (US Forest Service). People

also connect trees with specific events throughout their lives and value their significance like the Survivor Elm Tree in downtown Oklahoma City.

Phyto-remediation: The process of using plants and trees to clean up pollution in the environment. Trees have been shown to be effective in removing soil contaminants, such as heavy metals, petroleum products and chemicals. Trees can also help prevent wind, rain and groundwater from carrying pollution away from sites to other areas. Using trees to restore disturbed or contaminated sites can be an effective method of improving the environment at lower costs than other methods in most cases.

Food Source: Some of the trees in Oklahoma's urban and rural forests not only provide food for wildlife but they also provide residents with a local food source of fruits and nuts. Examples of trees and shrubs that provide a food source include: pecan, black walnut, sand plum, persimmon, chokecherry, mulberry, American plum and pawpaw.

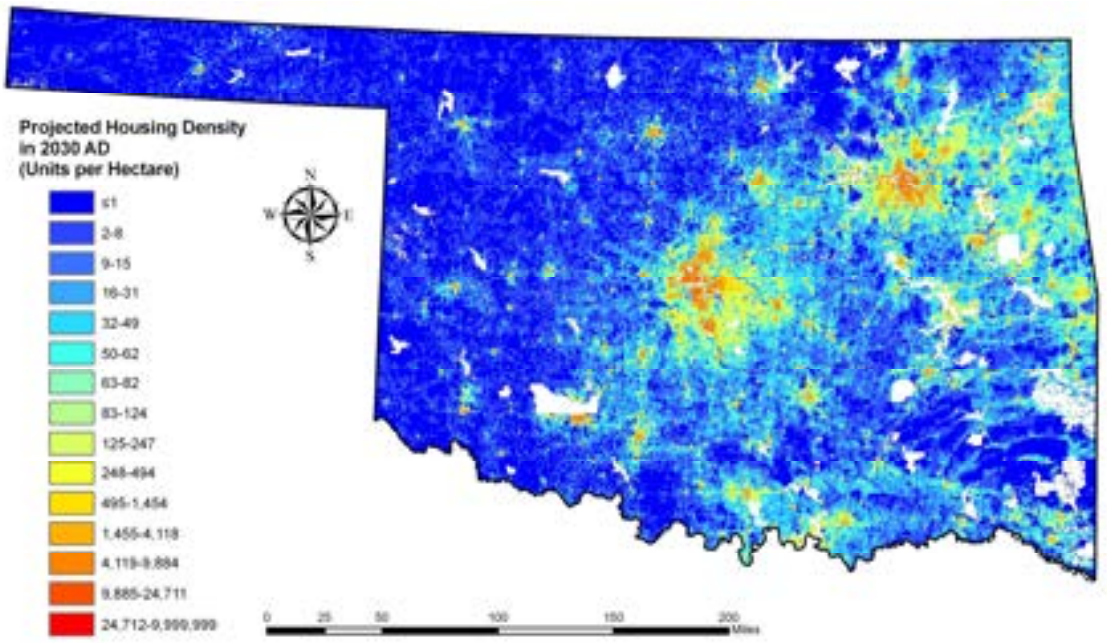
Reduction in stormwater runoff: Forested waterways can significantly decrease the amount of stormwater runoff because trees, other vegetation, and soils can absorb the water, filter the pollutants, and slow the flow. Stormwater runoff is rainfall that flows over the ground surface. It is created from rain falls on roads, driveways, parking lots, rooftops and other impervious surfaces that do not allow water to soak into the ground. Stormwater runoff is the number one cause of stream impairment in urban areas. These large volumes of water are swiftly flowing into our local streams, lakes, wetlands and rivers causing flooding and erosion, and washing away important forests and habitat for fish and wildlife that live in or around the water source. Stormwater runoff also carries a large amount of pollutants into the water supplies decreasing water quality.

Threats to Oklahoma's Forest Resources

This section briefly defines the threats to Oklahoma's forest resources which will be discussed in further detail in the Critical Issues and Priority Forestlands Section.

Urbanization: Physical growth of urban areas into rural areas typically from population growth often causes loss or degradation of forestlands as well as loss of open space. Increasing housing density and associated development (such as power lines, septic and sewer systems, and shopping centers) can be linked to a decrease in native fish and wildlife and their habitats, changes in forest health, reduced opportunities for outdoor recreation, poorer water quality, altered hydrology, greater loss of life and property to wildfire, changes in traditional uses of forests, and decreases in the production of timber and other forest products.

Figure 17: *Map of Projected Development in Oklahoma by 2030*



This map depicts the results of the Spatially Explicit Regional Growth Model (SERGoM v2) as applied to the counties of Oklahoma. The analysis was completed by Dr. David M. Theobald, of Colorado State Univeristy (Theobald, D.M. 2005. Landscape patterns of exurban growth in the USA from 1980 to 2020. Ecology and Society 10(1): 32. [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art32/.), using 2000 US Census Bureau density data and County-projected population increases.

Fragmentation: Isolation of forest tracts from one another affects landscape-level forest benefits. It generally results from parcelization of ownership, but can also be caused by introducing infrastructure (roads, power lines, pipelines, etc.) into the forest or even forest management activities that have the same effect. The fragmentation of ecosystems not only affects forest management but can also damage wildlife habitat as well as aquatic systems.

Parcelization: Division of ownerships often results in smaller holdings. This can result from inheritance of forests by multiple heirs, subdividing large blocks into smaller forest parcels or ranchettes, or sale of large holdings to multiple buyers or to single purchasers who in turn subdivide the land at some future date. Parcelization generally reduces the likelihood of active forestry or creates a more piecemeal approach to land ownership.

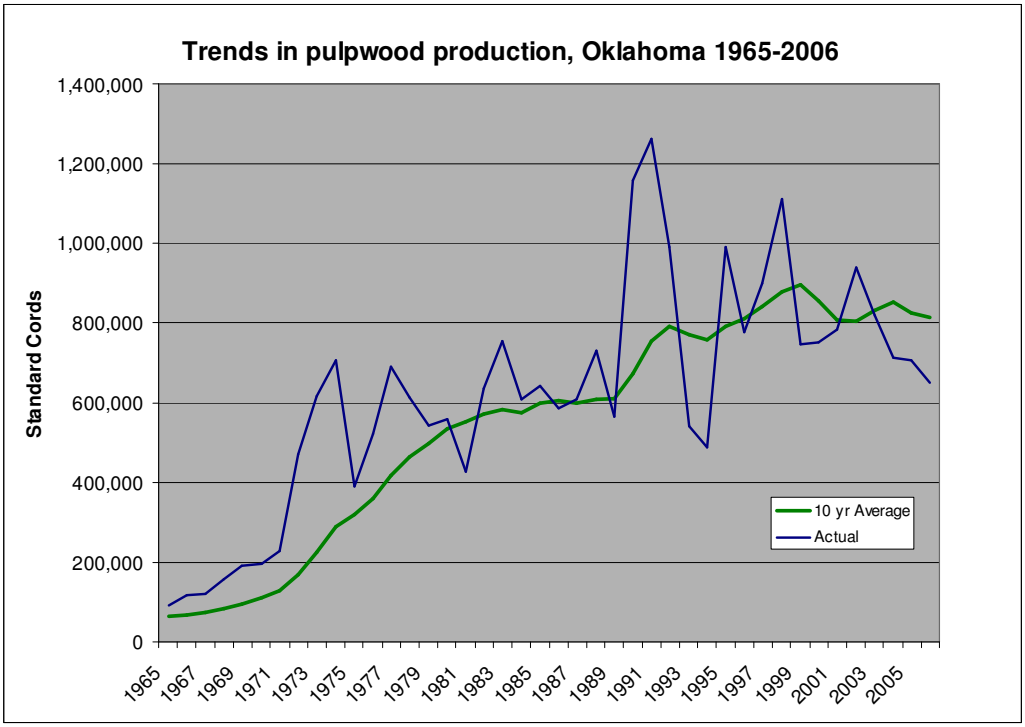
Wildland Urban Interface: These are areas undergoing a transition from forest and agriculture use to urban land uses. The interface involves a mixing of rural and urban land uses in the same

area. Issues in the interface include greater conflicts between people and natural resources, more social and political restrictions on forestry activities, increased risk of wildfire, loss of wildlife habitat and reduced water quality.

Changing land uses: Forests are constantly under pressure and being converted for non-forest uses. Riparian forests along rivers and water sources are being lost to cropland and development. Community forests and surrounding forest types are being lost to new construction of subdivisions and businesses. Forestlands are being converted to pastures for grazing and farming. Most of these land-use changes impact more than just the loss of forests, but also affect wildlife habitat, water quality and overall ecosystem health.

Changing markets: Oklahoma's forest product markets have recently declined and numerous sawmills have let employees go or even shut down. Because of current conditions with the forest industry, many landowners are not harvesting because prices are too low at local sawmills. Around the world there are new markets developing such as the use of biomass, biofuels, carbon sequestration and other ecosystem services but few have been established in Oklahoma. The declining forest industry in Oklahoma is currently negatively impacting Oklahoma's forest resources because there are few incentives for landowners to invest in forest improvement or even to keep their forests as forests. The pulpwood production in Oklahoma has been extremely volatile over the past 40 years. There was a peak in the industry in the early 1990s but in recent years the pulpwood production has declined (see Figure 18).

Figure 18: Pulpwood Production in Oklahoma

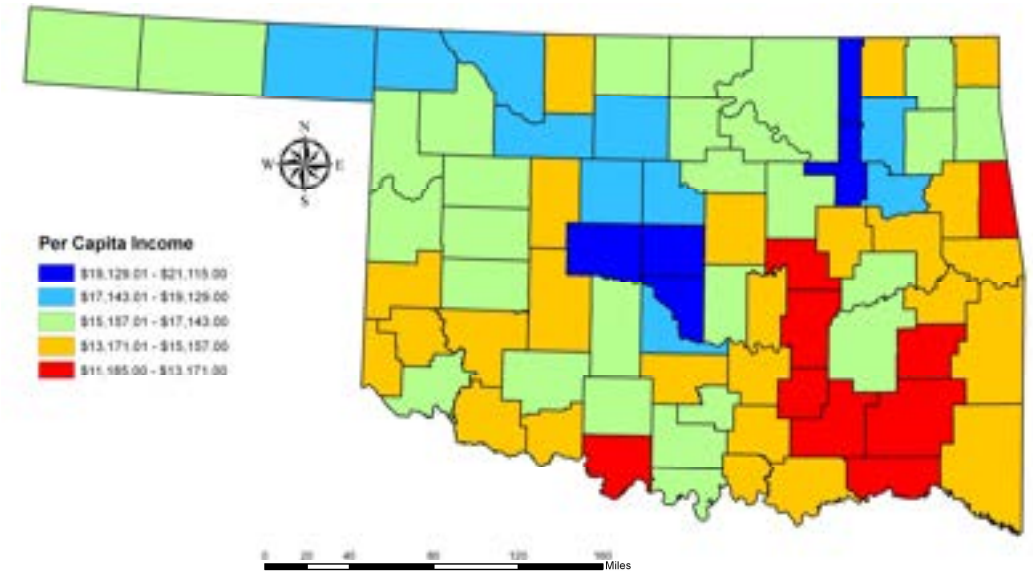


Source: USDA Forest Service – Trends in Southern Pulpwood Production, 2008.

Landowner income: Landowner income can play a major role in the type of forest management that will occur on their property. According to the US 2000 Census data, Oklahoma residents' annual income is below the national average. Oklahoma across the board is one of the poorer

states and many landowners spend their income on necessities. Oklahoma landowners have less disposable income to spend on forest management activities which in many areas has lead to declining forest health. The average annual income has changed since the 2000 US Census but this is the most current map available.

Figure 19: *Map of Per Capita Income in Oklahoma (by county)*



The Per Capita Income map of Oklahoma was created from data collected in the 2000 US Census. Specifically, Census 2000 Summary File 3 was exported by county, used to create a DBF IV file, and then joined to a counties of Oklahoma shapefile. Here, Per Capita values are represented by five equal interval classes described by the map legend. Values reported in the 2000 Census are representative of 1999 income.

Insects and disease: Currently Oklahoma has relatively minimal issues with forest insects and diseases. This is discussed further in the Forest Sustainability and Health issue description.

Exotic and invasive species: Invasive species can cause major issues with native ecosystems if they begin to invade and choke out native species. Some exotic and/or invasive species found in Oklahoma include: sericea lespedeza, Chinese privet, Japanese honeysuckle, salt cedar, etc. Some of these are discussed further in the Forest Sustainability and Health issue description.

Eastern redcedar encroachment: Many residents consider this the worst natural resource threat in the state, but more so on rangelands than in forested areas. Eastern redcedar is a native tree species that typically grows on ridges and in canyons. There are many reasons why this tree species has escaped its native ecosystems and moved onto hundreds of thousands of range and grass lands. Fewer people actively manage their rangelands, allowing redcedar to spread across the landscape. Lands owned by passive investors often are overrun with redcedar. This tree species can be controlled with fire and historically that was the reason eastern redcedar was only found in canyons and ridges where the fire would not reach. Suppression of fire with settlement also encouraged its spread. Eastern redcedar does add to wildfire severity because it increases the fuel loads. Eastern redcedar has been known to choke out hardwood species destroying valuable wildlife habitats and damaging riparian bottomland hardwood and post oak-blackjack oak forest types.

Wildfire and fire suppression: Wildfires can pose threats to the forest resources, associated benefits and values, and Oklahoma residents, therefore many resources and funds are utilized to suppress wildfires. Fire suppression for many decades has allowed fuel loads to increase within the forests. Many people have been moving to small forested tracts and often do not consider the wildfire risks associated with living in the wildland urban interface. In the past prescribed fire was utilized more often as a management tool and many people do not realize the benefits fire can offer to ecosystems. Fire suppression is important because wildfires can damage properties and threaten the safety of firefighters and citizens, but proper management ahead of time can drastically decrease the risk of damage or injury in the event of a wildfire. There are tools and management options Oklahomans can utilize to increase their safety and to become more prepared for wildfires. Issue #3 characterizes wildfire risks in more detail.

Climate change: Oklahoma's forests and vegetation have always been subject to a changing climate and there is a constant battle between grasslands and forests across central Oklahoma. Oklahoma is known for extended droughts as well as having floods. The Oklahoma Climatological Survey has predicted some future changes that might occur with Oklahoma's climate which are discussed further in issue # 6: Impacts of Climate Change on Oklahoma's Forest Resources.

Natural disasters: There are numerous weather events that often affect Oklahoma's forest resources such as tornados, ice storms, wind storms, droughts and hail. Oklahoma's weather, much like its landscape, is very diverse. The wide variety of weather does put stress on the vegetation and severe storms have drastically damaged urban and rural forests. In the past ten years, five major ice storms have left the forests across the state ragged.

Critical Issues and Priority Forestland Overview

Through stakeholder and public input, six critical issues related to Oklahoma's forests were identified. The six issues were analyzed and described by working groups to help characterize the issue and identify forestland areas at the highest risk.

The six critical issues discuss the main problems or concerns Oklahoma's forest resources are facing. These issues impact or will impact the forest resources that provide Oklahomans with many benefits and values. Each issue is described in detail with maps that depict where the priority forest areas are in the state. The priority forestlands depicted by the six issues will determine where work and funding are focused in the State Forest Resource Strategy. The issue descriptions are specific to Oklahoma's forest resources, but priority forest areas connect with surrounding states allowing for multi-state interaction.

The six issue topics identified for Oklahoma are:

- Forest Sustainability and Health
- Wildfire Risk to the Forest Resource
- Forest Economics and Markets
- Water Quality and Availability
- Community Forest Health and Care
- Impacts of Climate Change on Oklahoma's Forest Resources

Oklahoma's Forest Resource Assessment supports the State and Private Forestry (S&PF) National Priorities and Objectives identified by the USDA Forest Service that support the goal of maintaining working forest landscapes. These national priorities and objectives will be used to identify where and how Federal resources should be focused in order to make the most significant progress in providing diverse and sustainable public benefits from trees and forests. The three S&PF national priorities are:

- Conserve working forest landscapes
- Protect forests from harm
- Enhance public benefits from trees and forests

The six critical issues identified for Oklahoma link to these national priorities. The goals and objectives in the State Forest Resource Strategy will help address state and national desired outcomes. Oklahoma plans to take actions to reduce the rate of conversion of forested landscapes to other uses and inform decisions about which landscapes should be conserved as working forests. Oklahoma also plans to take action to reduce threats to the forest resources, restore forest health and productivity, and enhance the suite of public benefits associated with trees and forests.

Issue 1: Forest Sustainability and Health

- ❖ The productivity, health, and environmental benefits of Oklahoma's diverse forest ecosystems are significantly threatened by many factors including but not limited to land-use changes, ecological pressures, economic issues, and landowner and societal influences.

A healthy and sustainable forest is one that can maintain biodiversity, productivity, and regeneration capacity for present and future generations. These forests provide numerous resources and benefits to society and the environment such as wood products, job opportunities, economic stability, wildlife habitats, clean air and water, erosion control, and recreational opportunities. Oklahoma's landscape is typically, and incorrectly, viewed as non-forested which has lead to the loss of many forested areas. Oklahoma actually has approximately 10 million acres of forestland; this is approximately 23% of Oklahoma's land area. According to the Oklahoma Forestry Code, a forest is defined as a tract of land that is at least ten percent (10%) stocked by trees of any size, whether of commercial or noncommercial species, or formerly having tree cover and not currently developed for non-forest use, including woodlands, woodlots, windbreaks, and shelterbelts.

For more than a century, Oklahoma's eastern forests have supported a strong forest products industry as well as provided many benefits to our state. Oklahoma's often overlooked and underappreciated central forests and western riparian areas are quickly being lost due to numerous factors including those stemming from the common misconception that there are no forests of any value in Oklahoma. The shorter hardwood tree species within the central and western riparian forests are important and valuable to our quality of life. These forests are less productive and do not provide as much economic benefits as eastern productive forests, but the central and western forests do provide scenic beauty, clean air and water, recreational opportunities, etc. Land-use changes, ecological pressures, economic issues, as well as landowner and societal influences are all threatening the health and sustainability of Oklahoma's forests. When the health and sustainability of Oklahoma's forests diminish, so do the associated benefits.

Issue Description:

Oklahoma is a biologically rich and extremely diverse state with a landscape ranging from short grass prairies in the panhandle to loblolly pine forests and cypress swamps in the southeast. The diversity in the landscape offers a wide variety of benefits to the state including but not limited to: economic growth, recreation, wildlife habitat, clean air and water, aesthetics, and increased quality of life. Many people think of Oklahoma's landscape as flat to rolling grasslands with very few trees. This is true for parts of Oklahoma but there are approximately 10 million acres of forestland found within the state. Approximately 5.1 million acres make up the productive forestland or pine/hardwood forests located in eastern Oklahoma. Other forestland found throughout Oklahoma, such as the post oak-blackjack oak Cross Timbers area, the oak-hickory Ozark highlands and the numerous bottomland hardwoods located along the riparian areas are often ignored because they traditionally had little commercial value. These forested areas are rarely sustainably managed because there is a lack of awareness of the benefits these forests and trees provide, and there are few economic incentives to do so. It is important that all forests across Oklahoma are managed to maintain and enhance their productivity, health, and environmental benefits.

Forest sustainability is the ability to utilize forests in a manner and rate that maintains a forest's biodiversity, productivity, and regeneration capacity for present and future generations. Much of what we know about the health and sustainability of Oklahoma's forests is derived from the USDA Forest Service's Forest Inventory and Analysis (FIA) Program. FIA has established and measured a network of permanent sample plots in eastern Oklahoma for more than 70 years, starting with 5 counties in 1936. The survey was extended to the 18 eastern Oklahoma counties in 1976, and these plots were remeasured in 1986, 1993 and, most recently, in 2008. A low-intensity sample survey was conducted in the remaining 59 central and western counties in 1993. Starting with the new survey cycle in 2008, the entire state will be included in the standard FIA inventory from now on.

Concerns about the health and sustainability of Oklahoma's forests, although of a statewide nature, generally focuses more on eastern Oklahoma where reliable data has been collected for a long period of time, and where the majority of the State's productive forestlands and timber industry are located. Key measures of long-term sustainability may be found in part by estimates of total forestland, acres of timberland, growth and removals and land-use change. The following statistics may be helpful in this discussion.

Table 18: *Eastern Oklahoma Forestland and Productive Forestland acreages*

Survey Period	Total Forestland (acres)	Productive Forestland (acres)
1986	5,256,400	4,741,202
1993	5,417,800	4,895,479
2008	5,744,990	5,103,090

Source: USDA Forest Service FIA publications

The 2008 FIA survey estimated that there were 5.7 million acres of forestland in the 18 eastern counties, of which 5.1 million acres are productive forestland. These estimates reflect increases of 6% and 4% respectively over the 1993 inventory. Even though from 1993 to 2008 overall forestland acreage had increased by more than 200,000 acres, there was still approximately 380,000 acres of forestland lost to non-forest uses, such as agriculture, urban development and rights of way (USDA-FS, FIA). As a whole, it appears that forest regeneration, either by natural or artificial means, is more than offsetting the losses to conversion. The data above are only accurate for eastern Oklahoma, and there may be cause for concern about conversion impacts in central and western Oklahoma. As indicated above, FIA plots are currently being surveyed for the entire state which could drastically change the total number of documented forested acres in Oklahoma.

Another measure of resource sustainability is growth and removal data, also obtained from the FIA survey. In 1993, the overall average growth to removal ratio for softwoods was 2.07 to one, and for hardwoods it was 2.71 to one. In 2008, the growth to removal ratios were 1.02 to one for softwoods and 3.46 to one for hardwoods. These positive ratios show that eastern Oklahoma's forests are currently growing more volume than is being harvested or lost to mortality, but Oklahoma's forests would benefit from increased regeneration of softwoods and more markets for hardwoods.

Oklahoma's landscapes are being reshaped by numerous land-use changes such as parcelization, fragmentation, forest expansion, wildland-urban interface expansion and other land conversion to non-forest uses. Parcelization is the division of ownerships that results in smaller holdings. This can result from the inheritance of forests by multiple heirs, subdividing large blocks into smaller forest parcels or "ranchettes" or the sale of large holdings to multiple buyers or to single purchasers who in turn subdivide the land at some future date, which tends to increase absentee ownerships (SGSF – Forest Parcelization and Fragmentation Issue paper). Fragmentation occurs from land ownership parcelization but can also be caused by introducing roads, power lines, and other infrastructure. Forest tracts become isolated from one another which often constrain management options, impacts forest health and wildlife habitat, especially for sensitive species, impairs water quality, and ultimately leads to the loss of forests.

A land-use change issue that sparks many debates is the forest expansion or eastern redcedar encroachment that is occurring across much of Oklahoma. Eastern redcedar has been an issue for many decades and continues to encroach on our central forests, western riparian areas, and the open grasslands. Eastern redcedar is a tree species native to Oklahoma that historically only grew along the rocky ridges and in lower canyons where it was protected from fire and where very little vegetation could survive. Throughout the years, the lack of management on these lands coupled with a significant increase in fire suppression capacity throughout rural Oklahoma has allowed for eastern redcedar to expand from its native habitats. The number of fire

departments has almost tripled in the last 30 years through both federal and state grant programs. This forest expansion is causing a drastic change to Oklahoma's native ecosystems which is affecting forested landscapes, wildlife habitats, and water quality, as well as grasslands used for grazing and crops. Eastern redcedar threatens the sustainability and health of Oklahoma's forests because it decreases biodiversity by outcompeting other vegetation and establishing an eastern redcedar forest with very little understory that many wildlife species find undesirable. Eastern redcedar has some commercial value but markets have been slow to develop, so it continues to be an issue as it spreads across more of Oklahoma's landscape. The use and management of eastern redcedar could be seen as an opportunity for the state to stimulate the economy while at the same time working to restore native ecosystems.

Although Oklahoma's forestland cover may be expanding with eastern redcedar, there are many other factors causing conversion of our native forest ecosystems to non-forest uses. These factors include agriculture, development, and oil and gas production sites, etc. This land-use conversion is leading to the permanent loss of forestland and the many benefits they provide.

Another land-use change that is occurring around urban areas as well as lakes is the wildland-urban interface. The wildland-urban interface is the area on the outskirts of communities where structures and forests intermix. These areas are leading to management complications as well as increased wildfire complexity. The wildland-urban interface complicates how the land can be sustainably managed because of increased societal influences and more fragmented forests. Management options become less profitable because the small tracts of land increase expenses and time for logging crews and contractors. Additionally, lack of markets and longer distances to mills make sustainable forest management less viable.

The recent downturn in the economy has slowed new construction, decreasing the demand for wood products which has caused stress on several wood product mills in Oklahoma because fewer trees are being harvested or replanted. In Oklahoma very few markets are available for forest products other than the timber industry. This accentuates the importance of Oklahoma's need to invest some time and resources into researching and developing new forest products markets as well as looking into different values for the ecosystem services the forests provide. Landowner objectives and forest product markets are changing and it would benefit the state to have new and innovative ideas for establishing markets that will help us sustainably manage our forests as well as improve their health.

The influence landowners and society have on the sustainability and health of Oklahoma's forests is becoming more apparent. Oklahomans should be more aware of the pressures they are causing; otherwise forest resources and their associated benefits could be compromised. As the population continues to increase, forests are becoming more fractured leading to smaller tracts of land with a variety of landowners. In the past, large tracts of forestlands were owned by large timber companies, but now there are more Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs) as well as an increase in estate inheritance with multiple heirs and absentee landowners. All of these different landowner types are influencing how the forestlands are being managed because of personal values and different landowner objectives.

Timber Investment Management Organizations acquire and manage forests on behalf of financial institutions, pension funds, and other institutional investors. While in TIMO ownership, forest management decisions are focused on obtaining favorable return on investment during the anticipated ownership time horizon (generally 12-15 years) and upon eventual sale of the land. A REIT is a type of corporate structure that greatly reduces its income tax burdens thus increasing the payouts to investors. To qualify as a REIT, a company must distribute 90 percent of its annual profits to investors. The tax code also limits how much a REIT can hold in non-real estate assets, and how much income it can earn from those holdings. The trend of large forest product companies selling their lands to TIMO and REIT ownerships is becoming more pronounced. With each generation of transactions, the result will most likely be more parcelized ownerships and fragmented forests.

Many of the current forestland policies and laws, not only in Oklahoma, but nationwide are not favorable to maintaining forests in forests because taxes discourage long-term ownerships and there are few incentives for forest landowners. Many forest landowners are considering options other than forest management because typically the incentives or funds are more profitable and available, and cash flow is more consistent. Also, landowners that might have interest in forest management often do not have access to appropriate forest management information because some disciplines and agencies lack knowledge or training on sustainable forestry practices. Poor communication exists between disciplines and agencies. Agencies and other disciplines statewide need to work together to provide the best management information to landowners to insure proper reforestation occurs and forest biodiversity and productivity are considered.

Fire use has also become a management issue with the health and sustainability of Oklahoma's forests. In some areas, such as the wildland-urban interface, prescribed fire is not a reasonable option because of structures and smoke management considerations. In addition, the public has a huge fear of using fire as a management tool because fire has been suppressed on the landscape for so long and media coverage has increased the fear of wildfires causing the public to think all fires are bad. Some people are unaware of the benefits prescribed fire can provide to the landscape. There is also fear of fire because arson is a major problem in Oklahoma and has caused many catastrophic wildfires that have killed people, threatened lives and destroyed property. Prescribed fire can have great results on the landscape but there are certain precautions to take and a plan to develop to conduct a proper prescribed burn. It is important to remember that wildfire can be a destructive force in managing forests because it can set back succession in hardwoods and destroy investments in forest practices. The topic of wildfire is discussed more in the issue description of wildfire risks to Oklahoma's forest resources.

Along with landowner and societal influences, there are also ecological pressures that affect the health and sustainability of our forests. There have been and will be disasters, storms, insects, diseases, and invasive species that impact the health of Oklahoma's forests. Oklahoma's weather and the changing climate also have a huge impact on the vigor of Oklahoma's forest and natural resources.

Numerous natural disasters, including ice storms, tornados, flooding, severe thunderstorms, and strong winds, can be harmful to the health of the forest resources depending on the severity of an event. To add to the health risks, some non-native seed sources are being used for reforestation purposes. In some cases, non-native seed sources not as adapted to Oklahoma's climate are used for reforestation due to other more desirable characteristics, which can lead to greater risk of disease and pest outbreaks.

Some of the pests or damaging agents that have threatened or could threaten the health and sustainability of Oklahoma's forests include but are not limited to:

Insects:

- Emerald Ash Borer (EAB) – EAB kills ash trees but is not currently found in Oklahoma. EAB is currently expanding its range and has been detected as close as Missouri. Its primary method of movement is through firewood. According to 1993 FIA data for the 18 eastern counties, Oklahoma has an estimated 64 million ash trees, which is about 3 percent of the region's live tree population. Although there are not many ash trees in pure stands, they are common in riparian areas. Ash trees have also been extensively used as a high quality urban tree and do make up large parts of the urban forests in several cities across Oklahoma.
- Imported Gypsy Moth – Gypsy Moth feeds on foliage of oak, hickory and other hardwood species to the point of defoliation, reducing tree vigor. It frequently returns to the same area annually, and can eventually cause mortality. It is established in the eastern United States and eradication is no longer an option. The majority of Oklahoma's forests are made up of Gypsy Moth's preferred food (oak and hickory), but it is not yet found in Oklahoma.

- Imported Sirex wood wasp – This wasp bores into live southern pine trees and lays eggs in galleries. The hatched larvae eat bark and wood. The introduced insect may not be as much of a problem as feared when first identified in the United States. The Imported Sirex wood wasp feeds on and kills loblolly pine, the main commercial species in eastern Oklahoma.
- Southern Pine Beetle (SPB) – SPB is a native pest of shortleaf and loblolly pine and has caused pine mortality in Oklahoma in the past. It primarily attacks overstocked stands and stressed trees. Outbreaks are infrequent, and it has never been a major killer of pines in Oklahoma. According to the USDA Forest Service, there are 618 thousand acres at risk to SPB because of stocking and site related factors. Of these acres, more than 120,000 acres are at high and very high risk (Forest Health Technical Enterprise Team, 2008).
- Asian Longhorned Beetle – This pest invaded the U.S. from China and Korea in 2004, in shipping containers and packing material. It prefers maple species, but has not yet been found outside the Midwestern or New England states. It is another species that extends its range through the movement of firewood.

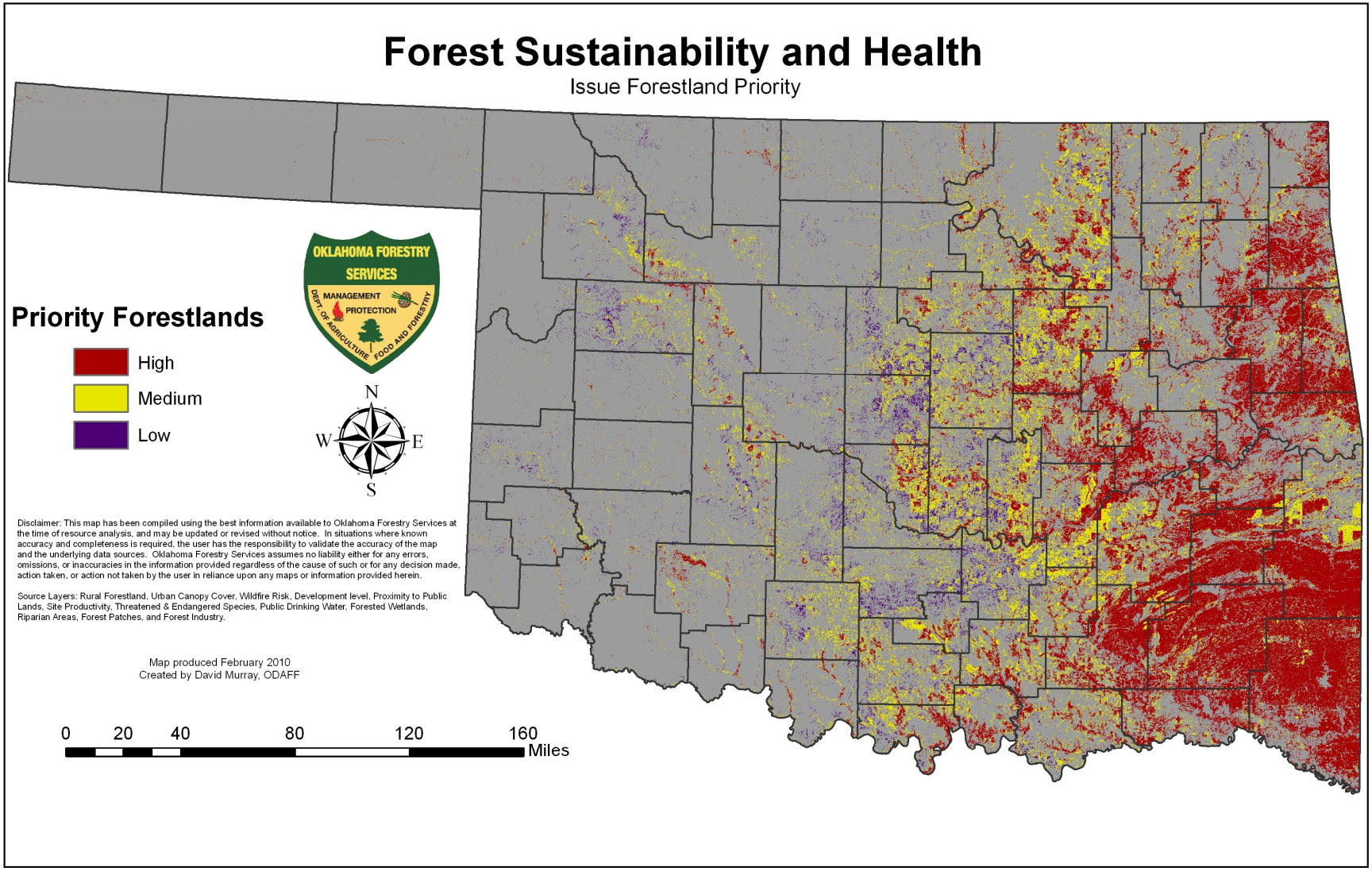
Diseases:

- Chestnut Blight – In Oklahoma, this disease is limited to the Ozark Chinkapin that occurs in the northeastern counties.
- Dutch elm disease – A serious elm disease common in urban areas that has destroyed many of the stately elms that once graced our city streets.
- Diplodia and Dothistroma – These fungal blights affect ornamental and windbreak pine species.
- Oak Decline – Decline is a complex that is often a result of tree stress, drought, age, insects and other factors. Hypoxylon canker is a secondary disease common to oaks that are damaged or under severe stress.

Plants:

- Chinese Privet – Privet is an invasive shrubby species that occupies the forest understory across Oklahoma and can hinder reproduction of desirable trees after harvest. It was planted initially as an ornamental in urban areas but has escaped.
- Kudzu – Kudzu is an aggressive, introduced vine that grows rapidly and can smother trees and understory vegetation. There are only a few locations in Oklahoma where this species has been able to become established, and it is not considered a serious problem.
- Salt Cedar (Tamarisk) – Salt cedar is encroaching on riparian areas in western Oklahoma, including the Canadian River system. It is a serious pest because it reduces streamflows, displaces desirable vegetation and is difficult and expensive to control.
- Russian Olive – This is an introduced species that spreads rapidly on subirrigated and riparian areas in western Oklahoma.
- Eastern Redcedar – Redcedar is an opportunistic native juniper species that has encroached the understory of forests, ranging from eastern hardwoods, Central Cross Timbers, hardwood bottomlands and riparian areas, as well as open rangelands and prairie systems. The eastern redcedar encroachment has displaced natural understory plants and increased wildfire severity. In some areas, eastern redcedar is replacing the previous forest type as well as historical vegetative cover across rangelands. Ashe Juniper is a similar species, and is native to southern Oklahoma, where it also is considered an invasive species. The issue of eastern redcedar encroachment has been addressed numerous times by a state task force and various publications by Oklahoma State University (documents available online).

The priority forestlands identified for the Forest Sustainability and Health Issue are illustrated in the map on the next page. To create this map of priority forestlands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.


Forest Sustainability and Health
Issue Forestland Priority
Priority Forestlands
High
Medium
Low
OKLAHOMA FORESTRY SERVICES
MANAGEMENT
PROTECTION
DEPT. OF AGRICULTURE FOOD AND FORESTRY
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Disclaimer: This map has been compiled using the best information available to Oklahoma Forestry Services at the time of resource analysis, and may be updated or revised without notice. In situations where known accuracy and completeness is required, the user has the responsibility to validate the accuracy of the map and the underlying data sources. Oklahoma Forestry Services assumes no liability either for any errors, omissions, or inaccuracies in the information provided regardless of the cause of such or for any decision made, action taken, or action not taken by the user in reliance upon any maps or information provided herein.
Source Layers: Rural Forestland, Urban Canopy Cover, Wildfire Risk, Development level, Proximity to Public Lands, Site Productivity, Threatened & Endangered Species, Public Drinking Water, Forested Wetlands, Riparian Areas, Forest Patches, and Forest Industry.
Map produced February 2010
Created by David Murray, ODAFF
0 20 40 80 120 160
Miles

Opportunities (Lead into Strategy and link to National Priorities)

A few of the opportunities related to this issue include:

- Improve the understanding of and information on Oklahoma's forest resource.
- Oklahoma's forests are already on the edges of their native ranges; improve their resilience through increased forest management and the use of prescribed fire.
- Promote favorable economic conditions which allow for implementation of forest management activities and discourage conversion of forestland.
- Encourage education programs for both the public and natural resource professionals.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all of the national priorities: Conserve working forests, protect forests from harm and enhance public benefits from trees and forests.

- Conserve Working Forests
    - Objective: Identify and conserve high priority forest ecosystems and landscapes
    - Objective: Actively and sustainably manage forests
- Protect Forests from Harm
    - Identify, manage, and reduce threats to forest and ecosystem health
    - Restore fire-adapted lands and reduce risk of wildfire impacts
- Enhance Public Benefits from Trees and Forests
    - Protect, conserve and enhance wildlife and fish habitat
    - Improve air quality and conserve energy
    - Assist communities in planning for and reducing wildfires
    - Maintain and enhance the economic benefits and values of trees and forests
    - Protect, conserve and enhance wildlife and fish habitat
    - Connect people to trees and forests and engage them in environmental stewardship activities
    - Manage and restore trees and forests to mitigate and adapt to global climate change.

Issue 2: Wildfire Risk to the Forest Resource

- ❖ Wildfire presents a risk to Oklahoma's natural and community resources as well as public safety.

Wildfire is an issue throughout Oklahoma. The issues associated with wildfire are troublesome in that fire has many benefits when applied properly, but can have destructive consequences when left unchecked. Wildfires often cause damage to forestlands, endanger firefighters and threaten public safety and property. State and federal natural resource agencies expend a considerable amount of their annual budgets on wildfire suppression to prevent these unwanted consequences. They also spend considerable funds to introduce fire on the landscape under proper conditions for the benefit that fire has on native vegetative communities.

Current lack of management practices, coupled with the suppression of fire for nearly 100 years have allowed for significant accumulation of wildland fuels which contributes to wildfire severity. Furthermore, fire complexity has increased with population growth, especially within the wildland-urban interface where an increasing number of structures in rural areas continues to complicate the fire control picture. Oklahoma's history of severe weather and drought as well as the effects of climate change have increased the chances of more catastrophic wildfires and are affecting ecosystem functionality.

Issue Description:

Oklahoma's diverse landscape, especially its forests, provide our citizens with many natural resources and benefits, including clean water, wood products, tourism and recreation amenities, wildlife diversity, and aesthetics. To the typical citizen wildfire may only be considered a risk if structures and lives are being threatened but wildfire also threatens the forest resource and investments landowners have put into forest management practices. A catastrophic wildfire can set back hardwood succession, destroy investments in pine plantations and degrade wildlife habitats. Wildfires can also damage and destroy property, including homes, local businesses, recreational and tourism opportunities and historical sites.

Oklahoma's normal climate allows for excessive yearly growth of vegetation. This fact coupled with land-use changes and the absence of land management has allowed for an excessive amount of wildland fuels to accumulate. The result is an increased wildfire severity during extreme weather events. Since statehood, fire suppression has allowed for an excessive amount of fuels to accumulate in Oklahoma's central and eastern forests as well as western grasslands, and management options are limited. Thousands of acres of former cropland are now unimproved rangeland. Mechanical fuel reductions are expensive or there are no markets for the resulting biomass. The use of prescribed fire for fuel reduction is the least expensive management option and provides great results, but is often restricted. Prescribed fire might not be a management option where many structures or homes are intermixed within wildland areas with high fuel accumulations. Smoke management considerations, fragmented ownerships and concern about liability also complicate prescribed burning opportunities. Prescribed fire can be an effective management practice but it is not appropriate for all situations and there are many factors to consider before implementing a successful prescribed burn.

Fire complexity has also increased because of the wildland urban interface. The wildland-urban interface is where homes and other human development are intermixed among wooded and undeveloped lands. The people and structures in the wildland urban interface are at a higher risk because little or no wildfire preparedness practices are implemented around many of these new

structures. The Firewise program has principles that can help reduce the risk of wildfire damages to communities and homes. There are very few communities in Oklahoma that have a Community Wildfire Protection Plan. Also in Oklahoma, there are no incentives like reduced insurance rates or building codes to address the issue of people migrating to the suburbs and not being prepared for wildfire risks.

There are numerous areas in Oklahoma where the wildland urban interface situation increases the wildfire risk of the area; examples include Lake Texoma in the south central portion of the state, Grand Lake and Lake Tenkiller in the northeastern portion of the state and the Hochatown/Broken Bow Lake area of the southeast. The Hochatown/Broken Bow Lake area is typical of Oklahoma's wildland-urban interface situations. This area has several hundred homes and nearly 600 cabins that have been built intermingled in the forested areas adjoining the lake, Beavers Bend State Park and the Ouachita National Forest. Many of these homes and cabins are built where there is poor fire resource access, limited firefighting capacity, few water sources, poor mapping, and steep terrain. To exacerbate the problem, most structures are surrounded by volatile fuels. These homes and cabins, now within the wildland-urban interface, are at risk because wildfire preparedness planning did not occur prior to development. In addition to the potential personal loss, these cabins contribute approximately $6 million to the local economy through rentals and other recreational activities. A catastrophic event in this area would severely impact the local economy. A number of fire prevention and preparedness measures are needed to adequately reduce the risk of a catastrophic wildfire in this area.

Figure 20: *Aerial of the Wildland Urban Interface Area near Hochatown/Broken Bow Lake, just north of Broken Bow, Oklahoma.*

There are many reasons why wildfire severity has increased over the years in Oklahoma. Perhaps the most significant contributors to Oklahoma's wildfire occurrences are extreme weather conditions and land management activities. Oklahoma's extreme weather is one reason wildfires are frequent catastrophic events. According to the Oklahoma Climatological Survey, the climate transitions from the moist subtropical climate in eastern Oklahoma to a semi-arid climate

in western Oklahoma. This transition between climate classifications allows for frequent hazardous weather events, such as tornados, severe thunderstorms, flooding, drought, extreme temperatures, and winter ice storms. Vegetation that is stressed or damaged by these weather events contributes to the amount of fuel available to burn during a wildfire. These fuel conditions are often exacerbated by prolonged periods of dryness extending over a season or longer. Losses from wildfire are increasing not just because of our climate but also because of changing land uses and management activities, including eastern redcedar encroachment, especially onto unmanaged lands in central and western Oklahoma, conversion of native pine-hardwood forests to pine plantations in the southeast, and continued expansion of the interface.

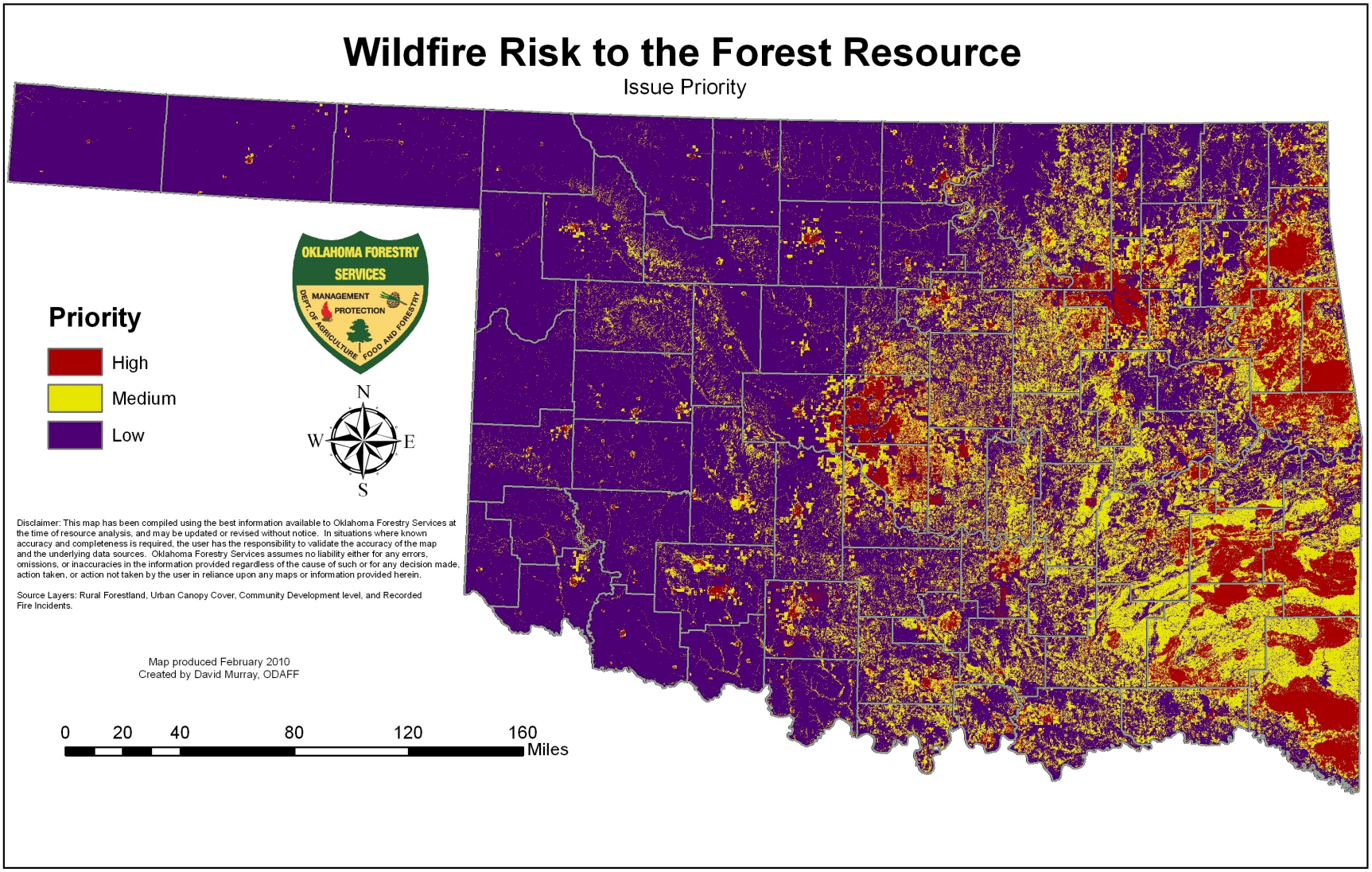
Fire protection in Oklahoma is becoming increasingly complicated because the majority of Oklahoma's land is privately owned and typically not managed to be prepared for a wildfire event. These private lands are protected by over 900 volunteer and career fire departments and by Oklahoma Forestry Services. Humans cause the majority of wildfires in Oklahoma. Human-caused fire can be expected to occur more frequently as the population increases. Due to the number and severity of wildfires in Oklahoma, most state existing funds for fire protection resources are spent on suppression efforts and federal funds are spent on improving equipment, training, planning, and prevention education.

A lack of a uniform fire reporting system also makes it difficult to deal with the wildfire issue and to analyze trends. Since 2004, Oklahoma Forestry Services alone has responded to over 9,000 fires totaling approximately 750,000 acres statewide. These fire suppression efforts have saved over 8,000 structures with a value of approximately 275 million dollars. Due to data limitations, the above numbers only include a small amount of the actual fires that have occurred in Oklahoma.

The cities of Choctaw and Midwest City are examples of what happens when a community finds itself in the path of a wildfire. The Choctaw/Midwest City fire occurred on April 9, 2009 and is a prime example of a wildfire in the wildland-urban interface. This fire burned 3,475 acres, injured close to 60 people and destroyed over 200 homes. Due to the severity of the wildfire, the Federal Emergency Management Agency (FEMA) was called in after the fact to assist with recovery efforts and supplement insurance coverage. The Loco-Healdton fire was another fire that occurred on April 9, 2009. This fire burned over 50,000 acres and damaged several homes and structures.

The values at risk to loss from wildfires in Oklahoma are substantial. For a variety of reasons, the State's wildfire situation is becoming more complex, and the need to raise awareness among those at risk is becoming more critical. Oklahomans need to work together through planning, hazardous fuels mitigation projects and wildfire prevention projects to be prepared for the next catastrophic event.

The forest resources at high risk to loss or damage by wildland fire are illustrated in the map on the next page. To create this map of priority forestlands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.


Wildfire Risk to the Forest Resource
Issue Priority
OKLAHOMA FORESTRY SERVICES
MANAGEMENT
PROTECTION
DEPT. OF AGRICULTURE FOOD AND FORESTRY
Priority
High
Medium
Low
N
W
E
S
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Source Layers: Rural Forestland, Urban Canopy Cover, Community Development level, and Recorded Fire Incidents.
Map produced February 2010
Created by David Murray, ODAFF
0 20 40 80 120 160
Miles

Opportunities (Lead into Strategy and link to National Priorities)
There are opportunities to help mitigate wildfire risk in Oklahoma's rural and community forests. Increased education about wildfire risks, education about benefits and the use of prescribed fire, planning in communities and around individual homes, can help reduce the threat of wildfires in forests and around homes.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all of the national priorities: Conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

- Conserve Working Forests
    - Objective: Actively and sustainably manage forests (Prescribed burns)
- Protect Forests from Harm
    - Objective: Restore fire adapted lands and reduce risk of wildfire impacts
- Enhance Public Benefits from Trees and Forests
    - Objective: Assist communities in planning for and reducing wildfire risks
    - Objective: Protect, conserve and enhance wildlife and fish habitat
    - Objective: Connect people to the trees and forests, and engage them in environmental stewardship activities.

Issue 3: Forest Economics and Markets

- ❖ Oklahoma's traditional forest markets are in a state of decline and non-traditional markets are underdeveloped, trends which are challenging landowners and communities who rely on those markets for jobs and economic stability.

Traditional forest products markets are changing or lack stability, causing great uncertainty among landowners and the communities that rely on the industry for jobs and economic growth. Although interest in ecosystem services and non-traditional wood products markets is increasing (carbon, biomass and bio-energy, recreation, water and wildlife), market mechanisms are not well developed. Conflicts are likely to develop between new and traditional wood product markets. We must be able to address questions of resource sustainability at the local level; therefore access to forest inventory data statewide is essential. The economic contribution of forestry to the state can increase substantially with better resource management and incentives, and focused attention on the new emerging markets.

Issue Description

According to the OFS analysis, Oklahoma has an estimated 10 million acres of forestlands, with approximately 90% privately owned. The State's forests have supported traditional timber harvesting and wood processing activities for more than 130 years, with intensive silviculture in practice for the past 40 years in eastern Oklahoma. In addition to these traditional markets, numerous small-scale and specialty markets have developed, but with much less consistency. Oklahoma's forests can bring economic growth to local communities by providing job opportunities and money, but they also provide our citizens with numerous benefits like clean water and air, wildlife habitat, erosion control, and recreational opportunities.

In 2009, the Forest2Market Inc. produced a report that described the economic impact of privately owned forests across the United States. Privately owned forests are an important part of the Oklahoma economy. These forests employ active management techniques (land management planning, fertilizing, planting, thinning, and harvesting) to produce timber, logs, pulpwood, chips and wood fuel. These outputs are then used by manufacturers to create higher value wood products such as paper, energy, etc. According to the report, each job in a forestry related industry creates 1.8 jobs in other industries and on average each 1,000 acres of privately-owned forest is responsible for the creation of 8 jobs. The table below illustrates the economic impacts of Oklahoma's privately owned forests but this report did not include furniture manufacturers as shown in Table 17.

Table 19: *Economic Impacts of Oklahoma's Privately-Owned Forests*

Forestry-Related Industries	All Forests	Privately-owned Forests
Employment	7,982	7,902
Payrolls	$300,343,142	$297,339,710
Annual Sales	$2,758,886,681	$2,731,297,815
Contribution to the State GDP	$1,068,876,000	$1,058,187,240

Source: Forest2Market, National Alliance of Forest Owners, 2009.

The recent downturn in the national economy, and especially the housing market, has seriously affected the state's forest products sector. The number of small sawmills is at its lowest level in recent history. The Weyerhaeuser Company's large pine sawmill at Wright City, in continuous operation since 1910, announced its closure in March 2009, putting 200 mill employees out of work. Other large mills, such as Huber's OSB plant and the Pan-Pacific's MDF plant at Broken Bow, Weyerhaeuser's sawmill at Idabel and the Valley Timbers' sawmill at Antlers, have

temporarily reduced operations by more than 50%. Small mills are struggling. The logging infrastructure is dwindling, as company owners are unable to make payments on their equipment due to the lack of work in the woods. The impact on local and regional employment is not limited to loggers and wood processors. The ripple effect of the global downturn in the forest products industry carries through to support industries, such as consumer goods and services, equipment sales and services, and food and retail businesses.

As fragmentation of forest ecosystems occurs all across Oklahoma's landscape, forestry no longer remains the most attractive option for some landowners. Many landowners are managing their land for objectives that will bring in the most income and typically more income can be made by fragmenting the landscape into smaller tracts of land to allow for real estate development. Landowners that are trying to manage their forests properly are struggling because smaller and limited markets reduce their ability to apply some forest management practices. This threatens the forest resource due to inadequate reforestation and stagnant forest stand conditions. There are many human activities that cause fragmentation to the forestland in Oklahoma. A natural fragmentation also occurs within the different ecoregions. Characteristics of the landscape and climate allow only certain vegetation to adapt or survive, therefore western forests are only found along the waterways.

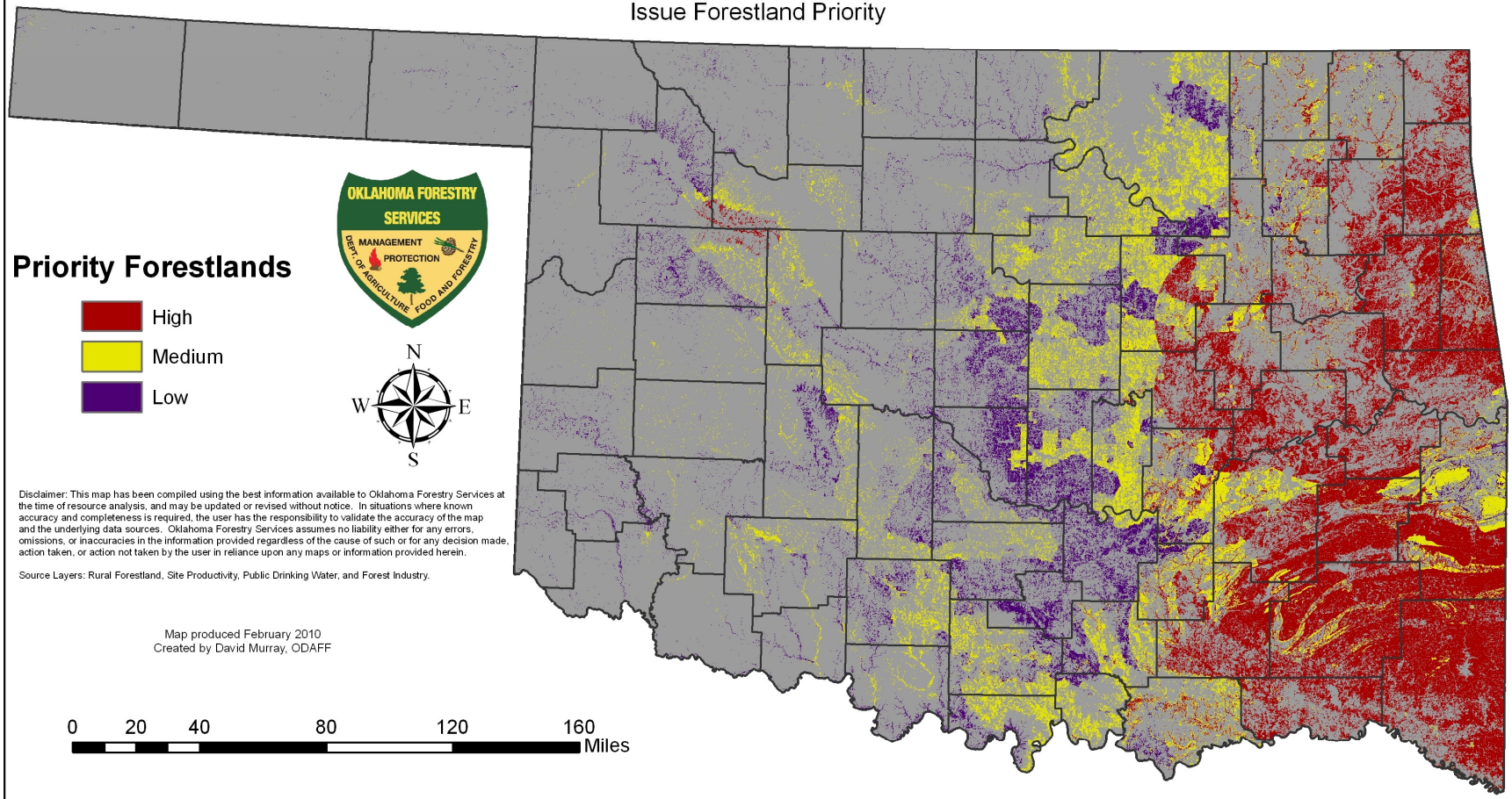
Oklahoma's forest industry is struggling primarily due to the housing market that imploded due to the financial crisis and loss of mortgage lines of credit in 2008-2009; high warehouse inventories of construction materials; reductions in consumer use of paper goods as they scaled back their purchasing; changes in the packaging industry; and capital investment needs to maintain the viability of older mills. The loss of markets provides a serious deterrent for landowners to consider investing in their forestlands, resulting in reduced site preparation and tree planting activity with corresponding negative impacts on forestry contractors, reduced seedling sales, reduced chemical applications, etc. Fewer forest improvement practices in the short run may lead to increased wildfire risks and increased losses to forest pests as stands begin to stagnate within a few years.

Oklahoma's traditional forest products markets have contracted, and non-traditional markets for the wood products and natural resources of the forests are currently limited. Eastern redcedar continues its expansion on hundreds of thousands of acres of rangeland and forestlands in central and western Oklahoma, degrading existing ecosystems, and increasing wildfire risk and complexity. Although redcedar wood is very useful in a variety of applications, including bioenergy, and can contribute good economic value, its use is inconsistent and occurs only on a small scale relative to its potential. In areas where it is common, there is no established logging infrastructure, further hampering its use. Eastern redcedar is not the only non-traditional market opportunity in the state; it is just so widespread that a market could possibly be established. Non-traditional markets and products need to be identified and established within the state to provide landowners with more incentives to practice sustainable forestry.

The priority forestlands identified for the Forest Economics and Markets Issue are illustrated in the map on the next page. To create this map of priority forestlands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.

Forest Economics & Markets

Issue Forestland Priority



Opportunities (Lead into Strategy and link to National Priorities)

In addition to the opportunities for expanding the eastern redcedar industry, new federal cap and trade legislation (if passed) may create carbon offset markets. There are also opportunities in biomass for energy. Ecosystem services is becoming a more popular term across the United States to describe all of the often overlooked free benefits and resources provided by forests. Existing smaller markets such as hunting leases, ATV trail riding leases, and other forms of recreation can be expanded. Since Oklahoma has such a diverse landscape and certain forest types currently have little or no commercial value, developing new markets for the ecosystem services they provide is a great opportunity for the state to enhance, protect, and conserve our forestlands.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all three of the national priorities: Conserve working forests, protect forests from harm and enhance public benefits from trees and forests.

- Conserve Working Forests
    - Objective: Actively and sustainably manage forests
- Protect Forests from Harm
    - Objective: Identify, manage and reduce threats to forest and ecosystem health
- Enhance Public Benefits from Trees and Forests
    - Objective: Maintain and enhance the economic benefits and values of trees and forests
    - Objective: Protect, conserve, and enhance wildlife and fish habitat

Issue 4: Water Quality and Availability

- ❖ Water is a critical natural resource and an element that is essential to life. Many human-related activities and other factors may adversely affect the sustainability, quality and availability of Oklahoma's water resources for present and future generations.

The State of Oklahoma is blessed with 200 lakes and reservoirs, 167,600 miles of rivers and streams and roughly 55,646 miles of shoreline along lakes and ponds (Oklahoma Water Resource Board). The watersheds associated with many of these lakes and rivers are forested and provide clean water, excellent recreational opportunities, and habitat for many species of wildlife. Oklahoma forests produce the cleanest water of any land use, providing numerous public benefits, including absorbing rainfall, slowing and filtering runoff, reducing flooding, and recharging aquifers, yet the role of trees and forests in protecting water quality is not well recognized by the public. Therefore, maintaining and protecting forested watersheds, while important, is not considered by many landowners and citizens as high priority.

With few exceptions, surface water in western Oklahoma is generally unsuitable for public supply due to undependable flows, high evaporation rates and large concentrations of dissolved minerals. In the east, annual precipitation pattern, mean annual temperatures, and the prevalence of forested watersheds provide for surface supplies of sufficient quantity and quality to accommodate public use and consumption.

Issue Description:

Water is an invaluable commodity. Issues associated with Oklahoma's water resources are becoming more contentious as our citizens, as well as surrounding states, look for new sources and dependable supplies of clean water. Available clean water may become a huge concern in the future because our forested watersheds are typically not managed for water supplies, may not be resilient to the impacts of climate change or may be converted to non-forested use resulting in lower quality and quantity of water produced.

Human activities can impact water quality and quantity through a variety of methods, resulting in pollution categorized as either point source or non-point source in nature. Some examples of human activities that can lead to point and non-point source pollution affecting our water resources are poultry litter runoff, improper septic systems, improper pesticide application, road construction, urban development, mineral extraction, excessive fertilization and oil and gas production sites.

Point source pollution is pollution that is discharged from a traceable facility or source such as a pipe, ditch, factory, oil refinery, etc. Point source discharges from municipalities and various industries, though now effectively regulated in the state and nationwide, still pose a potential threat to Oklahoma's streams and rivers. In contrast to point source pollution, non-point source pollution (NPS) refers to sources of water pollution that result from natural processes, including precipitation, seepage, percolation and runoff, and are not traceable to any discrete or identifiable facility or outlet. Non-point source pollution is determined to a great extent by land use in a particular drainage basin and has become a major determinant of surface water quality in the state. Non-point source pollution can take on a number of forms in a forested watershed:

- *Sediment.* Forest floor vegetation and organic debris protect the soil from the erosive action of falling raindrops and runoff. Removal of this protective layer, through deforestation, soil disturbance and land-use conversion can lead to erosion of the soil, creating sediment. In forestry, the largest contributors of sediment to stream systems are road construction and maintenance. When sediment is carried away in runoff and deposited elsewhere, sedimentation occurs. In the natural world, sedimentation is a slow, naturally occurring process. However, human activities often accelerate the process. The result can be large amounts of sediment accumulating in lakes, streams and wetlands that accelerate the aging of lakes and bury fish spawning grounds and aquatic plants. These plants are a source of food and habitat for fish and other aquatic organisms.

Accumulating sediment also constricts naturally flowing channels, leading to increased stream bank erosion and possible flooding. Suspended sediment can cloud the water; adversely affecting the feeding potential of sight-feeding fish. It can also damage the gills of some fish species, causing them to suffocate.

- *Organic Debris.* Leaves and large woody debris (generally defined as large fallen logs, at least 12 inches in diameter with root ball attached) that naturally fall into streams can greatly benefit aquatic ecosystems. However, too much organic debris deposited in a short time can harm water quality. Too much decomposing matter in streams can decrease dissolved oxygen in the water, which aquatic organisms need to thrive and reproduce.
- *Nutrients.* Nutrients, such as nitrogen and phosphorus, exist naturally in forest soil and can enter water bodies if the soil erodes into water. Also, if fertilizers are used in forest management, they can wash into water bodies in runoff. Excessive amounts of nutrients may cause algal blooms in lakes and streams, which can reduce levels of dissolved oxygen in the water to below what fish and other aquatic species need to survive.
- *Temperature.* Some sunlight filtering through trees is healthy for many streams. It can promote plant growth in the water and foster healthy ground vegetation along shorelines. However, when trees and the shade they provide are removed along small streams, peak mid-summer water temperatures climb as a result of increased solar radiation. This can reduce dissolved oxygen and affect the metabolism and development of fish and other aquatic organisms.
- *Chemicals.* Pesticides (herbicides, insecticides and fungicides) help control pests and undesirable plant species. However, when applied improperly, pesticides can be toxic to aquatic life. In addition, fuel, oil and coolants used in equipment must be handled carefully to avoid soil contamination and water pollution.
- *Streamflow.* Some timber harvesting and forest land conversion can increase peak streamflow which increases the likelihood of flooding, stream bank erosion and sedimentation. The use of heavy equipment can result in the compaction of large areas of the forest soil which leads to reduced water infiltration into the soil, thus increasing surface water runoff into streams. This also reduces water percolation and groundwater recharge. Groundwater provides cool, clean water to lakes and streams and maintains steady streamflows and lake levels throughout the year.

Forest fragmentation from land-use changes and development can also decrease water quality, as homes and impervious surfaces such as roads and parking lots replace woodland plants, wetlands, green space and soil that previously stored carbon dioxide, produced oxygen, absorbed pollutants and protected against erosion. Many riparian forest areas, especially in western and central Oklahoma, have been deforested to allow for more land for agricultural uses and urban development resulting in many forms of both point and non-point source pollution.

Another factor that is contributing to non-point source pollution is urban stormwater runoff. According to the Environmental Protection Agency, the 2004 *National Water Quality Inventory* reports that runoff from urban areas is the leading source of impairments to surveyed estuaries and the third largest source of water quality impairments to surveyed lakes. Cities install storm sewer systems that quickly channel this runoff from roads and other impervious surfaces. Runoff gathers speed once it enters the storm sewer system. When it leaves the system and empties into a stream, large volumes of quickly flowing runoff erode stream banks, damage streamside vegetation, and widen stream channels. In turn, this will result in lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures. Native fish and other aquatic life cannot survive in urban streams severely impacted by urban runoff. When runoff enters storm drains, it carries many of these pollutants with it. In older cities, this polluted runoff is often released directly into the water

without any treatment. Increased pollutant loads can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe.

The role forests play in cleaning and filtering Oklahoma's water is often overlooked or not understood. Many human activities are the leading cause for the loss of forests and the increase in the amount of contaminants in watersheds leading to the reduction in the quality of water supplies. This results in the increased risk of health issues in our state and also increases the cost of preparing water for human consumption and use.

The first federal legislation that addressed water pollution was the Federal Water Pollution Control Act (FWPCA), which was first passed in 1948. The FWPCA mainly focused on point source pollution and public health. The PL 92-500 known as the Federal Water Pollution Act of 1972 addressed both point source and non-point source pollution as important and provided funding for water treatment works. This Act required non-point sources to be included in water quality planning and was the first to mention and define best management practices (BMP). In 1977 this Act was amended and its name changed to the Clean Water Act (CWA). The purpose of this law is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." This Act has been amended several times in response to the public's increased awareness of, and concern about, water quality. In 1987, the Clean Water Act was amended again giving the states the responsibility for water quality programs and planning. The states set water quality standards, criteria and goals that are approved by the EPA. The Clean Water Act is important because it gives the federal government the primary role in determining water pollution policy and establishes specific water quality goals. The states are given the role of implementing federal policy once they have a qualifying state program in place.

Another federal law that may affect land use and management practices is the Endangered Species Act. Regulations resulting from concerns regarding the management of threatened and endangered (T&E) species may also require that additional actions are taken to protect the water resource. The federal Endangered Species Act prohibits harming protected species as well as the "taking" of protected species, including the destruction of habitats essential to their survival. There are several T&E species such as the Ozark cavefish, leopard darter, Neosho madtom and the Ouachita rock pocketbook mussel whose survival hinges on the quality of the water produced from Oklahoma's forests.

Federal and State laws, regulations and policies designed to eliminate or minimize pollution of the "waters of the U.S." deal with point sources and non-point sources separately. Most point sources are addressed by rules, regulations and permit authorities to prevent the release of a substance into a water body that could degrade its quality or impact a beneficial use of that water. On the other hand, NPS pollution, generally associated with land use practices, is addressed using best management practices (BMPs). BMPs lay out a framework of sound stewardship practices that help maintain a high degree of water quality. Although a few states have made BMPs mandatory, Oklahoma's approach to BMPs in agriculture, forestry and other NPS categories is non-regulatory in nature. Forestry Services of the Oklahoma Department of Agriculture, Food, and Forestry is mandated by Title 2, Article 16, Section 16-3 of the Oklahoma Statutes to "administer silvicultural best management practices in cooperation with forestland users under the provisions of the state and federal water pollution laws…" (ODAFF-FS – The Oklahoma Forestry Code). Oklahoma Forestry Services' general approach to the development and implementation of BMPs is one of education, technical assistance and cooperation.

The Water Resources Institute at Oklahoma State University is currently coordinating development of a long-range comprehensive water plan for the State of Oklahoma. The planning process includes considerable opportunity for stakeholder and public involvement. One focus area involves land use. The final report is likely to include recommendations that could ultimately affect forestry practices and the State BMP Guidelines.

Timber harvesting, forest road construction and other practices may be viewed as being detrimental to water quality, despite our use of Forestry BMPs. There is a risk that local and state regulators may pursue greater controls over the practice of forestry and other land uses to

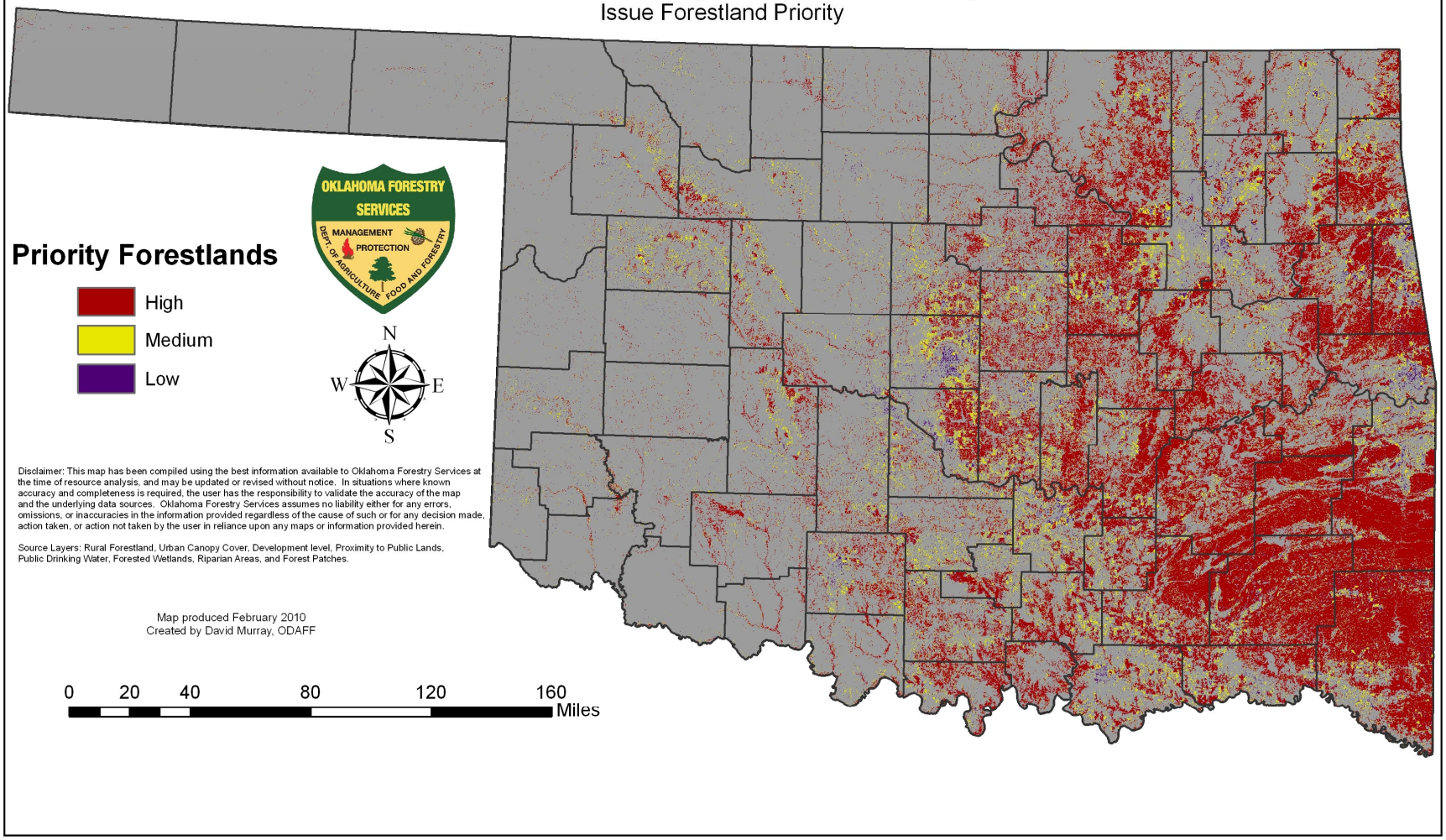
address the perceived negative impacts. Protection of forest water quality is the responsibility of the landowner, the logger, the land manager, and all others applying practices or using the forest. Through sound and consistent application of Forestry BMP Guidelines, voluntary compliance monitoring and continuing educational efforts, it is hoped that Oklahoma can protect water quality and avoid a costly regulatory program that relies on permits and inspections (ODAFF-FS – Oklahoma's Forestry BMP Guidelines).

Well-managed forests and healthy forest watersheds produce the highest water quality, and they can be manipulated to benefit stream flows and accommodate downstream users to some extent. Trees and forests reduce soil erosion, protect stream banks, filter pollutants, and reduce impacts of storm water runoff. Proper forest management, protecting streamside management zones and restoring riparian forests and planting trees to prevent erosion are critical elements of state efforts to protect water quality and availability.

The priority forestlands identified for the Water Quality and Availability Issue are identified in the map on the next page. To create this map of priority forestlands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.

Water Quality & Availability

Issue Forestland Priority



Opportunities (Lead into Strategy and link to National Priorities)

A few opportunities related to this issue include:

- Educate landowners, policy makers, natural resource professionals and forest industry on forests' contribution to the water resource and the protection of the water resource.
- Promote the conservation and proper management of the forest resource.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all three of the national priorities: Conserve working forest landscapes, protect forests from harm, and enhance public benefits from trees and forests.

- Conserve Working Forests
    - Objective: Identify and conserve high priority forest ecosystems and landscapes
    - Objective: Actively and sustainably manage forests
- Protect Forests from Harm
    - Identify, manage, and reduce threats to forest and ecosystem health
- Enhance Public Benefits from Trees and Forests
    - Objective: Protect and enhance water quality and quantity.
    - Objective: Connect people to trees and forests, and engage them in environmental stewardship activities.

Issue 5: Community Forests Health and Care

❖ The health and value of Oklahoma's community forests are not fully realized and provided for because there is a general lack of understanding, management, and conservation of this important resource.

A Community Forest:

- Includes the native and planted trees and wooded areas in and around developments, neighborhoods, communities, towns and cities (on both public and private land).
- Provides benefits and values such as air quality, water quality and quantity (flood control, ground water recharge), wildlife habitat, quality of life (shade, color, improved health, stress relief, beautification, recreation, etc.) and energy conservation.
- Includes green space/green infrastructure such as street trees, trees in city parks, trees along creeks, waterways and riparian corridors, and individual trees that are all linked together and make up the community forest.
- Along with adjoining forests are working ecosystems that are linked and ever changing.
- Give individual cities, towns, and urban areas identity.

Our community forests provide many benefits to local residents as well as people who visit our state. The trees within the community forests clean the air and water, provide protection from the sun and wind, block noise, cut energy costs, provide habitat for community wildlife, conserve soil, slow storm water runoff, filter pollutants before reaching our waterways, improve the mental and physical health of people and can increase property value. Consider a few of the reasons the trees in our communities are so valuable to our quality of life.

- Parents watching their kids play tee-ball on a hot day while they enjoy the cool shade of a large tree in the park.
- Collecting fruits and nuts from trees in the community forests as a local food source.
- Walking your dog through a neighborhood that has trees shading and beautifying the streets.
- Watching the squirrels and birds play around your backyard collecting fruit from the trees to eat.
- Stepping outside each day to take a deep breath of fresh air.
- Trying to find the best tree in the parking lot to park under so it won't be so hot when you return.
- Walking along the creek and seeing the fish swimming in the crystal clear water.
- Being so lucky to take a drink of water each day right out of the tap.
- Walking or biking on tree-covered trails in parks or by rivers.

These are just a few of the reasons the trees in our community forests are so important to our life styles. Individual actions of our citizens within the communities can have a significant impact on the overall community forest ecosystem. To continue to enjoy the many benefits and services provided from our forests, it is extremely important that natural resource professionals and the citizens of Oklahoma work together to care for the health of the trees within our community forests as well as all forested landscapes across the state.

Oklahoma's community forests are threatened by numerous factors, largely a result of the population density of the people living within this forest type. The community forest is often managed as individual trees or as small groups rather than looking at the entire landscape as a working forest ecosystem. Trees throughout our cities and towns, including individual trees in yards and parks, or along our streets and waterways, need to be viewed and managed as a working forest ecosystem to provide the greatest benefit of ecosystem services and highest quality of life for the residents within our communities. It is critical to take a proactive management approach to addressing the needs of our community forests because the make-up, health and overall condition of this forest impact the connected forests beyond the traditional city boundaries.

Issue Description

Oklahoma has an estimated 599 incorporated municipalities and whether the local governments in each of these communities realize it or not, they sustain and benefit from a community forest. According to the 2008 U.S. Census projections, approximately 65 percent of Oklahoma's population lives in an "urban area." Oklahoma's population in 2000 was 3,450,640 and it was projected in 2008 to have increased 5.6% to 3,642,361 (U.S. Census). Between 2000 and 2006, the U.S. Census estimated that Edmond's population had increased 12.2%, Moore's population increased 19.8%, and Broken Arrow's population had increased 9.8%. These are all cities on the outskirts of Oklahoma's major metropolitan areas, Oklahoma City and Tulsa. This population growth has caused more people to move to the edges of towns and cities, an area called the wildland urban interface.

As the population continues to increase, more and more people are moving into the wildland-urban interface, and what were once large tracts of forestlands are being fragmented and developed. The forests are being broken up and lost because of road construction, housing subdivisions, farms, businesses, or even small ranchettes. When the tracts are smaller and structures are intermixed within the forests, managing those lands becomes more complicated and the risks associated with wildfire increase.

Most of the forested areas surrounding Oklahoma City and Tulsa are within the post oak – blackjack oak forest type (Cross Timbers). This forest type is often underappreciated because it is considered to have little or no economic or commercial value. Landowners in these areas typically do not keep the land forested unless they identify often overlooked benefits such as aesthetics, wildlife, water quality, etc.

Typically during land-use planning, policy making and zoning decisions, trees are not considered for their values and benefits to society, which often leads to the loss of important forests. It is important that communities consider green infrastructure when developing urban land-use plans. Green infrastructure is the network of open space, wildlife habitat, parks, and natural features that support healthy, functioning communities. When planning community infrastructure, the trees and forests, wildlife, waterways and other natural features should be considered in order to reduce impacts to the working ecosystem. Developing or protecting greenbelts and corridors can help conserve riparian areas and wildlife habitats. According to the American Forests, impervious surfaces have increased by 20% over the past 2 decades in urban areas across the United States. Storm water facilities are created to compensate for the tree loss but these facilities are expensive to build and maintain. Planting trees and conserving greenbelts and corridors is a much easier way to reduce storm water runoff and save money.

Many communities lack community forest management plans and/or do not have staff with the technical expertise to properly manage its forests as a whole. When any tree-related expertise is supported within a local government, it often focuses on individual tree care in parks and public places. This limits a community's ability to determine the overall condition and needs of the urban forest that would support the prioritization of funds and activities. A management plan would describe the benefits to the community from the urban forest, and the long-term goals the community hopes to achieve. A plan also includes an inventory of trees and forested areas within and adjacent to the community. An inventory would help determine the species make-up, relative size, age, and overall health and condition of the trees within the community. It could provide structure for the management of the forest cover and prioritize issues needing to be addressed. It could also allow communities to assess any damage or loss of the community forest after a natural disaster.

In addition to communitywide goals, the objectives of individual homeowners and private landowners that mingle with public interests are often different depending on their personal values. As this ownership changes through time this could lead to land-use change. Land conversion from forest to other land uses impacts water quality, wildlife habitats, forest recreation opportunities and other related ecosystem services.

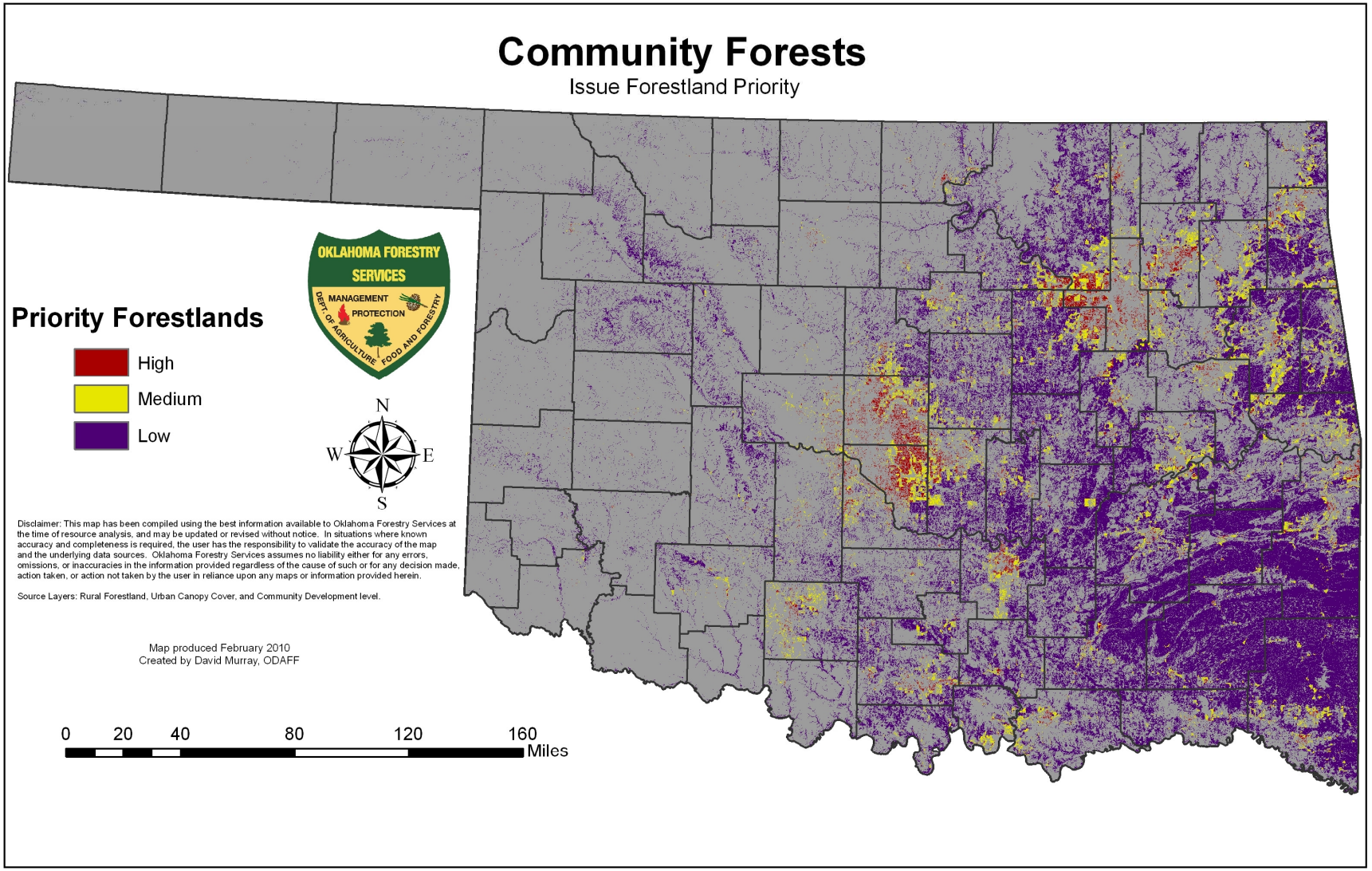
Our community forests are also impacted by the expansion of native eastern redcedar and invasive or exotic species such as Chinese privet and other ornamental trees such as the popular Bradford Pear can become an invasive species on rural landscapes. Insects and diseases can cause serious problems to trees around our communities, including but not limited to oak decline, defoliators, pinewood nematodes, needle blights, canker diseases, wilt diseases, Dutch elm disease and emerald ash borers. Many trees have been damaged within our communities because of natural disasters like wildfires, tornados, floods and ice storms occurring around the state. These are natural events that are not preventable but damage could be significantly reduced if communities prepared and managed the forests ahead of time.

Some ways to grow a more storm resistant forest is to select tree species that are less susceptible to breakage, use pruning techniques that result in a stronger trunk and branches, and use cultural practices that encourage a strong root system. Communities can also have emergency response plans in place to help manage an event and receive federal aid.

Some of the greatest threats to Oklahoma's community forests are the result of ignorance. Most people do not understand tree physiology and have little knowledge of or experience in natural resource issues, including tree care. This lack of awareness results in improper pruning, poor species selection, lawnmower blight, failure to match species to growing space and site conditions, improper planting techniques, failure to recognize hazardous trees, and interference with other elements of urban infrastructure, including power lines, water lines, sidewalks, streetlights, fences and neighbors.

Community forestry information and education is not generating widespread support and advocacy at the local/municipal level needed to develop local proactive community forest management programs. Currently, only 25 out of 599 communities in Oklahoma are recognized as a Tree City USA. Although these communities represent approximately 70 percent of the urban population and 50 percent of the State's population, improvement in the number of participating communities will extend the benefits of community forestry statewide.

The priority forestlands identified for the Community Forests Health and Care Issue are illustrated in the map on the next page. To create this map of priority forestlands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.


Community Forests
Issue Forestland Priority
Priority Forestlands
High
Medium
Low
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Disclaimer: This map has been compiled using the best information available to Oklahoma Forestry Services at the time of resource analysis, and may be updated or revised without notice. In situations where known accuracy and completeness is required, the user has the responsibility to validate the accuracy of the map and the underlying data sources. Oklahoma Forestry Services assumes no liability either for any errors, omissions, or inaccuracies in the information provided regardless of the cause of such or for any decision made, action taken, or action not taken by the user in reliance upon any maps or information provided herein.
Source Layers: Rural Forestland, Urban Canopy Cover, and Community Development level.
Map produced February 2010
Created by David Murray, ODAFF
0 20 40 80 120 160
Miles

Opportunities (Lead to Strategy and link to National Priorities)

There are numerous opportunities to improve and to address the health and care of Oklahoma's community forests. Education and planning are key components to maintaining and enhancing community forest ecosystems.

- Greater numbers of urban citizens moving into rural or wildland urban interface areas has created a larger more diverse audience for education programs related to forest sustainability and conservation.
- Increased opportunities for natural resource professionals to participate in community planning and policy making processes by use of tools such as green infrastructure and community wildfire protection plans.
- Promote the improved care of community forests through the use of forest management plans, staff with technical expertise, and encourage communities to become certified as Tree City USA.

Since few Oklahoma communities have CWPPs or are a certified Tree City USA, there is great opportunity to increase awareness of community forests benefits and values as well as plan for future generations.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all of the national priorities: Conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

- Conserve Working Forests
    - Objective: Identify and conserve high priority forest ecosystems and landscapes
    - Objective: Actively and sustainably manage forests
- Protect Forest from Harm
    - Objective: Restore fire adapted lands and reduce risk to wildfire risks (CWPPs)
    - Objective: Identify, manage, and reduce threats to forests and ecosystem health
- Enhance Public Benefits from Trees and Forests
    - Objective: Protect and enhance water quality
    - Objective: Improve air quality and conserve energy
    - Objective: Assist communities in planning for and reducing wildfire risk
    - Objective: Connect people to trees and forests, and engage them in environmental stewardship activities.

Issue 6: Impacts of Climate Change on Oklahoma's Forest Resources

❖ Oklahoma's diverse forest ecosystems, ecosystem components, and associated benefits will be affected by climate change.

Oklahoma's extensive forestlands and individual trees provide significant benefits to their owners and to society as a whole, yet there is considerable concern as to whether those benefits can be maintained in the future under changing climate scenarios. Because of serious concerns expressed by at least part of the scientific community, public attention has been galvanized on the well-publicized buildup of greenhouse gases (especially carbon dioxide), increasing temperatures, melting glaciers and extreme weather events, as well as on predictions of potentially catastrophic changes in our climate over the next century. The United States and countries around the world have devoted considerable resources to collect and analyze data, establish trends, model future scenarios, assess potential impacts and propose mitigation strategies intended to slow, stabilize or even reverse the predicted changes in our environment.

Although the role of forests in mitigating global climate change remains uncertain at best, professional foresters and the forestry community are prepared to contribute to the overall strategy. It is important to explore the potential impacts of climate change in Oklahoma and their effects on the state's forest resources. Despite the uncertainty about the reality and causes of climate change, it is important to recognize that:

- Natural landscapes are dynamic and our forests will be affected by climate change,
- There are things we can do now to increase the likelihood that our forests will continue to flourish, whether climate change predictions come true or not, and
- Forestlands and forestry can be part of a planned response to mitigate the impacts of climate change on people.

Oklahoma has one of the most diverse landscapes of any state and lies at a crossroads between eastern forests and western prairie, and northern versus southern plains ecosystems. Landscape level changes influenced by climate are part of our past and will be part of our future. It is likely that those changes may be expressed more clearly at the fringes of ecosystems - in Oklahoma and Texas for example - than in other states in the southern region. Oklahoma is at the *western* fringe of several forest types, including southern pines, eastern hardwoods and coastal plain bottomlands; and the *eastern* fringe of others, including pinyon-juniper, ponderosa pine and woody species of the desert southwest. The oak-hickory forests of the Cross Timbers occupy an extensive transition zone between native forests and prairies through central Oklahoma and are home to nearly half of the state's population.

Issue Description:

The Oklahoma Climatological Survey (OCS) has accumulated a considerable amount of data concerning Oklahoma's climate, and is concerned about the trends indicated and the likely changes that will result. The OCS expects the following scenarios to occur should the projected range of warming happen:

- The frequency of hot extremes and heat waves will increase
- Cold extremes and cold air outbreaks will decrease
- Atmospheric water content will increase
- The jet stream and its associated storms will move poleward

The Oklahoma Climatological Survey also predicts these implications for Oklahoma:

- The warm season becomes longer and arrives earlier
- The cool season warms and shortens which leads to a longer frost free period and growing season
- Earlier maturation of orchard crops leaves them more vulnerable to late freeze events
- Increase year-round evaporation from the ground transpiration from green vegetation
- Drought frequency and severity increases, especially in the summer

- Drier and warmer conditions will increase conditions conducive to wildfires
- Rain-free periods will lengthen, but individual rainfall events will become more intense
- More runoff and flash flooding will occur

The USDA Forest Service is also conducting a considerable amount of research on climate change. Researchers involved in the Southern Global Change Program at the Southern Research Station predict temperature increases of 5 to 10 percent and precipitation decreases of 10 to 25 percent during the period 2000-2020 across most of Oklahoma (USDA Forest Service).

Our forest ecosystems provide many benefits to Oklahomans, such as clean water, scenic beauty, biodiversity, outdoor recreation, natural resource jobs, forest products, renewable energy, and carbon sequestration (air quality). The benefits we receive from our forests are threatened by many different issues including the changing climate. Climate change will impact Oklahoma's forested landscapes because the rate of change will likely exceed many of our forest ecosystems' capabilities to naturally adapt. In addition, climate change will exacerbate current threats to forests such as wildfire, pests and eastern redcedar encroachment. These changes will degrade forest ecosystems and reduce associated benefits.

Climate Change is affecting Oklahoma's diverse forest ecosystems and individual tree species because of five main elements, which are:

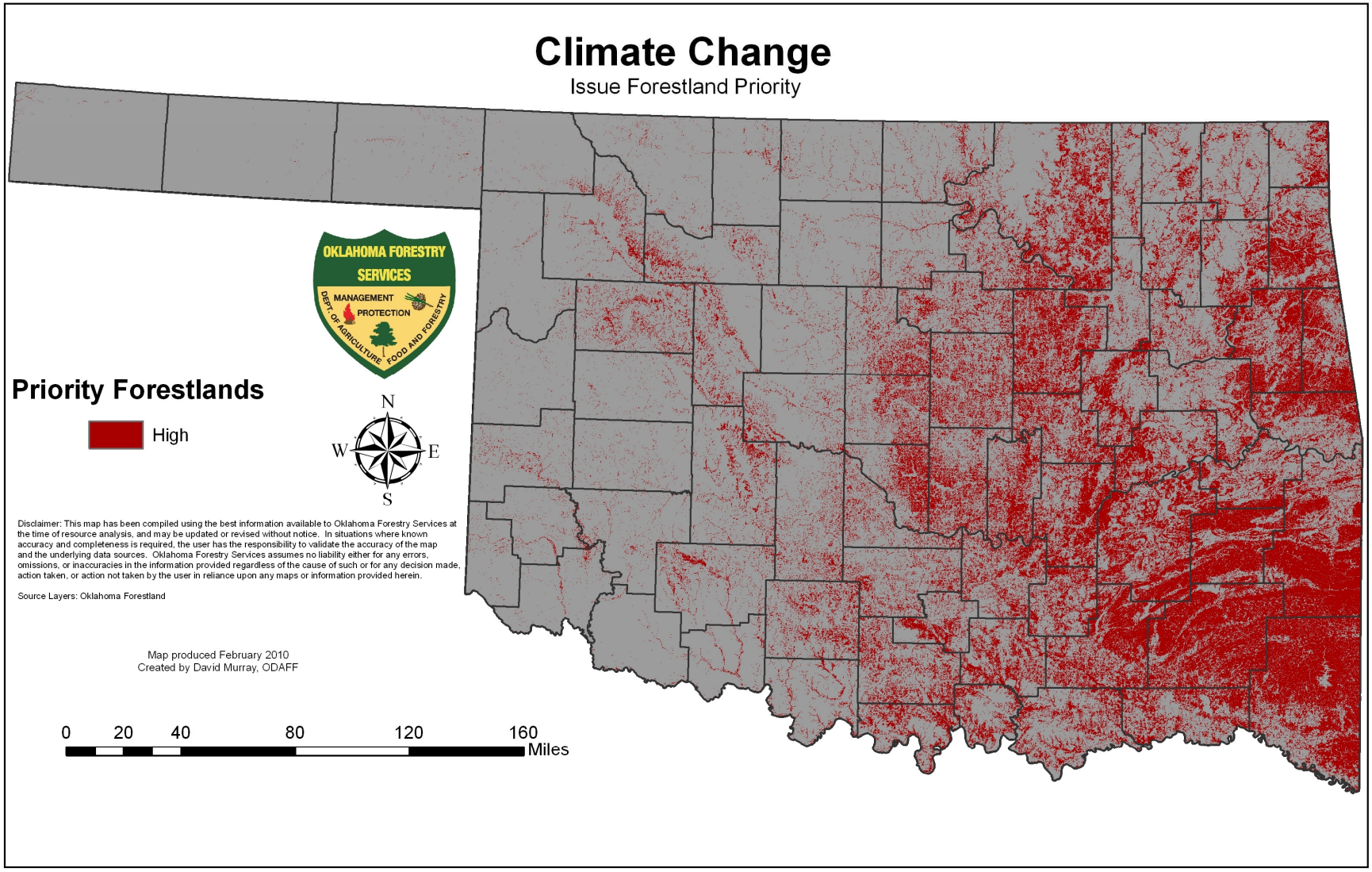
- The change in average precipitation
- The periods with extremely low amounts of precipitation
- The periods with extremely high amounts of precipitation
- The change in average temperature
- The periods of extremely high temperatures

These five elements of climate could result in an increase of droughts, wildfires, and natural disasters which have an effect on the types of tree species that will grow and the productivity of the trees and forests we rely on for clean water, recreation, and air quality. The changing climate could increase the occurrence of these major weather events and extreme wildfires. It is important to note that factors outside climate change also contribute to increased occurrence of these events. For example, large amounts of hazardous fuels in forests have increased wildfire severity and complexity. These factors are explored further in other issue topics of this assessment. Forests can be sustainably managed through thinning, harvesting small woody biomass for renewable energy, and prescribed fire to reduce the amount of hazardous fuels and lessen the threat of wildfires and greenhouse gas (GHG) emissions.

The climate change predicted by the Oklahoma Climatological Survey will impact natural and planted regeneration as well as forest biodiversity and productivity. A decrease in forest regeneration, biodiversity, and productivity will lead to the loss of forests including riparian areas, windbreaks and shelterbelts, and wildlife habitats. The changing climate also affects insect activity, tree species distributions, the spread of invasive species, and our water supplies.

Although many climate change impacts may negatively affect Oklahoma's forest resources, some researchers also expect beneficial aspects in certain areas. Moderate increases in carbon dioxide content in the atmosphere may actually stimulate tree growth responses, longer growing seasons may result in productivity gains if precipitation is not lacking, and the range of some individual tree species may actually expand.

The priority forestlands for the Climate Change Issue are illustrated in the map on the next page. No analysis was conducted for this issue because all forestlands could be impacted by climate change therefore all forests were identified as high priority.


Climate Change
Issue Forestland Priority
OKLAHOMA FORESTRY SERVICES
MANAGEMENT
PROTECTION
DEPT OF AGRICULTURE FOOD AND FORESTRY
Priority Forestlands
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Source Layers: Oklahoma Forestland
Map produced February 2010
Created by David Murray, ODAFF
0 20 40 80 120 160
Miles

Opportunities (Lead into Strategy and link to National Priorities)

Forests can help reduce GHG emissions while providing essential environmental and social benefits. There are many climate change mitigation opportunities that we need to evaluate and consider to help manage and ensure sustainable forest ecosystems.

Timber grown on sustainably managed forests can be replenished continually, providing a dependable supply of wood products while maintaining healthy forest ecosystems. Wood is essentially half carbon. This carbon is kept out of the atmosphere so long as the wood is not burned or decayed. Substituting wood for alternative materials, such as metal and plastic, may increase the long-term storage of carbon. In some applications, woody biomass can also be substituted for fossil fuels, helping reduce our reliance on imported oil and improving environmental quality. Sustainable forestry practices can reduce the risk of major wildland fires that emit large amounts of greenhouse gases into the environment. Another way to reduce GHG emissions is to keep forests as forests because more carbon is stored in forests than in agricultural or developed land. The development of new markets, such as woody biomass for renewable energy and biofuels, could provide revenues to landowners and offset some costs associated with fuels reduction treatments.

Oklahoma's forests need to be more resilient to the changing climate. Two active management approaches to addressing climate change are mitigation and adaptation. *Mitigation* is the use of forests and forest products for carbon sequestration (in live stands and durable forest products) and reduction of fossil fuel GHG emissions by substituting renewable energy through biomass. *Adaptation* is managing forests to maintain health and vigor despite the adverse conditions climate change is expected to cause. Adaptation includes increasing resistance to insects, diseases, and wildfires, and increasing resilience for recovering after a disturbance. Methods to achieve this resilience include selecting better-adapted species, expanded genetic diversity, increasing species mixtures and management of forest structure. The work of Dr. Ron Neilson, Pacific Northwest Experiment Station and Oregon State University, and Connie Millar, Pacific Southwest Experiment Station, is particularly pertinent in this area.

These opportunities will be discussed more in the Oklahoma Forest Resource Strategy which will set specific goals and objectives to address this issue. Goals and objectives set to address this issue link to all three of the national priorities: Conserve working forests, protect forests from harm, and enhance public benefits from trees and forests.

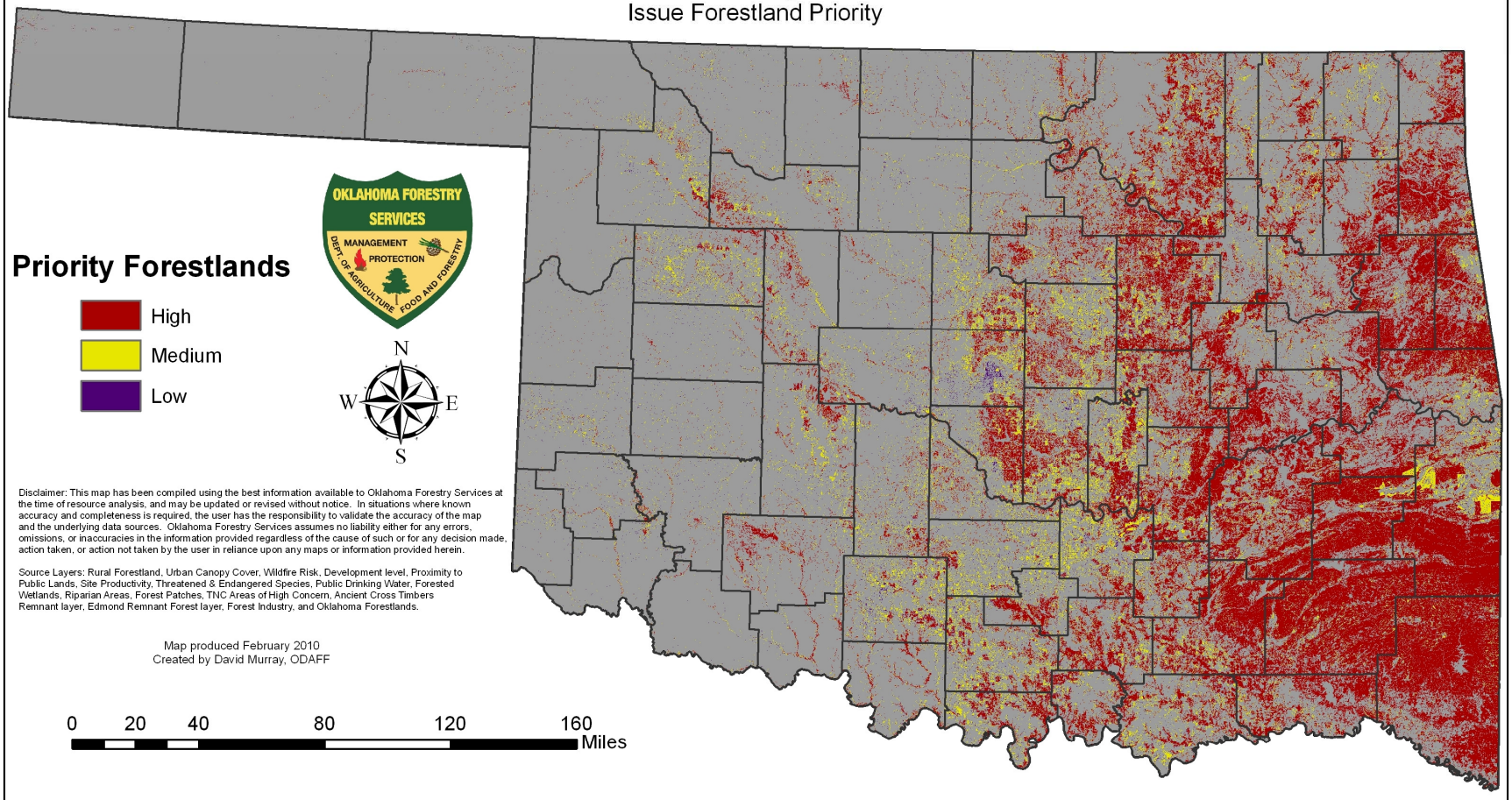
- Conserve Working Forests
    - Objective: Actively and sustainably manage forests (forest products, woody biomass, and ecosystem services market development)
- Protect Forests from Harm
    - Objective: Restore fire adapted lands and reduce risk of wildfire impacts
    - Objective: Identify, manage and reduce threats to forest and ecosystem health
- Enhance Public Benefits from Trees and Forests
    - Objective: Improve air quality and conserve energy
    - Objective: Maintain and enhance economic benefits and values of trees and forests
    - Objective: Connect people to trees and forests, and engage them in environmental stewardship activities
    - Objective: Manage and restore trees and forests to mitigate and adapt to global climate change

Oklahoma Priority Forestlands and Stewardship Potential Lands

The following two maps illustrate the priority forestlands statewide and the potential for the state's Forest Stewardship Program. Oklahoma priority forestlands are those forested areas with the greatest importance to the state, based upon our analysis of various issues, threats and opportunities associated with Oklahoma's forests. The Stewardship Potential Map depicts lands where funding and projects related to the Forest Stewardship Program administered by Oklahoma Forestry Services and the USDA Forest Service should be focused. To create these maps of priority lands, several geospatial data layers were analyzed by Oklahoma Forestry Services; details of the models and analysis utilized can be found in Appendix E.

Oklahoma Priority Forestlands

Issue Forestland Priority



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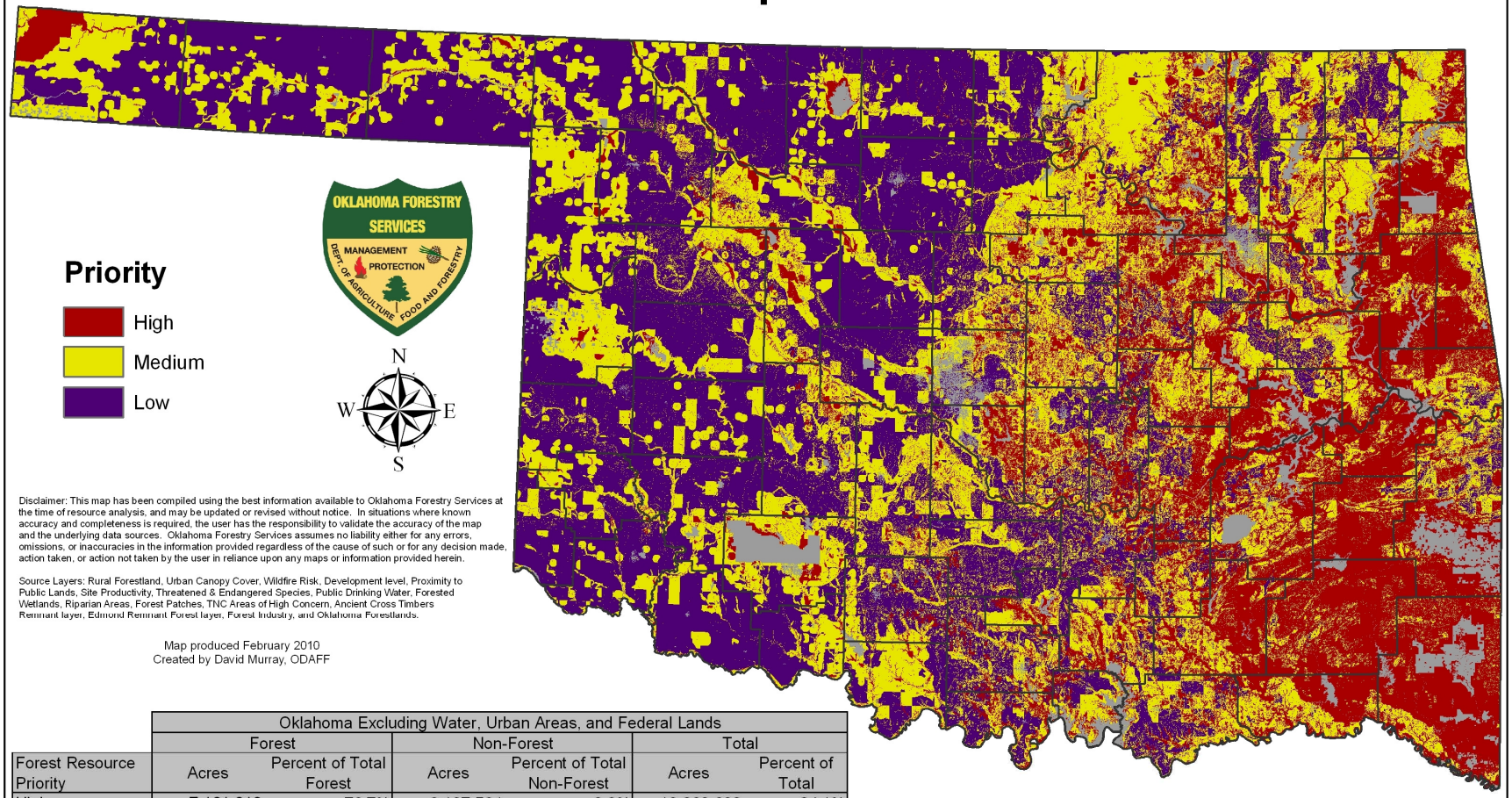
Source Layers: Rural Forestland, Urban Canopy Cover, Wildfire Risk, Development level, Proximity to Public Lands, Site Productivity, Threatened & Endangered Species, Public Drinking Water, Forested Wetlands, Riparian Areas, Forest Patches, TNC Areas of High Concern, Ancient Cross Timbers Remnant layer, Edmond Remnant Forest layer, Forest Industry, and Oklahoma Forestlands.

Map produced February 2010
Created by David Murray, ODAFF

Stewardship Potential



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Source Layers: Rural Forestland, Urban Canopy Cover, Wildfire Risk, Development level, Proximity to Public Lands, Site Productivity, Threatened & Endangered Species, Public Drinking Water, Forested Wetlands, Riparian Areas, Forest Patches, TNC Areas of High Concern, Ancient Cross Timbers Remnant layer, Edmond Remnant Forest layer, Forest Industry, and Oklahoma Forestlands.

Map produced February 2010
Created by David Murray, ODAFF

	Oklahoma Excluding Water, Urban Areas, and Federal Lands					
	Forest		Non-Forest		Total	
Forest Resource Priority	Acres	Percent of Total Forest	Acres	Percent of Total Non-Forest	Acres	Percent of Total
High	7,161,818	76.7%	3,107,564	9.3%	10,269,682	24.1%
Medium	1,831,243	19.6%	13,361,899	40.1%	15,193,142	35.6%
Low	346,299	3.7%	16,836,637	50.6%	17,182,936	40.3%
Total	9,339,360		33,306,100		42,645,760	

Forest Legacy Areas

Because Oklahoma's landscape is very diverse, there are many forest areas with unique features and special values that should be recognized and conserved, especially those that are being threatened by conversion to a non-forest use. In addition to various easement type programs currently operating in the state, the Forest Legacy Program offers Oklahoma an opportunity to compete for federal funding to help maintain and conserve these special places. Oklahoma Forestry Services, with the help of the public and other agencies and organizations (including The Nature Conservancy and Oklahoma Department of Wildlife Conservation), has identified forested areas with unique features or special values that should be conserved for future generations. These areas are called Forest Legacy Areas as shown on the map below and as described in this section.

Forest Legacy Program and Proposed Forest Legacy Areas

Oklahoma's Forest Resource Assessment is meant to encompass all requirements for other forest related statewide plans. To satisfy the requirements for Forest Legacy, this section, plus information contained elsewhere in the State Assessment, serves as Oklahoma's Assessment of Need (AON). Additional guidelines and planning process materials can be found in Appendix B.

The Forest Legacy Program is typical of various programs designed to prevent forests and other lands with special values from conversion to other uses. These programs generally rely on long-term conservation easements negotiated between a land trust organization and a willing landowner. In Oklahoma, other entities already active in this area include The Nature Conservancy, Land Legacy, Inc., The Conservation Fund, the Edmond Area Land Conservancy and the Norman Land Conservancy. The Healthy Forest Reserve Program, administered by the NRCS, offers easements in five counties of northeastern Oklahoma's Karst topography to protect endangered bat species.

The Forest Legacy Program is administered by the USDA Forest Service in cooperation with State Foresters or another designated agency in each state. Forest Legacy funding may be used for easements or for fee simple purchases of forestlands that meet the program's criteria. However, federal funding is limited, competition is very great and there is a fairly complex process that must be followed. Legacy applications must be reviewed and prioritized by Oklahoma's Forest Stewardship Committee, approved by the Forest Service in the Southern Region and Washington, D.C., and have funding authorized by Congress. A required component of the program is for each state to designate Forest Legacy Areas, which are geographic areas that encompass unique forest habitats, ecosystems and values worthy of consideration. Only landowners within these approved areas are eligible to work with a land conservation organization and Forestry Services to submit a Legacy application.

For the purposes of this Assessment, Forest Legacy Areas were selected from public and stakeholder input, while also considering other factors including the state's natural diversity, forest resources, ownership characteristics, forest threats and trends and current programs that influence the management of our forests. Each of these factors is discussed throughout this Assessment document. Some specific areas included in the identification of Forest Legacy Areas include The Nature Conservancy's conservation areas, the Probable Old-Growth Cross Timber Tracts, as well as unique or rare tree species and wildlife habitats identified by agency foresters and other stakeholders.

Forest Legacy Area (FLA) boundaries must encompass forestlands with significant environmental and other resource-based values. Areas may also include non-forested areas if they are an integral part of the landscape and are within the logical boundaries. Since FLA boundaries may not correspond to property boundaries, tracts located partially within the geographically defined FLA are eligible for Legacy, upon Forest Service approval of a boundary adjustment. To be eligible for Legacy, the proposed area must meet the following national criteria:

- Be an environmentally important forest area that is threatened by conversion to non-forest uses.
- Environmentally important forest areas shall contain one or more of the following important public values, as defined by the State:
    - Scenic resources
    - Public recreation opportunities
    - Riparian areas
    - Fish and wildlife habitat
    - Known threatened and endangered species
    - Known cultural resources
    - Other ecological values
- Provide opportunities for the continuation of traditional forest uses, such as forest management, timber harvesting, other commodity use, and outdoor recreation. Forest Legacy is not a strict preservation program, but is intended to conserve working forestlands that offer outstanding public benefits.

Oklahoma Eligibility Criteria for Identification of Forest Legacy Areas

Oklahoma Forestry Services and interested stakeholders utilized the following criteria to help identify potential Forest Legacy Areas throughout the State:

1. Forested areas threatened by conversion to non-forest use, in both the near and long term;
2. Forest resources including:
    - Aesthetic and scenic values;
    - Fish and wildlife habitat, including threatened and endangered species;
    - Mineral resource potential;
    - Public recreation opportunities;
    - Soil productivity;
    - Timber management opportunities; and
    - Watershed values.
3. Historical use of forest areas, and trends and projected future uses of forest resources;
4. Current ownership patterns and size of tracts, and trends and projected future ownership patterns;
5. Cultural resources that can be effectively protected;
6. Outstanding geological features;
7. Demographic trends as they relate to conversion of forest areas; and
8. Other ecological values.

The Forest Service, State or local government may only acquire lands and interests in lands identified within a Forest Legacy Area under the Forest Legacy Program authority on a willing seller/willing buyer basis.

The Forest Legacy Program will help Oklahoma better conserve its natural resources. It will help enhance existing programs and opportunities and better coordinate non-government organizations with state agencies toward a common goal.

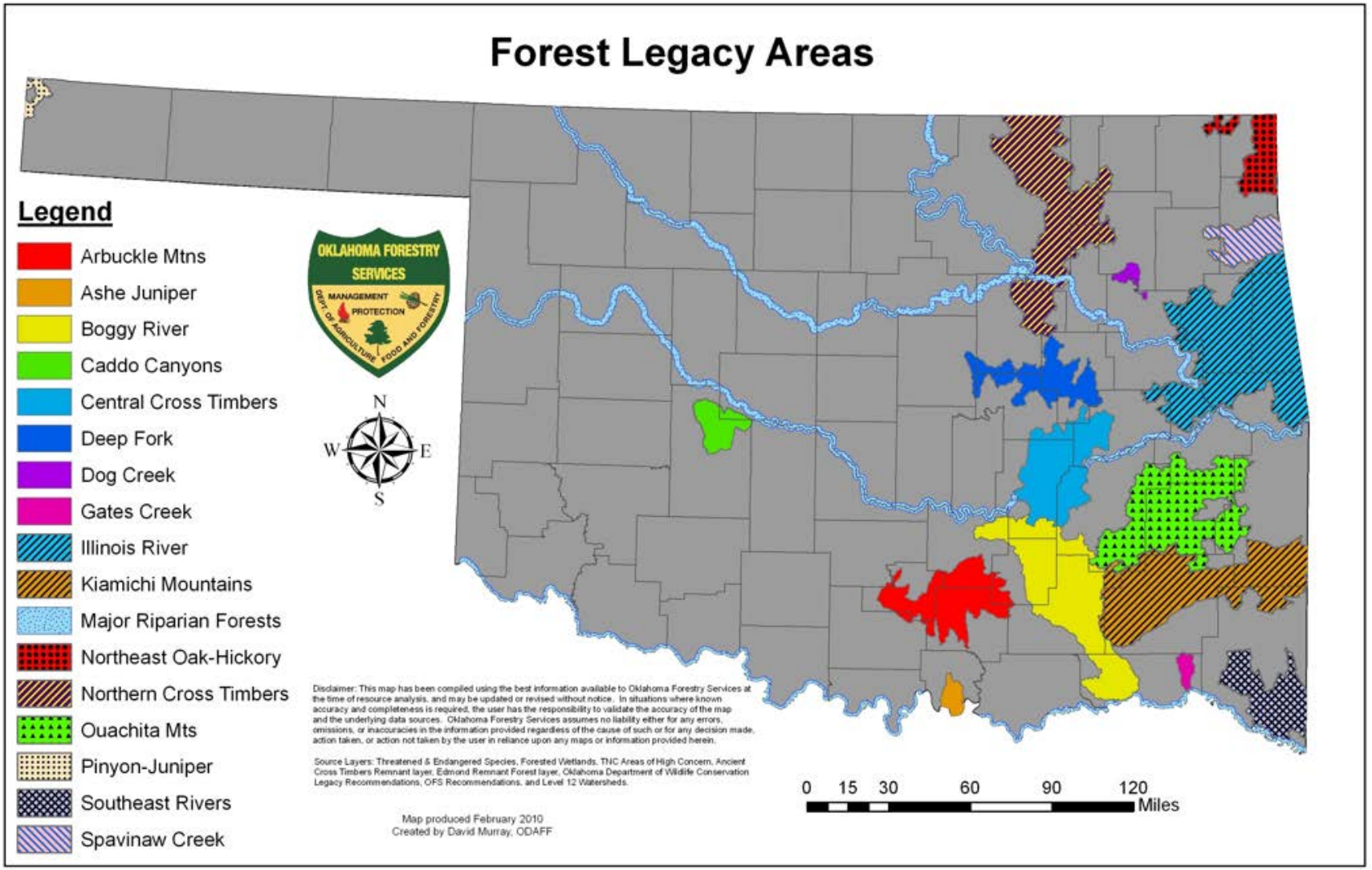
Objectives

Using the guidelines and input received by interested stakeholders, the following program objectives were determined: (Based upon discussions by Forest Stewardship Committee and our work with Land Legacy who drafted much of the earliest AON material)

1. Protect land adjacent to waterways and lakes or in sensitive watershed recharge areas.
2. Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.

3. Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.
4. Maintain cultural and economic contributions to rural communities.
5. Protect land for wildlife and unique, threatened or endangered species.
6. Maintain scenic value.
7. Provide opportunities to the public for outdoor recreation.

Using the above guidelines and information from returned surveys and interviews, 17 Forest Legacy Areas (FLA) were established. These areas were determined with the help of Oklahoma Forestry Services employees and many interested stakeholders including the Oklahoma Department of Wildlife Conservation and The Nature Conservancy. Oklahoma's proposed FLAs are illustrated on the map below and are followed by descriptions.


Forest Legacy Areas
Legend
Arbuckle Mtns
Ashe Juniper
Boggy River
Caddo Canyons
Central Cross Timbers
Deep Fork
Dog Creek
Gates Creek
Illinois River
Kiamichi Mountains
Major Riparian Forests
Northeast Oak-Hickory
Northern Cross Timbers
Ouachita Mts
Pinyon-Juniper
Southeast Rivers
Spavinaw Creek
OKLAHOMA FORESTRY SERVICES
MANAGEMENT
PROTECTION
DEPT OF AGRICULTURE FOOD AND FORESTRY
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Disclaimer: This map has been compiled using the best information available to Oklahoma Forestry Services at the time of resource analysis, and may be updated or revised without notice. In situations where known accuracy and completeness is required, the user has the responsibility to validate the accuracy of the map and the underlying data sources. Oklahoma Forestry Services assumes no liability either for any errors, omissions, or inaccuracies in the information provided regardless of the cause of such or for any decision made, action taken, or action not taken by the user in reliance upon any maps or information provided herein.
Source Layers: Threatened & Endangered Species, Forested Wetlands, TNC Areas of High Concern, Ancient Cross Timbers Remnant layer, Edmond Remnant Forest layer, Oklahoma Department of Wildlife Conservation Legacy Recommendations, OFS Recommendations, and Level 12 Watersheds.
Map produced February 2010
Created by David Murray, ODAFF
0 15 30 60 90 120
Miles

Forest Legacy Area (FLA) Descriptions

FLA: Northern Cross Timbers

Counties: Parts of the following counties are in the Northern Cross Timbers FLA: Creek, Nowata, Osage, Rogers, Tulsa and Washington.

Land Area and Ownership: The total land area of this forest legacy area is 1,074,625 acres. There are a few state and federally owned lands but the majority of this land is privately owned.

Description of Area: This area encompasses the northern-most largest remaining areas of intact Cross Timbers (post oak-blackjack oak forest type) in Oklahoma. Many of these large tracts are considered to contain 200 – 400 year old trees. Bottomland hardwood forests also exist in this area along the waterways including Caney River and Fish Creek. These upland oak forests and bottomland hardwood forests provide excellent habitat for many wildlife species including the following game species: White-tailed deer, wood duck, wintering waterfowl, river otter, wild turkey, bobcat, American woodcock, swamp rabbit, and northern bobwhite.

Threats to Area: The threats to this FLA include residential development, construction of power lines and water pipelines, dams, invasive/exotic species, and conversion of upland and bottomland hardwood forest to non-forest uses such as grazing lands and pastures, and loss of habitat. Wildlife species of concern in this FLA, according to Oklahoma Department of Wildlife Conservation, include: Swainson's Warbler, prothonotary warbler, rusty blackbird, alligator snapping turtle, rabbitsfoot mussel, Neosho mucket mussel, painted bunting, red-headed woodpecker, and regal fritillary.

Public Benefits: Recreation opportunities, scenic beauty, water quality values, fish and wildlife, historical values.

Parks and Recreation Areas: The Northern Cross Timbers Forest Legacy Area has several areas that provide recreational opportunities to the public. There are several state parks including, Osage Hills State Park and Wah Sha She State Park, which provide hiking trails, fishing and camping. There are also several wildlife management areas (WMA) including, Hulah WMA, John Dahl WMA, Osage WMA, and Candy WMA, which provide hunting and fishing opportunities. The federally owned Hulah Waterfowl Refuge is a great place to observe a variety of migratory birds.

Entities that may hold interests in lands of FLA: City of Sand Springs and The Nature Conservancy (Ancient Cross Timbers Preserve adjacent to Keystone Lake)

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas - Elk Prairie Conservation Area
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Bottomland hardwood forest on the lower Caney River and Upland Oak Forests and Woodlands in northeastern Osage County
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Kansas

Goals for FLA:

The goals for the Northern Cross Timbers FLA are as follows:

- Protect lands adjacent to the waterways and lakes to preserve water quality.
- Maintain cultural and economic contributions to rural communities.
- Protect habitat for wildlife and unique, threatened or endangered species.

- Maintain scenic value.
- Provide opportunities to the public for outdoor recreation.

FLA: Northeast Oak-Hickory

Counties: Parts of the following counties are in the Northeast Oak-Hickory FLA: Craig, Delaware and Ottawa.

Land Area and Ownership: The total land area of this forest legacy area is 244,713 acres. There are a few areas owned by the state and federal government but the majority of this land is privately owned with some tribal lands.

Description of Area: This area is comprised mostly of the oak-hickory forest type. The northeast part of this area encompasses a cave that has been occupied, at least historically by the endangered Ozark Cavefish. There is also forestland that has been occupied by the Cerulean Warbler, a rare songbird that has been documented in only six locations in Oklahoma. The southeast part of this area contains several large tracts of oak-hickory forest which lies over a karst formation that contains many caves and springs. One of the caves in the area supports a maternity colony of the federally endangered Gray Bat. Bottomland hardwood forests can also be found along the waterways including the Neosho River. The forests of this area provide wildlife with habitat including the following game species: White-tailed deer, wild turkey, American woodcock, wood duck, paddlefish, white bass, wintering waterfowl, and bobcat.

Threats to Area: Conversion of oak-hickory forest to non-forest uses such as pastures, loss of habitat, development (primarily retirement and secondary homes) and construction of power lines and water pipelines. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: Prothonotary warbler, rusty blackbird, alligator snapping turtle, trumpeter swan, Neosho mucket mussel, Western fanshell, elktoe mussel, Gray Bat, Arkansas darter, redspot chub, wedgespot shiner, Ozark minnow, cardinal shiner, stippled darter, Neosho crayfish, Oklahoma salamander, grotto salamander, cave salamander, Louisiana waterthrush, Kentucky warbler, warm-eating warbler, wood thrush, northern long-eared bat.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: The Northeast Oak – Hickory Forest Legacy Area has two state parks, Twin Bridges State Park and Spring River State Park, which provide a variety of recreational opportunities in and around the oak-hickory forest type. There is camping, hiking trails, and water sport opportunities. Grand Lake, also in the area, provides similar recreational opportunities. There is the federally owned Ozark Plateau National Wildlife Refuge, in this area, that protects threatened and endangered bat habitat but currently it is not open to the general public for recreation opportunities.

Entities that may hold interests in lands of FLA: The Nature Conservancy and Land Legacy, Inc.

Input used to identify this FLA:

- Oklahoma Forestry Services input
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Northeast and Southeast Ottawa County and Bottomland Hardwood Forest along Neosho River near Miami
- Oklahoma Biological Survey threatened and endangered species.

Other States the FLA enters: Kansas and Missouri

Goals for FLA:

The goals for the Northeast Oak-Hickory FLA are as follows:

- Protect lands adjacent to the waterways and lakes.

- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain cultural and economic contributions to rural communities.
- Protect land for wildlife and unique, threatened and endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Illinois River

Counties: Parts of the following counties are in the Illinois River FLA: Adair, Cherokee, Delaware, Muskogee, McIntosh, Okmulgee, Sequoyah and Wagoner.

Land Area and Ownership: The total land area of this forest legacy area is 1,379,005 acres. There are some state parks, state wildlife management areas and a few federal properties but the majority of this land is privately owned with some tribal ownership.

Description of Area: The Illinois River Watershed is one of the State's most valuable and controversial watersheds. This area is comprised of oak-hickory, oak-pine and bottomland hardwood forest types. The Illinois River is located in the middle of this area and is a popular recreation area. Pollution in the river, tributaries and lakes has been a significant concern to the surrounding communities. The forestlands in this area are important to maintaining and enhancing the water quality of the area. Lake Tenkiller is the major water supply for this area. This area also provides habitat to wildlife including these game species: white-tailed deer, American elk, wild turkey, American black bear, northern bobwhite, wood duck, wintering waterfowl, American woodcock and swamp rabbit.

Threats to Area: Conversion of oak-hickory, oak-pine, and bottomland hardwood forest to non-forest uses such as pastures and pine plantations, loss of habitat, residential development and pollution from poultry operations and streambank erosion. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: endangered Ozark big-eared bat, endangered gray bat, state-endangered long-nosed darter, black-sided darter, stippled darter, pallid shiner, cave salamander, Ozark salamander, ringed salamander, Louisiana waterthrush, cerulean warbler, hooded warbler, kentucky warbler, worm-eating warbler, wood thrush, and northern long-eared bat, endangered American burying beetle, Swainson's warbler, prothonotary warbler, bald eagle, Oklahoma salamander, bluntface shiner, Ozark minnow, and wedgetail shiner, rusty blackbird, alligator snapping turtle, crawfish frog, pallid shiner, and Louisiana fatmucket.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat, traditional timber products.

Parks and Recreation Areas: The Illinois River Forest Legacy Area provides excellent recreational opportunities to the public. There are eight state parks in the area that offer camping, hiking, water sports, and wildlife habitat. The state parks include Adair State Park, Brushy Lake State Park, Burnt Cabin Ridge State Park, Cherokee Landing State Park, Greenleaf State Park, Natural Falls State Park, Sequoyah Bay State Park and the Western Hills Guest Ranch/Sequoyah State Park Resort. There are also wildlife management areas, Cherokee-Gruber WMA, Cookson Hills WMA, Fort Gibson WMA, Lake Tenkiller State Park, McClellan-Kerr WMA, Tenkiller WMA, which provide hunting and fishing opportunities. Fort Gibson Lake and the Illinois River are also popular places to visit for recreation opportunities.

Entities that may hold interests in lands of FLA: The Nature Conservancy – Nickels Preserve, Land Legacy, Inc. in Spavinaw Creek, NRCS (through Healthy Forest Reserve Program and endangered bat project)

Input used to identify this FLA:

- Oklahoma Forestry Services Input
- The Nature Conservancy Conservation Areas - Cookson Hills, Dirty Creek, Fort Gibson, Cherokee-Gruber
- Oklahoma Department of Wildlife Conservation Recommendation Areas - Eastern Boston Mountains, Western Boston Mountains, Bottomland Hardwood Forest Along Dirty Creek
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:

The goals for the Illinois River FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.
- Maintain cultural and economic contributions to rural communities.
- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Spavinaw Creek

Counties: Parts of the following counties are in the Spavinaw Creek FLA: Delaware and Mayes.

Land Area and Ownership: The total land area of this forest legacy area is 216,907 acres. The majority of this land is privately owned with some tribal ownership.

Description of Area: This area is dominated by the oak-hickory forest type. It contains two important public water supply reservoirs. The area lies over a limestone karst formation that includes many caves and springs including two caves that serve as maternity sites for the endangered gray bat, and all of the known caves that support the state-endangered Oklahoma cave crayfish. In this area, there are game species including white-tailed deer, American elk, wild turkey, American woodcock and sport fish.

Threats to Area: Conversion of oak-hickory forest to non-forest uses such as croplands, pastures and pine plantations, loss of habitat, residential development and construction of power lines and water pipelines. Wildlife species of concern in this area, according to Oklahoma Department of Wildlife Conservation, include endangered gray bat, state-endangered Oklahoma cave crayfish, threatened Ozark cavefish, Arkansas darter, redspot chub, wedgespot shiner, Ozark minnow, cardinal shiner, stippled darter, Neosho crayfish, Oklahoma salamander, grotto salamander, cave salamander, Ozark salamander, Louisiana waterthrush, cerulean warbler, prothonotary warbler, Kentucky warbler, worm-eating warbler, wood thrush, northern long-eared bat, and three species of Ozark endemic cave isopods and two species of Ozark endemic amphipods.

Public Benefits: Soil productivity, aesthetic and scenic values, fish and wildlife habitat, traditional timber products, recreation opportunities, cultural values.

Parks and Recreation Areas: The Spavinaw Creek Forest Legacy Area has some recreational opportunities for the public. There are two state parks, Lake Eucha State Park and Spavinaw State Park, which offer water sports, camping, scenic beauty and hiking. There is also a state owned Spavinaw WMA that provides hunting and fishing opportunities.

Entities that may hold interests in lands of FLA: The Nature Conservancy, Land Legacy, Inc. and NRCS (through Healthy Forest Reserve Program)

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas - Spavinaw Creek
- Oklahoma Department of Wildlife Conservation Recommendation Areas - Spavinaw Creek Watershed
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:

The goals for the Spavinaw Creek FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Dog Creek

Counties: Parts of the following counties are in the Dog Creek FLA: Rogers and Wagoner.

Land Area and Ownership: The total land area of this forest legacy area is 39,422 acres. The majority of this land is privately owned but Army Corps of Engineers owns some of the land.

Description of Area: This area is dominated by the bottomland hardwood forest type. The Verdigris river flows through this area and a variety of large bottomland hardwoods can be found along the river and tributaries. The water quality in these waterways is important to fish and mussel populations. The forestlands in this area provide wildlife and the following game species with habitat: white-tailed deer, wood duck, wintering waterfowl, river otter, wild turkey, bobcat, American woodcock, swamp rabbit and multiple species of sport fish.

Threats to Area: Conversion of bottomland hardwood forest to non-forest uses such as pastures and pecan orchards, loss of habitat, residential development. Wildlife species of concern in this area, according to Oklahoma Department of Wildlife Conservation, include: Kentucky warbler, prothonotary warbler, rusty blackbird, alligator snapping turtle, crawfish frog, rabbitsfoot mussel, Neosho mucket mussel.

Public Benefits: Scenic beauty, public recreation opportunities and fish and wildlife habitat.

Parks and Recreation Areas: There are some recreational opportunities like fishing in the Dog Creek Forest Legacy Area.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas - Verdigris River and Horseshoe Lake
- Oklahoma Department of Wildlife Conservation Recommendation Areas - Bottomland Hardwood Forest along the Verdigris River near Dog Creek
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:

The goals for the Dog Creek FLA are as follows:

- Protect lands adjacent to the waterways to preserve water quality.
- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Central Cross Timbers

Counties: Parts of the following counties are in the Central Cross Timbers FLA: Hughes, McIntosh, Okfuskee, Okmulgee and Pittsburg.

Land Area and Ownership: The total land area of this forest legacy area is 567,043 acres. There are a few state owned lands but the majority of this land is privately owned.

Description of Area: This area is dominated by the post oak – blackjack oak forest type and contains some of the oldest trees found in the state. There are large tracts of post oak and blackjack oak aging from 200 to 400 years old. The forest type is not the stereotypical ancient forest which often leads to the loss or degradation of these forests. Large tracts of ancient Cross Timbers can also be found around Lake Eufaula. In this area, there are game species including white-tailed deer, northern bobwhite, wild turkey and bobcat. Currently in this area there is a large tract of land for sale called the Canadian River Ranch which contains about 4,000 acres of the post oak – blackjack oak forest type.

Threats to Area: Conversion of ancient post oak – blackjack oak forest to non-forest uses such as grazing lands or grasslands for livestock production, loss of habitat, residential development and construction of power lines and water pipelines. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: painted bunting, red-headed woodpecker, prothonotary warbler, Kentucky warbler, crawfish frog, and scarlet snake.

Public Benefits: Fish and wildlife habitat, public recreation opportunities, cultural values and water quality values.

Parks and Recreation Areas: There are no state parks in the Central Cross Timbers forest legacy area but there are two wildlife management areas that provide hunting and fishing opportunities: Deep Fork WMA and Eufaula WMA.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas – Parts of Coal County Woodlands, Deep Fork, Lake Eufaula Old Growth Cross Timbers, Lake Eufaula Tributaries, Canadian River (Cross Timbers)
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Parts of Upland Oak Forests and Woodlands in eastern Hughes and western Pittsburg Counties and Upland Oak Forests and Woodlands in Northeastern McIntosh County.
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:

The goals for the Central Cross Timbers FLA are as follows:

- Protect lands adjacent to the waterways and lakes to preserve water quality.
- Protect land for wildlife and unique, threatened and endangered species.
- Maintain scenic beauty.
- Maintain cultural and economic contributions to rural communities.
- Provide outdoor recreation opportunities.

FLA: Deep Fork

Counties: Parts of the following counties are in the Deep Fork FLA: Creek, Lincoln, McIntosh, Okfuskee and Okmulgee.

Land Area and Ownership: The total land area of this forest legacy area is 368,073 acres. There are a few state and federally owned lands but the majority of this land is privately owned.

Description of Area: This area is dominated by the bottomland hardwood and post oak – blackjack oak forest types. There are large hardwoods found along the Deep Fork River and its tributaries that provide water quality and fish and wildlife habitat. The following game species are found in this area: white-tailed deer, wood duck, wintering waterfowl, wild turkey, bobcat, American woodcock and swamp rabbit.

Threats to Area: Conversion of bottomland hardwood and post oak – blackjack oak forest to non-forest uses such as grazing lands for livestock production, loss of habitat, residential development. Wildlife species of concern in this area, according to Oklahoma Department of Wildlife Conservation, include: Swainson's warbler, prothonotary warbler, Kentucky warbler, rusty blackbird, alligator snapping turtle and crawfish frog.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: The Deep Fork Forest Legacy Area has several areas for recreational opportunities. There is one state park, Okmulgee/Dripping Springs State Park, which offers camping and fishing. There are also two state wildlife management areas, Deep Fork WMA, Okmulgee WMA, which provide hunting and fishing opportunities. There is also the federally owned Deep fork National Wildlife Refuge in this area.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas – Keystone Woodlands, Deep Fork, and Lake Eufaula Tributaries
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Deep Fork River Bottomlands
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:

The goals for the Deep Fork FLA are as follows:

- Protect lands adjacent to the waterways.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Protect land for wildlife and unique, threatened and endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Boggy River

Counties: Parts of the following counties are in the FLA: Atoka, Choctaw, Coal, Hughes, Pittsburg, Pontotoc and Pushmataha.

Land Area and Ownership: The total land area of this forest legacy area is 918,474 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by bottomland hardwood forest type but also contains oak – pine and post oak – blackjack oak forest types. There are some ancient post oak – blackjack oak forest tracts that can be found in this area. There are also large hardwoods, including bur oak and pecan, found along the river and tributaries. The Clear Boggy and Muddy Boggy Rivers flow through this area and provide water quality, recreation, and fish and wildlife habitat. In this area, there are game species including wood duck, white-tailed deer, river otter, swamp rabbit and several species of wintering waterfowl (e.g. mallard, green-winged teal, ring-necked duck).

Threats to Area: Conversion of bottomland hardwood and post oak – blackjack oak forest to non-forest uses such as pastures, loss of habitat, residential development. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: prothonotary warbler, wood stork, rusty blackbird, alligator snapping turtle, razor-backed musk turtle, Kentucky warbler, crawfish frog, rocky shiner, blue sucker, and Ouachita kidneyshell.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat and soil productivity.

Parks and Recreation Areas: The Boggy Creek Forest Legacy Area provides several recreational opportunities to the public. The McGee Creek Natural Scenic Recreation Area and the McGee Creek State Park offer multiple outdoor recreation activities. There are also three wildlife management areas, Atoka WMA, McGee Creek WMA and Stringtown WMA, which provide hunting and fishing opportunities.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy – Parts of McAlester, Pipewort Haven, Boggy Seeps, Coal County Woodlands, Lake Eufaula Old Growth Cross Timbers, Red River East of Lake Texoma
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Clear Boggy and Muddy Boggy River Bottomland Hardwood Forests
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:

The goals for the Boggy FLA are as follows:

- Protect lands adjacent to the waterways to preserve water quality.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain scenic beauty
- Provide outdoor recreation opportunities

FLA: Kiamichi Mountains

Counties: Parts of the following counties are in the Kiamichi Mountains FLA: Atoka, Latimer, LeFlore, McCurtain, Pittsburg and Pushmataha.

Land Area and Ownership: The total land area of this forest legacy area is 1,013,328 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the oak – pine forest type but shortleaf and loblolly pine and oak – hickory forest types can be found. Most of this area is adjacent to the Ouachita National Forest and is privately owned which is at risk to conversion to non-forest uses. There are areas where large older shortleaf pine can be found. In this area, there are game species including eastern wild turkey, white-tailed deer, river otter, bobcat, black bear and northern bobwhite.

Threats to Area: Conversion of oak – pine forest to non-forest uses such as pastures, loblolly pine plantations, loss of habitat, residential development. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: Bachman's sparrow, worm-eating warbler, Ouachita dusky salamander, northern long-eared bat, Kentucky warbler, brown-headed nuthatch, prairie Warbler, Ouachita rock pocketbook, Ouachita kidneyshell, cerulean warbler, hooded warbler, wood thrush, rich mountain salamander, southern red-backed salamander, Kiamichi slimy salamander, northern long-eared bat, Louisiana waterthrush, ringed salamander, Ouachita dusky salamander, southeastern bat, spotted skunk, Kiamichi river shiner, Kiamichi crayfish, leopard darter, Ouachita mountain shiner, rocky shiner, peppered shiner, Mena crayfish.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat, soil productivity and traditional timber products.

Parks and Recreation Areas: There are several state owned lands in the Kiamichi Mountain Forest Legacy Area which provide recreational opportunities. The Clayton State Park, Gary Sherrer WMA and Pushmataha WMA all offer public recreation. In this area, there are also several federally owned lands such as Winding Stairs National Recreation Area, Ouachita WMA, Black Fork Mountain Wilderness, Robert S. Kerr Memorial Arboretum and Botanical Area, Upper Kiamichi River Wilderness, and Ouachita National Forest.

Entities that may hold interests in lands of FLA: The Nature Conservancy and The Conservation Fund

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas – Beavers Bend Hills, Pushmataha WMA, Rich Mountain, Pipewort Haven.
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Central Ouachita Mountains, Forestland surrounding Pushmataha WMA, and John's Valley.
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:

The goals for the Kiamichi Mountains FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.

- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain cultural and economic contributions to rural communities.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Ouachita Mountains

Counties: Parts of the following counties are in the FLA: Haskell, Latimer, LeFlore, Pittsburg and Pushmataha.

Land Area and Ownership: The total land area of this forest legacy area is 926,482 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the oak-pine, oak-hickory and post oak – blackjack oak forest types. This area is a transition zone from the oak – pine forests to the oak – hickory and post oak – blackjack oak forest types. There are a few areas where some remnant Cross Timber tracts can be found. In this area, there are game species including eastern wild turkey, white-tailed deer and black bear, northern bobwhite, and American elk, wood duck, wintering waterfowl, river otter, bobcat, American woodcock, swamp rabbit

Threats to Area: Conversion of oak – pine and oak – hickory forest to non-forest uses such as grazing lands and pastures, loblolly pine plantations, loss of habitat, residential development and construction of power lines. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: Swainson's warbler, hooded warbler, prothonotary warbler, rusty blackbird, alligator snapping turtle, crawfish frog, pallid shiner, southern hickorynut mussel and Louisiana fatmucket, Kentucky warbler, Louisiana waterthrush, brown-headed nuthatch, and prairie warbler, Ouachita dusky, many-ribbed salamander, northern long-eared bat, worm-eating warbler, and rich mountain salamander, spotted skunk

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat, traditional timber products and soil productivity.

Parks and Recreation Areas: The Ouachita Mountains Forest Legacy Area has an abundance of recreational opportunities on the following lands: Eufaula WMA, Gary Sherrer WMA, James Collins WMA, Robbers Cave State Resort Park, Robbers Cave WMA, Talimena State Park, Wister WMA and Yourman WMA. The federal government owns the Ouachita National Forest, Winding Stair Mountain NRA and Ouachita WMA which provide hiking trails, horseback riding, scenic beauty, camping, and other outdoor activities. The Talimena Scenic Byway traverses the Winding Stairs National Recreation Area and is a popular drive to observe beautiful fall foliage.

Entities that may hold interests in lands of FLA: The Conservation Fund

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy Conservation Areas – Parts of Rich Mountain, Arkansas River Valley Prairies, Lake Eufaula Tributaries
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Western Winding Stair Mountain Ridge, San Bois Mountains, Bottomland Hardwood Forest on Gaines Creek
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:

The goals for the Ouachita Mountains FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.

- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain cultural and economic contributions to rural communities.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Southeast Rivers

Counties: Parts of the following county is in the FLA: McCurtain

Land Area and Ownership: The total land area of this forest legacy area is 394,291 acres. The majority of this land is privately owned but there are a few federal lands.

Description of Area: This area is dominated by the bottomland hardwood forest type but loblolly pine and oak – pine forests can be found. In this area, some beautiful large bald cypress can be found in and around the river and tributaries. The rivers in this area include the Little River and Glover River which are popular recreation areas. An estimated 25 to 30 threatened and endangered plant and animal species occur along the Little River including the American Alligator. The Glover River is a tributary of the Little River and considered critical habitat for the threatened leopard darter. In this area, there are also game species including white-tailed deer, wood duck, wintering waterfowl, wild turkey, bobcat, American woodcock and swamp rabbit.

Threats to Area: Conversion of bottomland hardwood, pine and oak – pine forest to non-forest uses such as grazing lands for livestock production, loss of habitat for threatened and endangered species, residential development and southern pine beetle. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: Swainson's warbler, hooded warbler, Kentucky warbler, wood thrush, prothonotary warbler, rusty blackbird, alligator snapping turtle, razor-backed musk turtle, western mudsnake, Louisiana milksnake, three-toed amphiuma, lesser siren, Sequoyah slimy salamander, crawfish frog, blackspot shiner, Creole darter, Harlequin darter, goldstripe darter, taillight shiner, American burying beetle, Blair's swamp crayfish.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: There are no state lands in the Southeast Rivers Forest Legacy Area but a few federal lands exist. The Little River National Wildlife Refuge and Ouachita WMA Tiak and McCurtain Unit provide wildlife observation and some hunting and fishing opportunities. The Glover River is a popular recreation area in McCurtain County and is an area that has been discussed for conservation, protection and possibly scenic river designation.

Entities that may hold interests in lands of FLA: The Conservation Fund and The Nature Conservancy

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy – Parts of Beavers Bend Hills, Little River, McCurtain County, and Weyerhaeuser Tiak.
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Watersheds of McKinney Creek and North Caney Creek.
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:
The goals for the Southeast Rivers FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.
- Protect habitat for wildlife and unique, threatened or endangered species.

- Maintain cultural and economic contributions to rural communities.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Gates Creek

Counties: Parts of the following county is in the FLA: Choctaw.

Land Area and Ownership: The total land area of this forest legacy area is 38,998 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the bottomland hardwood forest type. This is one of the Red River tributaries that is still predominately forested. In this area, there are game species including white-tailed deer, wood duck, wild turkey, bobcat, American woodcock and swamp rabbit.

Threats to Area: Conversion of bottomland hardwood and oak – pine forest to non-forest uses such as pastures, loss of habitat, residential development, and conversion to loblolly pine plantations. Wildlife species of concern according to Oklahoma Department of Wildlife Conservation: Kentucky warbler, hooded warbler, prothonotary warbler, rusty blackbird, crawfish frog, goldstripe darter, crystal darter, blackspot shiner, Kiamichi shiner and southern hickorynut mussel.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat, soil productivity, traditional timber products.

Parks and Recreation Areas: There is one state park, Raymond Gary State Park, in the Gates Creek Forest Legacy Area which provides some hunting and fishing opportunities.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy – Meadow Rue Seep Area 1 and 2
- Oklahoma Department of Wildlife Conservation Recommendation Areas – Gates Creek
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Arkansas

Goals for FLA:

The goals for the Gates Creek FLA are as follows:

- Protect lands adjacent to the waterways and lakes.
- Conserve highly productive soils and aid in soil stability thus protecting riparian habitat and water quality.
- Maintain traditional forest uses, including retention of forestlands for timber production and preventing fragmentation.
- Protect habitat for wildlife and unique, threatened or endangered species.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Major Riparian Forests

Counties: Parts of the following counties are in the FLA: Blaine, Bryan, Canadian, Choctaw, Cleveland, Cotton, Creek, Dewey, Ellis, Grady, Harmon, Haskell, Hughes, Jackson, Jefferson, Kay, Kingfisher, Logan, LeFlore, Lincoln, Love, Major, Marshall, McClain, McIntosh, McCurtain, Muskogee, Osage, Payne, Pittsburg, Pontotoc, Roger Mills, Seminole, Sequoyah, Tillman, Tulsa, Wagoner, Woods and Woodward.

Land Area and Ownership: The total land area of this forest legacy area is 1,652,489 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the bottomland hardwood forest type. The major riparian forests grow along the Red, Cimarron, Arkansas, and Canadian Rivers as well as their tributaries. The hardwood species found along the rivers in west Oklahoma are significantly different than the species found in east Oklahoma. Western riparian forests have been drastically degraded over the years from lands being converted to croplands and pastures. Willows, oaks, and cottonwoods are typically species that can be found in western riparian forests. As you move toward central Oklahoma riparian forests the number of trees and species increase. In central riparian forests, there are typically elms, willows, cottonwoods, sycamores, pecans, and walnuts. The eastern riparian forests are the most diverse and where ashes, elms, sweetgums, maples, pecans, oaks, walnuts, boxelders and other moist site species can be found. The riparian forests are important to keeping ecosystems healthy and providing quality water to our state. There are a wide variety of wildlife and fish species that depend on these waterways to survive.

Threats to Area: Conversion of bottomland hardwood forest to non-forest uses such as development, pastures and grazing land for livestock, salt cedar invasion, loss of habitat, erosion, water quality and construction of power lines and water pipelines.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: The Major Riparian Forests Forest Legacy Area provides an abundance of recreational opportunities to the state. There are numerous state parks and wildlife management areas in and around these riparian forests including Feyodi Creek State Park, Keystone Lake and State Park, Little Sahara State Park, Oliver Wildlife Preserve, Walnut Creek State Park, Greenleaf State Park, Eufaula WMA, Cherokee-Gruber WMA, Kaw WMA, Keystone WMA, Lone Valley WMA, McClellan-Kerr WMA and Packsaddle WMA. These areas are enjoyed by many for the variety of outdoor activities offered.

Entities that may hold interests in lands of FLA:

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy – Cimarron River, Canadian River, Red River Floodplain, Cimarron River Floodplain, Canadian River (Cross Timbers), Pecan Bayou
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Texas, Kansas and Arkansas

Goals for FLA:

The goals for the Major Riparian Forests FLA are as follows:

- Protect lands adjacent to the waterways to preserve water quality.
- Protect habitat for wildlife.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Arbuckle Mountains

Counties: Parts of the following counties are in the FLA: Carter, Coal, Johnston, Murray and Pontotoc.

Land Area and Ownership: The total land area of this forest legacy area is 511,026 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the post oak – blackjack oak forest type. Some ancient Cross Timber tracts can be found in this area mixed in the rocky rolling hills.

Threats to Area: Conversion of post oak – blackjack oak forest to non-forest uses such as croplands and pastures, loss of habitat, residential development, construction of power lines and water pipelines.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: The Arbuckle Mountains Forest Legacy Area has several public recreation areas such as the Blue River Public fishing and hunting area, Turner Falls and Texoma/Washita Arm/Tishomingo WMA. These areas provide camping, fishing, swimming, and hiking opportunities. There are also the federally owned Chickasaw National Recreation Area and Tishomingo National Wildlife Refuge which provide wildlife observation and some hunting opportunities

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input – Arbuckle Aquifer
- The Nature Conservancy Conservation Areas – Parts of Arbuckle Mountains and Arbuckle Plains
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species
- SAF Natural Area – Seaside Alder along Pennington Creek

Other States the FLA enters: None

Goals for FLA:

The goals for the Arbuckle Mountains FLA are as follows:

- Protect lands adjacent to the waterways to preserve water quality.
- Protect habitat for wildlife.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Caddo Canyons

Counties: Parts of the following counties are in the FLA: Caddo and Canadian

Land Area and Ownership: The total land area of this forest legacy area is 153,309 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the bottomland hardwood forest type. Isolated canyons along Sugar Creek support relict stands of sugar maple, locally known as Caddo Maple. There are also a variety of other hardwoods that can be found in this area such as post oak, blackjack oak, bur oak and black walnut. This area is unique to the state because it is the only area where these stands occur.

Threats to Area: This area has been heavily impacted by agriculture. Cotton, wheat, grain sorghum, peanuts, and other row crops were once grown across much of Caddo and Canadian Counties. There is evidence of severe soil erosion across this area. Oil and gas development, residential development, and other infrastructure threaten this area and forests could be lost to non-forest uses.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: Red Rock Canyon State Park is found within this area which offers a variety of recreational opportunities such as camping, fishing, hiking, and rappelling.

Entities that may hold interests in lands of FLA: None identified

Input used to identify this FLA:

- Oklahoma Forestry Services input
- The Nature Conservancy – Parts of Caddo Canyons
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:

The goals for the Caddo Canyons FLA are as follows:

- Protect lands adjacent to the waterways and lakes to preserve water quality.
- Protect habitat for wildlife.
- Maintain scenic beauty.
- Provide outdoor recreation opportunities.

FLA: Pinyon – Juniper

Counties: Parts of the following county is in the FLA: Cimarron

Land Area and Ownership: The total land area of this forest legacy area is 44,726 acres. There is one state park in this area but the majority of this land is privately owned.

Description of Area: This area is dominated by the pinyon pine – juniper forest type. These are more often woodlands because the trees are no taller than 20 feet and the crowns typically do not touch. There are small tracts of ponderosa pine throughout this area which is unique because this is the single native area for this species in the state. This is a very arid area and very little vegetation grows across this landscape and this is the only area in the panhandle where native trees can be found.

Threats to Area: Conversion of pinyon pine – juniper forest to non-forest uses such as grazing land and pastures for livestock production.

Public Benefits: Recreational opportunities, scenic beauty, wildlife habitat.

Parks and Recreation Areas: The Black Mesa State Park Reserve provides some excellent overlooks as well as some camping and trail opportunities.

Entities that may hold interests in lands of FLA:

Input used to identify this FLA:

- Oklahoma Forestry Services input
- Society of American Foresters – Natural Area
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: Colorado and New Mexico

Goals for FLA:

The goals for the Pinyon – Juniper FLA are as follows:

- Protect habitat for wildlife.
- Maintain scenic beauty and cultural value.
- Provide outdoor recreation opportunities.

FLA: Ashe Juniper

Counties: Parts of the following county is in the FLA: Marshall.

Land Area and Ownership: The total land area of this forest legacy area is 59,536 acres. The majority of this land is privately owned.

Description of Area: This area is dominated by the post oak – blackjack oak forest type but is one of the only areas Ashe juniper can be found in the state.

Threats to Area: Conversion of post oak – blackjack oak forest to non-forest uses such as croplands and pastures, loss of habitat, residential development.

Public Benefits: Recreational opportunities, scenic beauty, water quality values, fish and wildlife habitat.

Parks and Recreation Areas: There are some recreational opportunities along the Red River and near Lake Texoma.

Entities that may hold interests in lands of FLA:

Input used to identify this FLA:

- Oklahoma Forestry Services input
- Remnant Cross Timbers Layer, David Stahle, University of Arkansas
- Oklahoma Biological Survey threatened and endangered species

Other States the FLA enters: None

Goals for FLA:
The goals for the FLA are as follows:

- Protect lands adjacent to the waterways to preserve water quality.
- Protect habitat for wildlife.
- Maintain scenic beauty and cultural value.
- Provide outdoor recreation opportunities.

Project Evaluation and Prioritization Procedures

In implementation of these Forest Legacy objectives, the following actions will be pursued in order to address the primary threats to the state's forestlands and resources:

*In **protecting lands adjacent to waterways and lakes or in sensitive watershed recharge areas,** priority will be given to:*

- Tracts that contain riparian habitat.
- Tracts owned by landowners who will encourage regeneration of healthy stands of native species.
- Tracts owned by landowners who will identify and protect sensitive riparian habitat and who will seek to minimize non-point sources of pollution.
- Tracts that drain directly into streams, lakes or aquifers, especially drinking water sources.

*In **protecting and conserving highly productive soils, aiding in soil stability and protecting water quality,** priority will be given to:*

- Tracts that contain highly productive soils.
- Tracts that contain soils that are highly erodible.
- Tracts that produce high levels of sediment and runoff into streams, rivers, and lakes that is preventable with treatment.
- Tracts owned by landowners that will actively manage in accordance to forest water quality Best Management Practice Guidelines.

*In **maintaining traditional forest uses, including retaining forest land for timber production and preventing fragmentation,** priority will be given to*:

- Tracts owned by landowners that will actively manage for forest health.
- Tracts of sufficient size and site quality to produce volumes of wood products that help satisfy timber demands, provide income, and make significant contributions to the economy.
- Tracts in danger of conversion to non-forest uses within five years based upon local trends.

*In **maintaining cultural and economical contributions to rural communities,** priority will be given to*:

- Tracts which could contribute to the development or sustainability of local and regional wood products industries.
- Tracts owned by landowners who will work cooperatively to implement a long-term Forest Stewardship plan for their property.
- Tracts, which could contribute to the continuance of wildlife production and livestock grazing on forested lands, in accordance with owner objectives.

*In **protecting land for wildlife and unique, threatened or endangered species,** priority will be given to*:

- Tracts adjacent to public lands managed for wildlife habitat.
- Tracts that currently exhibit connective habitats, migratory corridors, habitat linkages and areas of biological isolation.
- Tracts owned by landowners who will identify and protect areas with species or communities of concern and manage for key habitats.
- Tracts owned by landowners who will restore and/or maintain forest cover and structure to provide habitat connectivity for the range of wildlife species that would normally populate the area.

*In **maintaining scenic values and protecting natural beauty,** priority will be given to*:

- Tracts that contain unique or outstanding natural beauty, including vegetation, topographic and geological features and scenic views.
- Tracts whose owners will preserve, protect and enhance unique and outstanding features of natural beauty on their lands.

*In **providing opportunities for public outdoor recreation,** priority will be given to:*

- Tracts whose owners will allow restricted public access for such purposes as hunting, fishing, bird watching, and hiking.
- Tracts that contain unique natural beauty, including vegetation, wildlife topographic and geological features and scenic views.

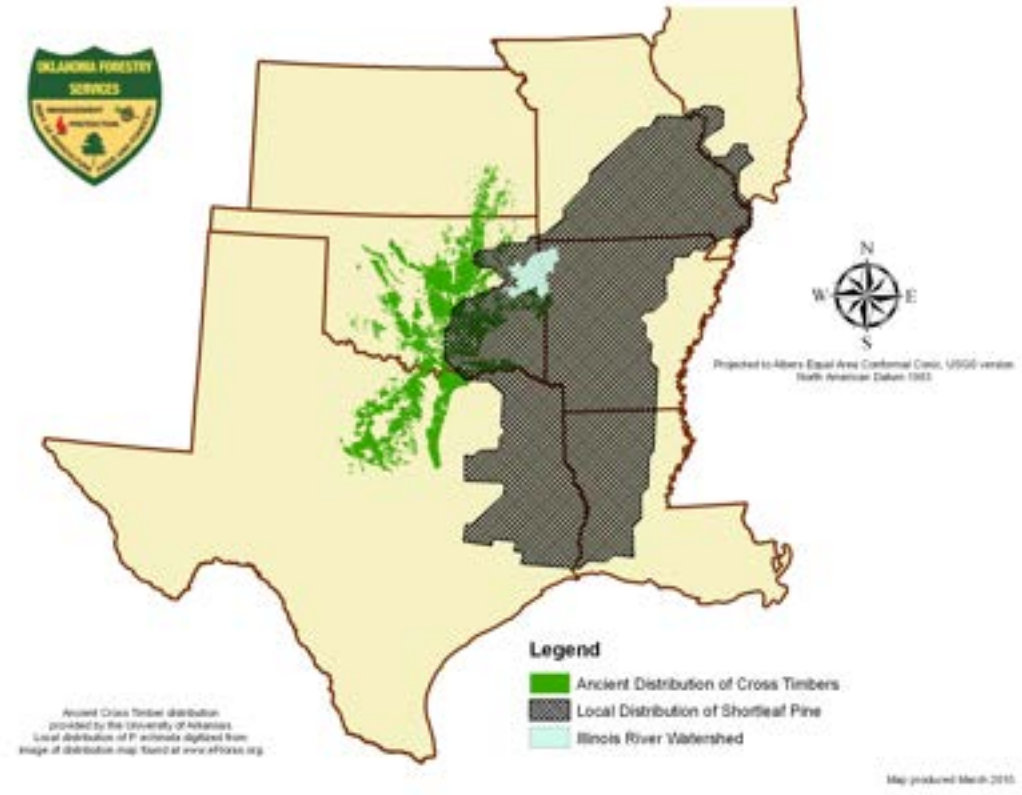
The Forest Legacy Program can help address the primary threats to Oklahoma's forestlands which are described earlier in this document. By working with owners of large, unbroken tracts, parcelization and fragmentation can be reduced. Through Forest Stewardship plans developed with landowners enrolled in Forest Legacy, forest health, productivity and sustainability issues can be addressed using appropriate land management practices. Finally, by protecting forestlands through permanent conservation easements or outright purchase, Forest Legacy can help to alleviate the permanent loss of forest resources throughout Oklahoma, thus protecting these lands for their economic, recreation, water quality, cultural, and ecological benefits.

The Forest Legacy Areas will be discussed more in the Oklahoma Forest Resource Strategy with how funding will be focused and how the major goals and objectives will be implemented.

Multi-State Areas (Regional Priority)

This section illustrates and describes a few important forest areas found in Oklahoma that cross state boundaries. These are large project areas where funding can be focused on a landscape scale across multiple states.

Figure 21: *Multi-state Areas*



Project Area: Cross Timbers – Post oak – Blackjack oak Forest Type

Description:

The Cross Timbers is a large area that spreads from north central Texas through Oklahoma into south Kansas and east Arkansas. This Cross Timbers area and the post oak – blackjack oak forest type is discussed in detail in this assessment. The ancient Cross Timbers tracts are threatened by conversion to non-forest uses and are areas that should be conserved and managed for future generations. This forest type receives little funding and is rapidly being lost due to conversion to crop and range land and urbanization and associated development.

States: Oklahoma, Texas, Kansas and Arkansas

Project Area: Illinois River Watershed

Description:

The Illinois River Watershed is located in northeast Oklahoma and northwest Arkansas and is a valuable and controversial watershed. This area is comprised of oak-hickory, oak-pine and bottomland hardwood forest types. The Illinois River is located in the middle of this area and is a popular recreation area. Pollution in the river, tributaries and lakes has been a significant concern to the surrounding communities. The forestlands in this area are important to maintaining and enhancing the water quality of the area. There are numerous issues

associated with this watershed and collaborative management of the watershed is vital to enhance water quality as well as wildlife and aquatic habitats.

States: Oklahoma and Arkansas

Project Area: Shortleaf Pine Restoration

Description:

Shortleaf pine is the most widespread native southern pine and is common in adjoining states to our south and east, including Missouri. However, because of its slower growth rate, loblolly pine is preferred for forest regeneration purposes on many sites previously occupied by shortleaf. As a native species adapted to droughty sites, with the ability to sprout following fire, shortleaf may be better able to provide forest cover under changing climate conditions in the western fringes of the pine range. Shortleaf pine management, combined with prescribed burning, may improve wildlife habitat, restore habitat for the Red-Cockaded Woodpecker on some sites, protect forest watersheds and water quality, sustain quality timber supplies, and provide more aesthetically pleasing scenic value to the traveling public and buffer communities and public lands from the risks and ravages of wildfire. Ecosystem services from all lands, including public lands (e.g., state parks and wildlife management areas), may be more sustainable where natural resource managers favor well-adapted native species, especially on marginal sites. There is an opportunity for Oklahoma and the adjoining states to focus greater attention on restoring shortleaf on sites where it is better adapted to long-term growing conditions, and able to survive increased use of prescribed fire to maintain these native forest ecosystems, especially on public lands. A competitive grant was approved in federal FY 2010 for this project, involving surrounding states Texas and Arkansas as well as Virginia and North Carolina.

States: Oklahoma, Missouri, Texas and Arkansas

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Appendices

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Appendix A: Glossary

Biodiversity – the variability among living organisms within species, between species, and between ecosystems.

Bioenergy – renewable energy derived from biological sources, to be used for heat, electricity, or vehicle fuel.

Biomass – the living or dead weight of organic matter in a tree, stand, or forest or harvesting the wood product obtained from in-woods chipping of all or some portion of trees including limbs, tops, and unmerchantable stems, usually for energy production.

Carbon Sequestration – storage of carbon dioxide, the uptake and storage of carbon dioxide by trees, plants and soil.

Cropland – land with an annually tilled crop.

Crown Cover – percentage of the ground surface covered by a vertical projection of crowns from above.

Ecoregion - an ecologically and geographically defined area that is characterized by its biodiversity, flora, fauna and ecosystems.

Ecosystem – a dynamic complex of communities of plants, animals and other organisms interacting with their non-living environment as a functional unit. Examples: Urban Park, wetlands, forests, grasslands, etc.

Estuary – a bay at the mouth of a river where the tide meets the river current.

Exotic – a plant or species introduced from another country or geographic region outside its natural range.

Federal Forestland – forestland owned by the federal government.

Forestland – land at least 10% stocked (see stocking definition) by forest trees of any size or formerly having such tree cover and not currently developed for non-forest uses, with a minimum area classification of 1 acre (USDA Forest Service and Oklahoma Forestry Code definition).

Forest Trees – plants having a well-developed, woody stem and usually more than 12 feet in height at maturity (USDA Forest Service – Forest Inventory and Analysis definition).

Forest Type – A classification of forest land based upon the trees or tree communities that constitute the majority of stocking on the site.

Forestry – the profession embracing the science, art, and practice of creating, managing, using, and conserving forest and associated resources for human benefits in a sustainable manner to meet desired goals, needs, and values (Note: The broad field of forestry consists of those biological, quantitative, managerial, and social sciences that are applied to forest management and conservation; it includes agroforestry, urban forestry, industrial forestry, nonindustrial forestry, and wilderness and recreation forestry.

Greenbelt or Green Space – a park-like strip of unoccupied land with little or no development, usually surrounding or partially surrounding urban areas.

Green Infrastructure – strategically planned and managed networks of natural lands, working landscapes and other green spaces that conserve ecosystem values and functions and provide associated benefits to human populations.

Hardwoods – Dicotyledonous trees, usually broadleaved and deciduous (sheds leaves in the fall). Examples include hickories, maples, elms and oaks.

Introduced Species – an established plant or animal not native to the ecosystem.

Invasive Species – a nonnative species (plants, insects, fish, pathogens, mammals, birds, reptiles, etc.) that causes or is likely to cause economic or environmental harm or harm to human health.

Karst – topography with sinkholes, caves and underground drainage that is formed by dissolution in limestone, gypsum, and other rocks.

Native Species – an indigenous species that is normally found as a part of a particular ecosystem.

Prescribed Fire/Burn – to deliberately burn wildland fuels in either their natural or their modified state under specified environmental conditions, which allows the fire to be confined to a predetermined area and produces the fireline intensity and rate of spread required to attain planned resource management objectives.

Private Forestland – forestland owned by individuals, families, corporations, organizations, tribes, or the forest industry.

Primary Wood Product Producer - process wood in raw log form. This includes sawmills, portable sawmills, pulp and paper mills, veneer mills and specialty mills.

Priority Forestland – areas found to have the highest priority because of the number of factors threatening the forestlands.

Pulp – separated wood fibers used in manufacturing paper and allied products.

Pulpwood – roundwood, whole-tree chips or wood residues used for the production of wood pulp for paper and paper products.

Rangeland - land supporting vegetation suitable for grazing, including grazable woodland and shrubland.

Riparian – related to, living, or located in conjunction with wetlands, on the bank of a river or stream but also at the edge of a lake or tidewater.

Roundwood – refers to the length of cut tree such as a log, usually with a round cross-section, with or without bark.

Saw logs – trees or logs cut from trees with a minimum diameter and length and with stem quality suitable for conversion to lumber.

Secondary Wood Product Producer - process wood from primary producers and add additional value. This includes window, door, furniture, pallet and crafting, envelope and box manufacturers.

Silviculture – the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

Softwoods – Coniferous trees, usually evergreen (retains leaves throughout the year) having needles or scale-like leaves. Examples include pines, junipers and cedars.

State Forestland – forestland owned by the state and local governments.

Stocking – A loose term for the amount of anything on a given area, particularly in relation to what is considered the optimum (usually in terms of numbers of trees or basal area per acre).

Timberland (Productive forestland) – forestland capable of producing in excess of 20 cubic feet per acre per year and not legally withdrawn from timber production, with a minimum area classification of 1 acre (USDA Forest Service – Forest Inventory and Analysis definition).

Transition Zone – An area where a distinct boundary between two or more different conditions cannot be determined.

Unproductive Forestland – forestland that produces less than 20 cubic feet per acre per year.

Watershed – a region or land area drained by a single stream, river or drainage network.

Wildfire – any nonstructure fire, other than prescribed fire, occurring on wildland.

Wildland – land other than that dedicated for other uses such as agricultural, urban, mining, or parks.

Wildland Urban Interface – an area where increased human influence and land use conversion are changing natural resource goods, services and management.

Woodland – where stocking cannot be determined, at least 5 percent crown cover by trees of any size or has had at least 5 percent cover in the past (USDA Forest Service – Forest Inventory and Analysis definition).

Sources: USDA Forest Service, Oklahoma Forestry Services, Society of American Foresters and the Southern Forests for the Future Report, World Resources Institute. 2010.

Appendix B: Programs and Plans

Community Wildfire Protection Plans

The incentive for communities to engage in comprehensive forest planning and prioritization was given new and unprecedented impetus with the enactment of the Healthy Forests Restoration Act (HFRA) in 2003. This legislation includes the first meaningful statutory incentives for the U.S. Forest Service and the Bureau of Land Management to give consideration to the priorities of local communities as they develop and implement forest management and fuel reduction projects.

In order for a community to take full advantage of this opportunity, it must first prepare a Community Wildfire Protection Plan (CWPP). Local wildfire protection plans can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection – or all of the above.

The process of developing a CWPP can help a community clarify and refine its priorities for the protection of life, property, and critical infrastructure in the wildland urban interface. It also can lead community members through valuable discussions regarding management options and implications for the surrounding watershed.

The language in the HFRA provides maximum flexibility for communities to determine the substance and detail of their plans and the procedures they use to develop them. Because legislation is general in nature, some communities may benefit from assistance on how to prepare such a plan. A handbook is available to provide communities with a concise, step-by-step guide to use in developing a CWPP. Also, Oklahoma Forestry Services has contracted a consultant to assist communities in preparing their CWPPs. If interested in more information, contact Oklahoma Forestry Services at 405-522-6158 or visit http://www.communitiescommittee.org/pdfs/cwpphandbook.pdf.

Communities with a completed CWPP (as of 12/2009):

- City of Allen
- City of Atoka
- City of Bokchito
- City of Stilwell
- City of Temple
- City of Yuba

Forest Inventory and Analysis Program

The Forest Inventory and Analysis (FIA) Program has been in operation since 1930 surveying forestlands within the United States. The FIA program collects, analyzes, and reports information on the status and trends of America's forests: how much exists, where it exists, who owns it, and how it is changing, as well as how the trees and other forest vegetation are growing and how much has died or has been removed in recent years. The forest resource data collected is used to monitor tree growth and harvests, but also tree species and land-use patterns, forested wildlife habitat, mortality, and other forest health attributes, regional biological processes, timber and nontimber forest products, and associated human activities. This information is essential for evaluating whether current forest management practices are sustainable in the long run and whether current policies will allow future generations to enjoy America's forests. For more information about the FIA Program visit: www.fia.fs.fed.us/.

Forest Legacy Program

Authority and Purpose of Forest Legacy Program

The purpose of the Forest Legacy Program (FLP) is to identify and protect environmentally important forestland from conversion to non-forest uses, through the use of conservation easements and fee purchase negotiated with willing landowners. The purposes of the Assessment of Need (AON) are to document the need for a Forest Legacy Program in Oklahoma; to analyze the state's forest resources

and the threats impacting the benefits provided by our forests; to identify and delineate the boundaries of forest areas meeting the eligibility criteria for designation as Forest Legacy Areas; and to recommend specific areas to the U.S. Forest Service and Secretary of Agriculture for inclusion in the Forest Legacy Program.

Oklahoma's participation in the Forest Legacy Program is predicated on several factors.

1. Public recognition that our forestlands as a whole are an invaluable natural resource that provides incomparable benefits to the state's citizens.
2. The working forests that provide these public benefits must be managed and sustained for present and future generations.
3. Some forests contain exceptional features that are worthy of protection for the long term, with assistance from state and federal government resources.
4. Many of Oklahoma's important forestlands are threatened by conversion to non-forest uses, with a subsequent loss of public as well as private forest benefits.
5. Assuring the long-term sustainability and maintenance of these important lands can best be achieved through a partnership between government, private landowners and non-governmental organizations with similar goals.
6. There will never be enough public funds to protect all of the state's most valuable working forests. However, the Forest Legacy Program will help raise awareness, establish a mechanism and serve as a model program for similar efforts in Oklahoma.

Legacy is guided by federal legislation, USDA Forest Service guidelines and State directives, policies and laws. Oklahoma Forestry Services of the Oklahoma Department of Agriculture, Food and Forestry offers this Assessment of Need as the guiding document for Forest Legacy Program (FLP) implementation in Oklahoma.

Enabling Legislation and Authorization

The federal Cooperative Forestry Assistance Act of 1978, as amended (16 U.S.C. 2103c et. seq.), authorizes the U.S. Secretary of Agriculture to provide financial, technical, educational and related assistance to States, communities, and private forest landowners. Section 1217 of Title XII of the Food, Agriculture, Conservation and Trade Act of 1990 (P.L. 101-624:104 stat.3359), also referred to as the 1990 Farm Bill, amended the Cooperative Forestry Assistance Act and allows the Secretary to establish the Forest Legacy Program to protect environmentally important forest areas that are threatened by conversion to non-forest uses. Through the 1996 Farm Bill (Federal Agricultural Improvement and Reform Act of 1996; P.L. 104-127); Title III – Conservation; Subtitle G – Forestry; Section 374, Optional State Grants for Forest Legacy Program), the Secretary is authorized, at the request of a participating state, to award grants for the state to carry out the FLP, including acquisition of lands and interests in lands.

In 2001, Governor Frank Keating designated Oklahoma Forestry Services of the Oklahoma Department of Agriculture, Food & Forestry as the state lead agency to develop and administer the Forest Legacy Program in Oklahoma. The Cooperative Forestry Assistance Act directs the Secretary to establish eligibility criteria for the designation of Forest Legacy Areas, in consultation with the Forest Stewardship Coordinating Committee. These criteria are developed based upon the State lead agency's Assessment of Need for establishing a State Forest Legacy Program.

Background

To participate in the FLP, each state must develop an Assessment of Need, which identifies important forestlands, called Forest Legacy Areas (FLAs), in need of long-term protection and management. The maximum federal contribution for total program costs may not exceed 75 percent. Twenty-five percent of FLP costs may consist of matching funds or in-kind contributions from non-federal sources.

Public Involvement Process

Initially, the Oklahoma Department of Agriculture, Food and Forestry, Forestry Services, the lead agency in the Forest Legacy Program, contracted the Trust for Public Land (TPL) to gather information and develop the Assessment of Need (AON). In order to gather necessary input, TPL sent 117 surveys to stakeholders across the state of Oklahoma asking about various aspects of forest health and what the goals of the Forest Legacy Program should be. Stakeholders included government agencies, tribes, universities, and private landowners, both industrial and non-industrial. At the same time, eight one-on-one meetings and four phone meetings with members of the Forest Stewardship Committee and other professionals were conducted.

The survey asked individuals to rate certain objectives. These objectives included:

- Maintaining traditional forest uses.
- Protecting and enhancing water quality.
- Protecting lands adjacent to waterways and lakes.
- Conserving highly productive soils and soil stability.
- Assisting in forest health.
- Protecting significant cultural resources.
- Conserving lands that provide habitat for unique, threatened, or endangered species.
- Protecting or enhancing fisheries and wildlife habitat.
- Maintaining and enhancing economic contributions to rural communities.
- Preventing fragmentation of ownership on forested land base.
- Maintaining scenic values, including frontage along rural and scenic roads.
- Enhancing existing or potential public recreation values.

In addition, two broad questions were asked to receive a general understanding of what direction the program should take in Oklahoma. These were:

1) What goals and objectives do you feel the Forest Legacy Program in Oklahoma should achieve?
2) What geographic areas do you believe constitute forest resources worthy of protection priority?

Landowner Participation

(Application process, evaluation, selection, acquisition, use of easements, management, eligibility criteria for areas as a whole and for individual properties within those areas)

Interested landowners are key in the development of the Forest Legacy Program. Landowner participation in the program is voluntary and shall consist of two elements:

1) Conveyance of interests in lands to achieve the land conservation objectives of the Forest Legacy Program; and
2) Preparation of a Stewardship Management Plan or multi-resource management plan for protected sites. The management plan must be prepared and approved prior to signing the acquisition of the easement. Future modifications of the plan must be agreed to by the State lead agency. A plan is not needed if the landowner does not retain the right to harvest timber or conduct other land or resource management activities, or if the land is sold in fee.

Landowners may submit to the State lead agency an application for enrollment of interests in their lands in the FLP. All owners of private forests within the designated FLA are eligible to submit an application.

For a landowner to participate in the program, it is not required that their tracts be completely forested. However, priority will generally be given to tracts that are currently forested or are identified to be forested in the landowner Stewardship Management Plan.

Application requirements for landowner participation in the FLP are shown below:

Landowners or their designated representatives may submit their application to the Forestry Division and will be asked to supply information about the property proposed for entry into the program.

Forestry Services, along with the Stewardship Committee, shall cooperatively review the applications and establish State acquisition priorities and continue with landowner consultation. Priority for FLP acquisitions shall be given to lands which can be effectively managed; and which have important scenic or recreational values, riparian areas, timber, fish and wildlife values, including threatened and endangered species, or other ecological values.

The FLP respects the rights of private property holders. Under no circumstance shall the right of eminent domain be used for the unwilling taking of any property rights. Conservation easements or deed reservations acquired or reserved pursuant to the FLP are intended to allow continued forest management activities deemed consistent with Forest Legacy purposes.

Tree City USA and Tree Line USA Program

The Tree City USA and Tree Line USA program, sponsored by the National Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters, provide direction, technical assistance, public attention, and national recognition for urban and community forestry programs in thousands of towns and cities that more than 135 million Americans call home. The many benefits of being a Tree City include creating a framework for action, education, a positive public image, and citizen pride.

Oklahoma Forestry Services supports and endorses the Tree City USA and Tree Line USA program in partnership with the National Arbor Day Foundation. Communities recognized for this annual certification are the leaders in Oklahoma when it comes to conserving, enhancing and protecting the urban and community tree cover across the state.

Incorporated Natural Resource Plans or Projects

- Oklahoma Comprehensive Wildlife Conservation Strategy, 2005 (State Wildlife Action Plan). Ron Suttles, Natural Resources Supervisor. Oklahoma Department of Wildlife Conservation. www.wildlifedepartment.com/CWCS.htm

- Oklahoma Forest Legacy Plan, 2007 (Draft Assessment of Need). Kurt Atkinson, Assistant Director. Oklahoma Forestry Services. www.forestry.ok.gov

- Ecoregional Assessments. The Nature Conservancy, Oklahoma Chapter. http://www.nature.org/wherewework/northamerica/states/oklahoma/about/science.html

- Oklahoma Comprehensive Water Plan, 2009 in development. Oklahoma Water Resources Board. http://environ.okstate.edu/OWRRI/waterplan/

- Southern Forest Futures Project, 2009 in development. USDA Forest Service and Southern Group of State Foresters. http://www.srs.fs.usda.gov/futures/

- Oklahoma Forest Resource Issues 1980 and Program Direction through 1995. John Burwell, State Forester. Oklahoma Department of Agriculture, Forestry Division.

Appendix C: Oklahoma Threatened and Endangered Species Information

This section includes federally listed threatened and endangered species descriptions. Endangered Species with no local account available include: Eskimo Curlew, Scaleshell Mussel, and Winged Mapleleaf Mussel.

- **American alligator (*Alligator mississippiensis*):**

Status: Threatened
Habitat: Alligators inhabit rivers, swamps, estuaries, lakes, and marshes.
Distribution: Alligators are found throughout the southeastern United States, from North Carolina to Texas. Oklahoma represents the northwestern most reaches of their range. The historic distribution in Oklahoma was limited to the Red River and Little River drainages in southeastern Oklahoma. Currently, alligators are considered to be an occasional visitor along the Red River in McCurtain County.
Causes of Decline: Alligators have declined in numbers due to overhunting and destruction of habitat. The young are at high risk from predation and human disturbance.

- **American burying beetle (*Nicrophorus americanus*)**

Status: Endangered
Habitat: Habitat requirements for American burying beetles (ABB), particularly reproductive habitat requirements, are not fully understood at this time. The ABB has been found in various types of habitat including oak-pine forests, open fields, oak-hickory forest, open grasslands, and edge habitat.
Distribution: The historical distribution of the American burying beetle included the eastern half of North America. This range included the eastern half of Oklahoma. At this time, there are only 3 known areas of occurrence. Two of these are in Oklahoma and one is in Rhode Island, but the range includes 8 states, Rhode Island, Massachusetts, South Dakota, Nebraska, Kansas, Arkansas, Texas, and Oklahoma.
Cause of Decline: The cause of decline of this species is not clearly understood. Declines could be a result of habitat fragmentation, habitat loss, carcass limitation, pesticides, disease, light pollution, or a combination of these factors.

- **Arkansas River Shiner (*Notropis girardi)***

Status: Threatened
Habitat: The shiner is native to wide, sandy-bottomed streams of the Arkansas River in Arkansas, Kansas, New Mexico, Oklahoma, and Texas.
Distribution: Historically, it was abundant throughout these portions of the Arkansas River and its tributaries. The shiner is presently almost entirely restricted to the Canadian/South Canadian River in Oklahoma, Texas, and New Mexico, a distance of about 508 river miles. A small, relict population is believed to remain in the upper Cimarron River in Kansas and Oklahoma.
Causes of Decline: The species is threatened by habitat destruction and modification from stream dewatering or depletion due to diversion of surface water and groundwater pumping, construction of impoundments, and water quality

degradation. Other causes include competition with introduced fishes, incidental capture, and drought.

- **Black-capped vireo (*Vireo atricapilla*)**

Status: Endangered
Habitat: Black-capped vireo habitat consists of scattered trees and brushy areas. The presence of oak trees appears to be more important to the vireo than junipers. Foliage that extends to ground level is the most important requirement for nesting. Most nests are between 15 and 50 inches (35-125 cm) above ground level and are screened from view by foliage. Territories are sometimes located on steep slopes, where trees are often clumped and intermediate in height. On level terrain, preferred black-capped vireo habitat is a mixture of shrubs and smaller trees that average from eight to 10 feet high (2.5-3.5 m). Black-capped vireos will no longer use sites where many trees are nearing full size.
Distribution: The historic breeding distribution of the black-capped vireo extended south from south-central Kansas through central Oklahoma and Texas to central Coahuila, Mexico. At present, the range extends from Oklahoma south through the Edwards Plateau and Big Bend National Park, Texas, to at least the Sierra Madera in central Coahuila, Mexico. In Oklahoma, the black-capped vireo is found only in Blaine, Cleveland, and Comanche counties. The winter range of the black-capped vireo is not well known. It is thought to winter along the west coast of Mexico from southern Sonora to Guerrero.
Causes of Decline: The black-capped vireo is threatened by brown-headed cowbird (*Molothrus ater*) nest parasitism, human disturbance, and loss of habitat to urbanization, fire exclusion, grazing, and brush control.

- **Eastern prairie fringed orchid (*Platanthera leucophaea*)**

Status: Threatened
Habitat: The eastern prairie fringed orchid is found in moist to wet tallgrass prairie.
Distribution: A historic record exists for Choctaw County, Oklahoma, but the plant has not been observed in the past 150 years.
Causes of Decline: The major factor in the decline has been a loss of habitat due to grazing, fire suppression, and agricultural conversion.

- **Gray Bat (*Myotis grisescens*)**

Status: Endangered
Habitat: Gray bats almost always roost in caves year-round. Historically, hibernation caves could contain well over a million individuals. Summer colonies can reach 250,000 individuals. Gray bats have very specific cave requirements. As a result, fewer than five percent of available caves are suitable. Winter caves must be very cold with a range in temperature between 42° and 52°F (6-11°C). Winter caves are deep with vertical walls. Summer caves must be warm (57-77°F or 14-25°C) or with restricted rooms that can trap the body heat of roosting bats. Summer caves are located close to rivers or lakes where the bats feed. Bats are known to range at least 12 miles (20 km) from their colony to feed.
Distribution: Gray bat distribution is limited to limestone cave areas of the

southeastern United States. Major populations are found in Alabama, Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations may occur in surrounding states. In Oklahoma, the historic population probably was limited to the limestone region of the northeastern part of the state. At present, this bat is found in only four counties in northeastern Oklahoma - Adair, Cherokee, Delaware, and Ottawa. Gray bats may occur in caves in other counties, but there have been no recent sightings. No hibernation caves are known in Oklahoma.

Causes of Decline: The gray bat is extremely vulnerable to human disturbances at roosting caves. This is especially true at hibernation and maternity caves. The gray bat is also threatened by pesticides, loss of habitat due to flooding by man-made impoundments, commercializing of caves, and improper gating of caves.

- **Indiana bat (*Myotis sodalis*)**

Status: Endangered

Habitat: For hibernation, Indiana bats need limestone caves with stable temperatures of 39º to 46ºF and 66 to 95 percent humidity. Only a small percentage of the caves meet the specific conditions. During the summer, they can be found under tree bark, in hollow trees, under bridges, or in old buildings. Indiana bats forage above small to medium sized streams. Streams lined with large, overhanging trees are preferred.

Distribution: The Indiana bat is found primarily in the Midwestern and eastern United States. Oklahoma is the western limit of its range. The present Oklahoma range includes Adair, Delaware, LeFlore, and Pushmataha counties. It is now rare in Oklahoma and usually only scattered individuals are found. They may be in company with gray bats.

Causes of Decline: Indiana bats are subject to both natural and human threats. Periodic flooding of winter caves and the collapse of cave or mine ceilings both pose threats. However, the most serious threat to Indiana bats is the disturbance of hibernating colonies by spelunkers or vandals. Pesticides, the commercialization of roosting caves and the channelization of streams also pose threats.

- **Interior least tern (*Sterna antillarum*)**

Status: Endangered

Habitat: Interior least terns favor islands or sandbars along large rivers for nesting. The sand must be mostly clear of vegetation to be used by the terns. Least terns prefer shallow water for fishing. Water levels must be low enough so that nests stay dry.

Distribution: The historic distribution of the interior least tern was the major river systems of the Midwestern United States. These rivers included the Red, Rio Grande, Arkansas, Missouri, Ohio, and Mississippi river systems. In Oklahoma, interior least terns nest along larger rivers, as well as at the Salt Plains National Wildlife Refuge near Jet, Oklahoma.

Causes of Decline: Many nesting areas have been permanently flooded by reservoirs and channelization projects. Unpredictable water discharge patterns below dams flood nesting areas. Overgrowth of brush and trees also eliminates remaining habitat. The recreational use of sandbars by humans is a major threat to the tern's reproductive success.

- **Leopard darter (*Percina pantherina*)**

  Status: Threatened

  

  Habitat: Leopard darters are found in intermediate to larger streams. From May to February, leopard darters prefer large, quiet pools with a rubble and boulder substrate. Spawning occurs on gravel substrates.

  Distribution: Historically, the leopard darter was limited to upland, large stream habitats of the Little River drainage in Oklahoma and Arkansas. Currently, scattered populations are found within its historic range. In Oklahoma, it occurs within the Little River drainage in LeFlore, McCurtain, and Pushmataha counties.

  Causes of Decline: Leopard darters have never been common. The greatest threat to the survival of the species is the loss of habitat due to the construction of reservoirs. These impoundments also isolate populations, which further endangers the species. Logging activity like road construction, agricultural and industrial runoff, and gravel removal all pose threats as well.

- **Neosho madtom (*Noturus placidus*)**

  Status: Threatened

  

  Habitat: The preferred habitat of adult Neosho madtoms is shallow riffles with loose, uncompacted gravel bottoms. They are occasionally found in areas with sandy bottoms covered with leaf litter. Young Neosho madtoms may be found in deeper pools, downstream from riffles.

  Distribution: Historically, the Neosho madtom was found in the Neosho, Cottonwood, Spring, and Illinois Rivers in Kansas, Missouri, and Oklahoma. It is believed to be no longer present in the Illinois River and scattered through the rest of its historic range. In Oklahoma, it is present only in Ottawa and Craig counties.

  Causes of Decline: The Neosho madtom has declined due to habitat destruction. Construction of dams, dredging of gravel, and an increase in water demands have contributed to habitat loss. Pollution from cattle feedlot runoff has adversely affected the fish as well.

- **Ouachita rock pocketbook mussel (*Arkansia wheeleri*)**

  Status: Endangered

  

  Habitat: The Ouachita rock pocketbook inhabits pools, backwaters, and side channels of certain rivers and large creeks in or near the southern slope of the Ouachita Uplift. The species occupies stable substrates containing gravel, sand, and other materials. The Ouachita rock pocketbook always occurs within large mussel beds containing a diversity of mussel species.

  Distribution: The historical distribution of the Ouachita rock pocketbook included the Kiamichi River in southeastern Oklahoma, the Little River in southwestern Arkansas, and the Ouachita River in central Arkansas. Recent surveys have found it surviving in a small section of the Little River in Oklahoma, at one locality in the Ouachita River in Arkansas, and within an 88-mile (141 km) section of the Kiamichi River upstream from Hugo Reservoir. Other recent evidence of the species includes single shells

recovered from Pine and Sanders Creeks in Texas.
Causes of Decline: The range of the Ouachita rock pocketbook has been reduced due to the construction and operation of dams and by decreases in water quality. These and other factors pose continuing threats to the species.

- **Ozark Big-eared bat (*Corynorhinus [=Plecotus] townsendii ingens*)**

Status: Endangered
Habitat: Caves used by Ozark big-eared bats are located in karst regions dominated by oak-hickory forests. The temperature of hibernation caves ranges from 40° to 50°F (4-9°C). Maternity colonies are located in caves that range in temperature between 50° and 59°F (10-15°C). Ozark big-eared bats forage along forest edges.
Distribution: The distribution of the Ozark big-eared bat was probably limited to northwestern Arkansas, neighboring Oklahoma and Missouri. In Oklahoma, this subspecies is known to occur in Adair, Cherokee, Delaware, and Ottawa counties. There is a historical record for Sequoyah County.
Causes of Decline: The Ozark big-eared bat was probably never very common. The species is intolerant of human disturbance, which causes them to abandon favorite roosts. Disturbance of hibernating bats causes them to use valuable fat stores and increases the probability of starvation during the winter. Disturbance of maternity colonies can cause significant mortality of the young.

- **Ozark cavefish (*Amblyopsis rosae*)**

Status: Threatened
Habitat: Caves which have populations of the Ozark cavefish all have a relatively large source of nutrients, such as bat guano or blown leaf litter. Water quality in caves that contain cavefish is usually high. Ozark cavefish are able to tolerate the extremely low oxygen content of ground water found in caves. Cavefish tend to occur in flowing cave streams as opposed to quiet pools.
Distribution: The Ozark cavefish is native to the Springfield Plateau of the Ozark Highlands (southwestern Missouri, northwestern Arkansas, and northeastern Oklahoma). Currently, 15 caves in this area have verified cavefish populations. In Oklahoma, populations are known to occur in Delaware County. There are historical records for Ottawa and Mayes counties.
Causes of Decline: Factors that have led to the decline of the Ozark cavefish include destruction of habitat, collecting of specimens, and disturbance by spelunkers.

- **Piping plover (*Charadrius melodus*)**

  Status: Threatened (Endangered in the watershed of the Great Lakes.)
  Habitat: Piping plovers nest on sandy beaches along the ocean or lakes. Along rivers, piping plovers use the bare areas of islands or sandbars. They also nest on the pebbly mud of interior alkali lakes and ponds. Birds nesting on gravel have higher reproductive success than those nesting on alkali. During the winter, piping plovers use algal, mud, and sand flats along the Gulf Coast. Spoil islands in the intracoastal waterway are also used.

  Distribution: Historically, piping plovers bred along the Atlantic Coast, on the Northern Great Plains, and around the Great Lakes. Piping plovers winter along the southern Atlantic and Gulf coasts, and in the Bahamas and West Indies. Although drastically reduced, remnant populations occur throughout their historic range. Piping plovers migrate through Oklahoma each spring and fall.
  Causes of Decline: Piping plovers have been drastically reduced in number, due to the loss of beach habitat and to the modification of habitat through the channelization and damming of rivers. These practices eliminate sandbars and allow the growth of vegetation on nesting areas. Nesting success of piping plovers on beaches used by humans is much lower than on isolated beaches, because of disturbance.

- **Red-cockaded woodpecker (*Picoides borealis*)**

  Status: Endangered
  Habitat: Red-cockaded woodpeckers live in old-growth (60-70+ years) loblolly, shortleaf, and especially slash and longleaf pine forests. Nesting and roosting cavities are generally made only in living pine trees over 60 years old. These trees produce large amounts of resin around the woodpeckers' cavities. The resin is thought to discourage potential predators, such as the black rat snake, from climbing the tree and attacking the woodpeckers. Ideal colony sites are located in parklike stands of pines with little or no understory growth. Foraging habitat of the woodpecker includes extensive pine or pine-hardwood forests. Fire plays an important part in maintaining red-cockaded woodpecker habitat by eliminating hardwood undergrowth.

  Distribution: The historic distribution of the red-cockaded woodpecker included the southeastern United States. They ranged from Florida north to Virginia and west to eastern Texas and Oklahoma. In Oklahoma, they were restricted to the shortleaf pine area of southeastern Oklahoma. The red-cockaded woodpecker once occupied Bryan, Latimer, LeFlore, McCurtain, Pittsburg, and Pushmataha counties. The current distribution in Oklahoma includes only a limited area of McCurtain and Pushmataha counties. The Pushmataha colony was inactive in 1992.
  Causes of Decline: Red-cockaded woodpeckers have declined primarily due to the loss of suitable habitat. Short-term-rotation timber management of private and public forests has eliminated much of the old-growth pine forest necessary to maintain healthy woodpecker populations.

- **Whooping Crane (*Grus Americana*)**

  Status: Endangered

  

  Habitat: Whooping cranes inhabit marshes and prairie potholes in the summer. In winter, they are found in coastal marshes and prairies.

  Distribution: Historically, whooping cranes were found from the Northwest Territories in Canada through the prairie provinces and northern prairie states to Illinois. The whooping crane formerly wintered in the Carolinas, along the Texas Gulf Coast, and on the intermountain plateau of central Mexico. Currently, an experimental population summers in Idaho and winters in New Mexico. The main population breeds in northern Canada and winters along the Texas Gulf Coast. It passes through western Oklahoma each spring and fall during migration. The Salt Plains National Wildlife Refuge, near Jet, Oklahoma, is a very important migration stopover area. During migration, whooping cranes sometimes are sighted elsewhere in Oklahoma along rivers, in grain fields, or in shallow wetlands.

  Causes of Decline: Whooping cranes have declined primarily because of loss of wintering and breeding habitat. Shootings and collisions with powerlines or fences have been sources of mortality in recent years.

- **Western prairie fringed orchid (*Platanthera praeclara*)**

  Status: Threatened

  

  Habitat: The western prairie fringed orchid is a plant of the tallgrass prairie and requires direct sunlight for growth. It is most often found in moist habitats or sedge meadows. Western prairie fringed orchids have persisted in areas that have been lightly grazed, periodically burned, or regularly mowed. It is not yet understood how these activities affect plant survival. It may be that removal of dead grass mulch is beneficial, but heavy grazing is detrimental.

  Distribution: Historically, the western prairie fringed orchid was found in tallgrass prairies west of the Mississippi River. It occurred from extreme southern Canada south to northeast Oklahoma. In Oklahoma, historical records (1975) exist for Craig and Rogers Counties. Currently, extant populations of the orchid are found in Iowa, Kansas, Minnesota, Missouri, Nebraska, and North Dakota.

  Causes of Decline: The major factor contributing to the decline of the western prairie fringed orchid has been the conversion of native prairie to croplands. Fire suppression, overgrazing, and habitat fragmentation also have contributed to the decline of the species.

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Appendix E: Oklahoma Forest Resource Assessment – GIS Methodology

Map Models and Descriptions

The 2010 Oklahoma Forest Resource Assessment (OFRA) needed a method of objectively quantifying priority forestland areas. To accomplish this task, it was decided that the models used in the OFRA would be additive in nature: quantifiable variables pertaining to each issue would be overlapped; the areas with more overlapping variables would receive a higher issue priority. Within each model, a single variable was represented by a 30 meter resolution raster image covering the state, with cells containing a value from 0 to 2, depending on variable presence in that cell. Once added together, the resulting sum of variables produced a state-wide raster image that then needed to be divided into priority levels of high, medium, or low.

Instead of following the SFLA's priority classification methodology, it was decided that using Quantiles (unless inapplicable) would be a more accurate method of determining OFRA's high, medium, and low categories. Areas which received the 'high' priority ranking had the highest summation of variable values, 'low' priority areas had the least summation of said values, while 'medium' priority areas had variable summations falling in between the previous two.

The 'Forestland Filter,' found in some models, is a raster that, when added to a statewide raster, limits output values to known forest areas without altering the values found in those areas.

Forest Sustainability and Health Issue Map

The Forest Sustainability and Health Issue model was created from 12 raster variable layers, all of which are assigned a value of 2 where the variable occurs, unless otherwise specified. Layers used were as follows: riparian areas (denoted by alluvial soils), the [future] development level raster that emphasizes lower population density (rural) with a value of 2, areas of recorded wildfire presence, rural forestland, urban canopy cover (where cover is greater than 30%), forest patches (over 500 acres), proximity to public lands (within one half mile, raster =2, up to one mile, raster =1), forested wetlands (same as in the SFLA), site productivity (data only available for eastern part of state; for productivity values less than 50, raster =0, 50-70=1, and >70=2), public drinking water sources (delineated by Level 12 watersheds), threatened and endangered species, and the Forest Industry layer (a raster that shows a general mill reach buffer around primary timber mills based on mill size; value within each buffer set to 2). The quantile breakdown of priority classes occurred at values 4, 8, and 22, for low, medium, and high priorities, respectively.

Figure 22: *Forest Sustainability and Health Priority Forestlands Analysis Model*

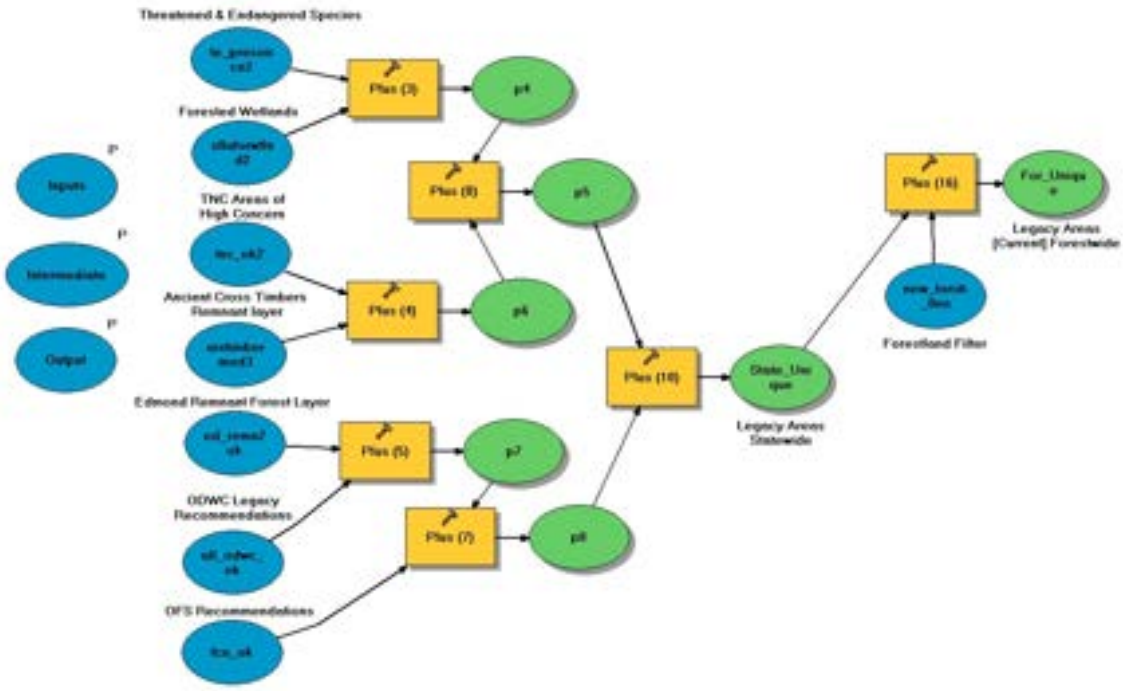
Forest Legacy Areas Map

The delineation of Forest Legacy areas followed a two phase methodology: first, a model was created to highlight priority areas; second, Level 12 watersheds containing areas of high priority were selected and merged to form areas of common factors (resulting in the seventeen Forest Legacy Areas depicted in the OFRA).

The legacy areas model was created using the following rasters (each containing a value of 2, where variable was found present): threatened and endangered species, forested wetlands (a layer taken from the SFLA), The Nature Conservancy's areas of high concern, the ancient cross timbers remnant layer (a model output produced by Dr. Krista Peppers, in 1994), Edmond's old growth remnant forest layer, the Oklahoma Department of Wildlife Conservation's areas recommended for legacy status, and a layer depicting the recommendations of Oklahoma Forestry Service personnel. Quantile breaks occurred at 0, 2, and 12.

On top of this statewide legacy model output, the Level 12 HUC (watersheds) layer was overlain. Areas considered of high priority were isolated, the containing watersheds selected, and those watersheds merged together to form the seventeen Forest Legacy Areas depicted on the OFLA map of the same name.

Figure 23: *Forest Legacy Areas Analysis Model*



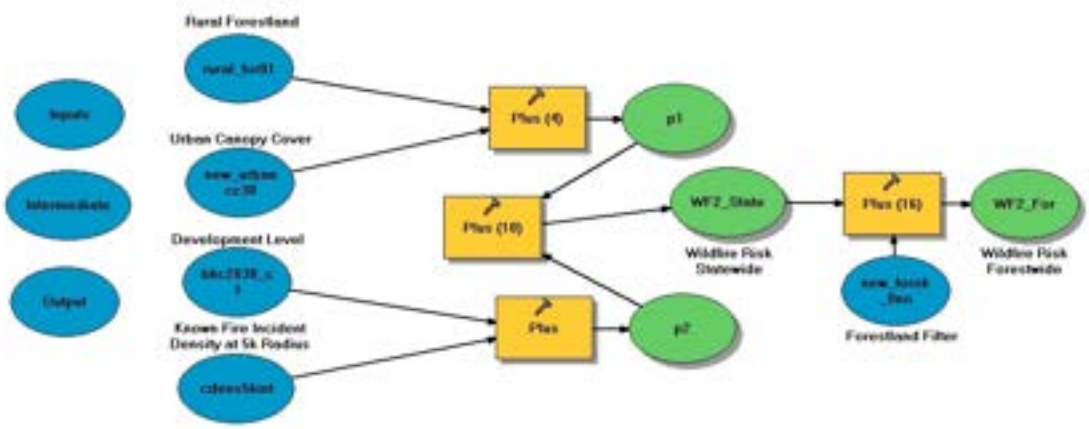
Wildfire Risks to the Forest Resource Map

The Wildfire Risk to the Forest Resource model was difficult to simulate due to the lack of up-to-date wildfire occurrence data for the State of Oklahoma. Layers used in this model were four: rural forestland, urban canopy cover, the [future] development level raster (reclassified in such a way that the bhc2030_30ok2 dataset's Theobald classes are given the following raster values: 0-7 is 0; 8-11 is 1; 12-15 is 2), and a density map of known fire occurrence.

The fire occurrence density layer used recent Fire Family Plus fire occurrence points and known fire occurrence boundaries collected by OFS personnel in 2009; a density analysis was run on fire occurrence centroids, wherein 5 kilometers was used as the search radius. The output density file was then converted to raster (decimals were removed) to produce a raster layer containing values 1 through 5, the number of fires per square mile, for each 30 meter cell.

Output from the wildfire risk model was categorized by quantile: low, medium, and high priorities were divided at breaks of 0, 1, and 7, respectively. As this output was used as one of the input layers in the Stewardship Potential model, each category was reclassed to 0, 1, and 2 values (ascending value corresponds to ascending priority), and the new raster saved as gorg_wildfire.

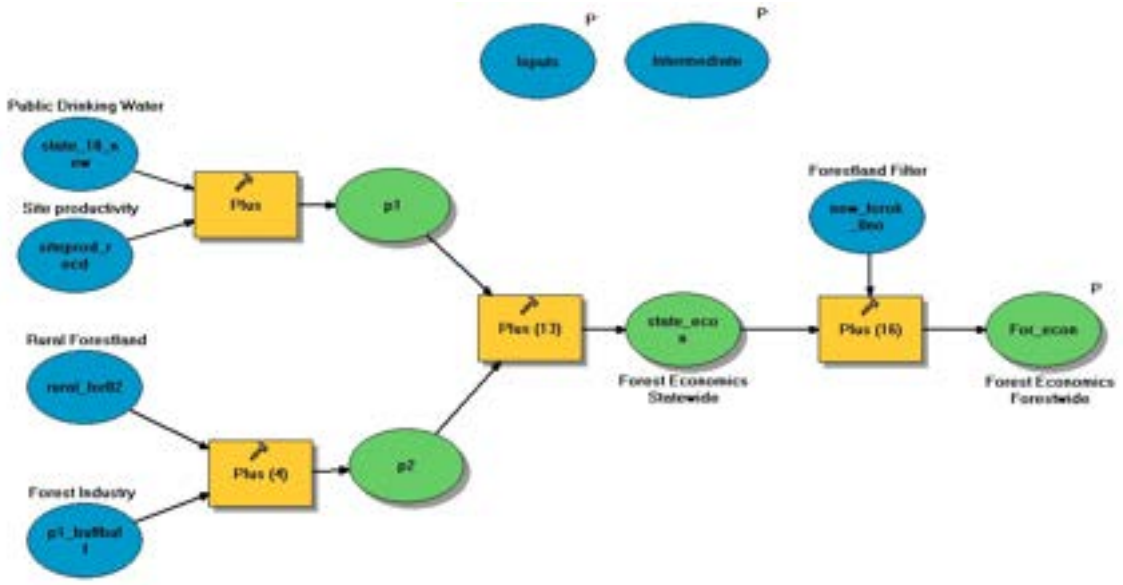
Figure 24: *Wildfire Risks to the Forest Resource Priority Lands Analysis Model*



Forest Economics and Markets Map

The Forest Economics and Markets was modeled using rasters representing public drinking water sources (delineated by Level 12 watersheds; presence of drinking water source given a value of 2), site productivity (data only available for eastern part of state; for productivity values less than 50, raster =0, 50-70=1, and >70=2), the rural forestland layer of value 2, and the Forest Industry layer (a raster that shows a general mill reach buffer around primary timber mills based on mill size; value within each buffer set to 2). The breaks for low, medium, and high priorities were 2, 4, and 8, respectively.

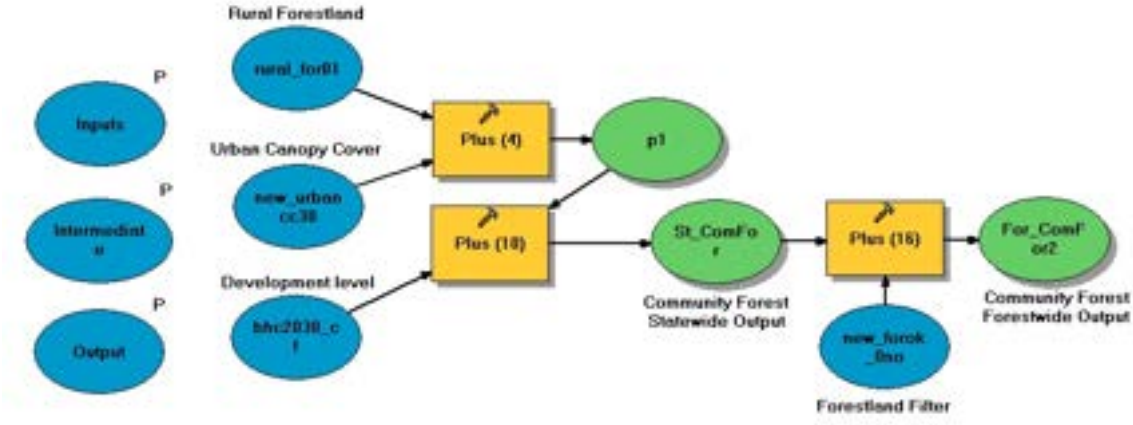
Figure 25: *Forest Economics and Markets Priority Forestlands Analysis Model*



Community Forest Health and Care Map

The Community Forest Health and Care model utilized the rural forestland layer of value 1 (using a rural forestland layer of value 2 unfairly emphasizes forestland in non-community areas, skewing the quantile breakdown of priority), the urban canopy cover raster, and the [future] development level raster that emphasizes higher population density with a higher value. In finding the priority divisions of the result of this particular model, 'low priority' was set to the value of 1 (this being the value given to the rural forestland layer), values 2 through 5 were then divided into two quantiles providing priority breaks at 1, 2, and 5 (low, medium, and high, respectively).

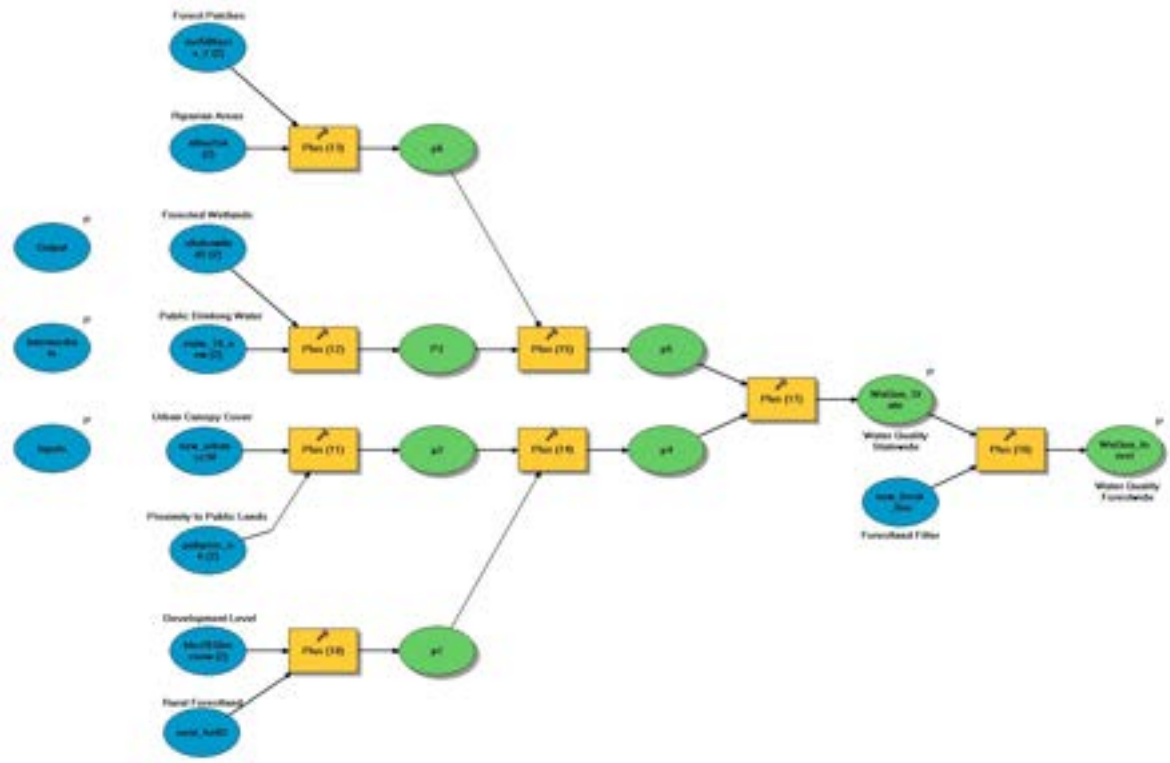
Figure 26: *Community Forest Health and Care Priority Forestlands Analysis Model*



Water Quality and Availability Issue Map

The eight variables related to Water Quality and Availability each used a value of 2 to show where each variable was present, unless otherwise specified. The layers used were as follows: forest patches (over 500 acres), riparian areas (denoted by alluvial soils), forested wetlands (same as in the SFLA), public drinking water sources (delineated by Level 12 watersheds), urban canopy cover (where cover is greater than 30%), proximity to public lands (within one half mile, raster =2, up to one mile, raster =1), the [future] development level raster that emphasizes lower population density (rural) with a value of 2, and rural forestland. The quantile breakdown of priority classes occurred at values 2, 4, and 14, for low, medium, and high priorities, respectively.

Figure 27: *Water Quality and Availability Priority Forestlands Analysis Model*



Stewardship Potential Map

The Stewardship Potential model was by far the largest created, utilizing 14 raster variable layers, all of which are assigned a value of 2 where the variable occurs, unless otherwise specified. Layers used were as follows: riparian areas (denoted by alluvial soils), the ancient cross timbers remnant layer (a model output produced by Dr. Krista Peppers, in 1994), Edmond's old growth remnant forest layer, the [future] development level raster that emphasizes lower population density (rural) with a value of 2, wildfire risk (the classified output from the statewide wildfire risk model, the *gorg_wildfire* layer contains values of 0, 1, and 2 (from low, medium, and high priority categories, respectively)), urban canopy cover (where cover is greater than 30%), rural forestland, forest patches (over 500 acres), proximity to public lands (within one half mile, raster =2, up to one mile, raster =1), forested wetlands (same as in the SFLA), site productivity (data only available for eastern part of state; for productivity values less than 50, raster =0, 50-70=1, and >70=2), public drinking water sources (delineated by Level 12 watersheds), threatened and endangered species, and The Nature Conservancy's areas of high concern.

The output of the above summation needed masking of water, urban areas, and federal lands, for in these areas, traditional forestry has little role (or no jurisdiction). A shapefile of waters in Oklahoma was retrieved from the Natural Resources Conservation Service (NRCS), and the larger wet areas were turned into a mask (raster value 0) for these areas. Similarly, a mask was created for federal lands. For urban areas, a simple delineation by municipal boundaries would neither be precise nor accurate in Oklahoma, due to the inclusion of lands within city limits anyone would refer to as 'rural,' and the quadruped residents would agree. Here, an NLCD-derived raster of percent impervious surfaces produced by the Multi-Resolution Land Characteristics (MRLC) Consortium (file IS64166387) was used; raster cells considered to contain over 30% impervious surface were reclassified to urban, and thus, became the OFRA's urban mask layer. The Statewide Stewardship model output was multiplied by the urban mask, that output multiplied by the water mask, and that layer multiplied by the federal land mask; each mask removing its subject matter from each intermediate stewardship map. The final output is the one shown in the Stewardship Potential map, and the acreage totals shown on that map reflect the masking process described here.

Figure 28: *Analysis Model for Masking Process of Urban, Water and Federal Lands*

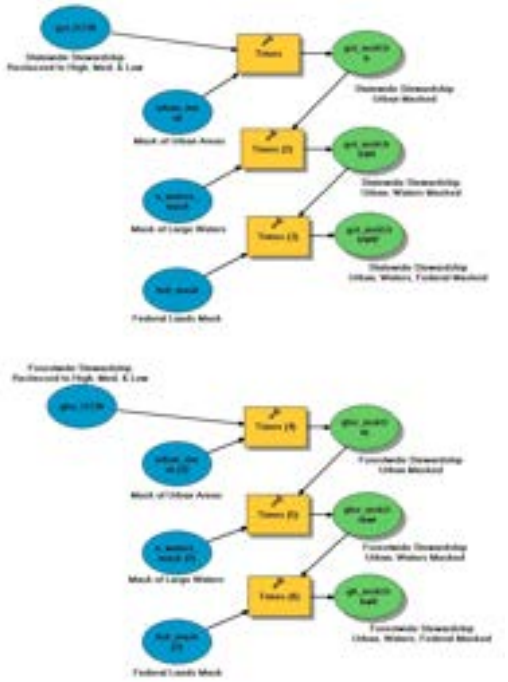
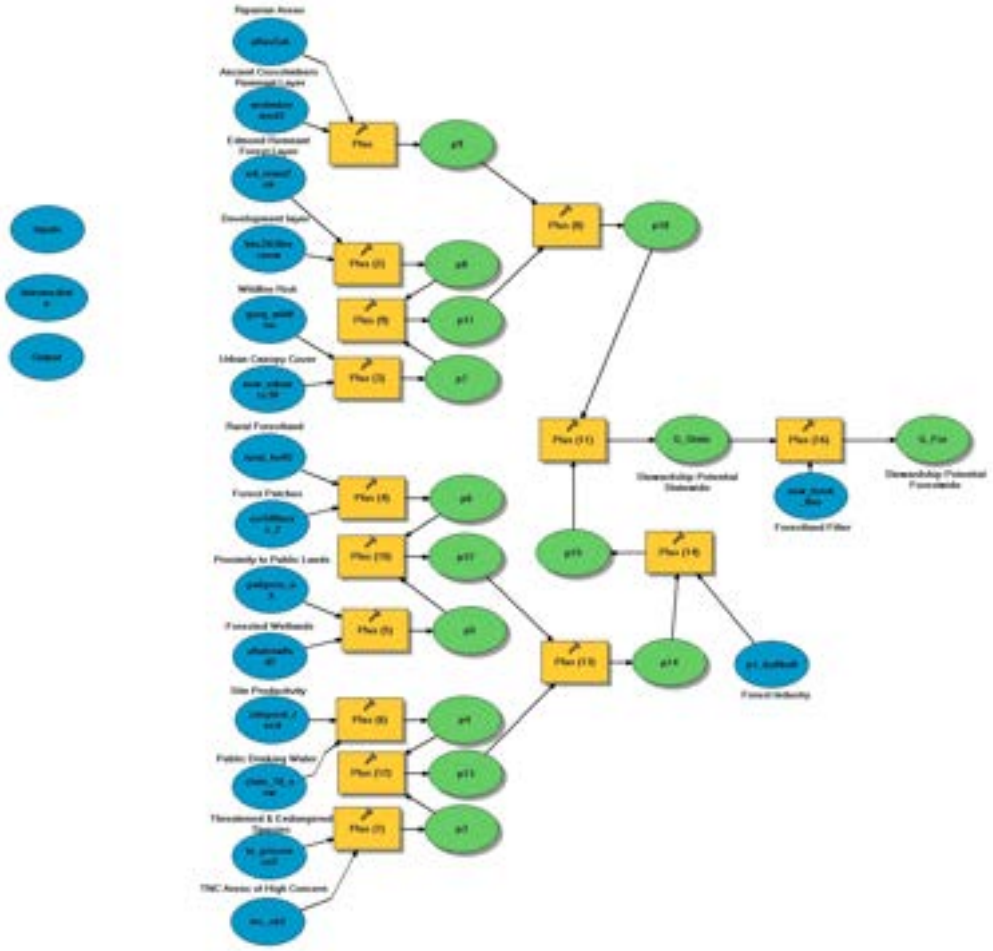


Figure 29: *Forest Stewardship Priority Lands Analysis Model*



Appendix F: Coordination with Stakeholders

Letters and announcements were sent out to personnel from each organization on the stakeholder list below. Many of the stakeholders participated in meetings and provided input throughout the development of this assessment.

- December 2008: Informative letter sent out to stakeholder list on Oklahoma Forest Resource Assessment and Strategy.
- January 15, 2009: Forest Advisory Meeting (stewardship committee)
- February 3, 2010: Press Release to announce survey on website
- February 2009: Electronic card emailed to stakeholder list to inform about assessment
- February 2009: Summary of Oklahoma Comprehensive Wildlife Conservation Strategy received.
- March 2009: Survey opened to interested stakeholders and public (Over 200 surveys received from stakeholders and public on statewide issues)
- May – July 2009: Issue Working Group Meetings (Several people from the Stewardship and State Technical Committee were participants in one or more of Issue Working Groups).
- December 28, 2009: Information received from ODWC – Forest Legacy Areas
- September 21, 2009: Press Release and ODAFF Newsletter (Agri Roundup) article
- November 23, 2009: Follow up letter sent to stakeholder list
- March 10, 2010: Follow up email sent out to stakeholder list and survey open to public for comments of draft assessment document
- March 23, 2010: Press release to announce Draft Assessment on website
- March 24, 2010: Edits and Review with NRCS – Resource Conservationist
- April 12, 2010: Follow-up email sent to State Technical Committee

Stakeholder List Includes:

Oklahoma Forest Advisory Committee (Stewardship Coordinating Committee): USDA Forest Service – Ouachita National Forest, USDA Natural Resources Conservation Service, USDA Farm Services, USDOI – Fish and Wildlife Service, USDOI – National Park Service, Oklahoma Department of Wildlife Conservation, Oklahoma Department of Tourism and Recreation – State Parks Division, Oklahoma Conservation Commission, Oklahoma Association of Conservation Districts, Noble Foundation – Wildlife Society, The Nature Conservancy – Oklahoma Chapter, Oklahoma State University – Natural Resource Ecology and Management, Oklahoma State University – Extension, Langston University, Oklahoma Forestry Association, The Campbell Timberlands Group, International Paper, Bureau of Indian Affairs, Oklahoma Department of Agriculture, Food and Forestry, Oklahoma Urban and Community Forestry Council, Large and Small Landowners, Oklahoma Forestry Services, Oklahoma Forest Industry, Consulting Foresters,

State Technical Committee: Farm Service Agency, Oklahoma Conservation Commission, OPC, U.S. Environmental Protection Agency, Land Legacy, Oklahoma Farm Bureau, Oklahoma Wheat Growers, American Farmer and Ranchers, Tulsa Metropolitan Authority, Oklahoma Grazing Lands, Oklahoma Department of Wildlife Conservation, U.S. Fish and Wildlife Service, Noble Foundation, Cherokee Nation, Oklahoma State University, Oklahoma Forestry Services, Vance Air Force Base, USDA APHIS – Wildlife Services, Oklahoma Office of the Secretary of the Environment, Playa Lakes Joint Venture, Natural Resources Conservation Service

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