



Forest Action Plan

Kansas Forest Service
2020



Acknowledgements

The Kansas Forest Service extends special thanks to Mark Stadtlander, K-State Research and Extension, Department of Communications and Agricultural Education, for his dedication to the mission of the Kansas Forest Service and his editorial expertise necessary to complete the 10-year revision.

Thanks to Karen Woodrich, State Conservationist, NRCS, and her staff for hosting the Kansas Technical Committee meeting that allowed so many critical partners to review and provide input on the plan. Thanks also to the Kansas Forestry Association Board, which also serves as the State Forest Stewardship Coordinating Committee for their review and input on the document.

Thanks to Kansas Forest Service staff who identified issues, weighted data layers, provided authorship, photos, and review of the plan.

Finally, thanks to the National Association of State Foresters and the USDA Forest Service for the critical partnership that enables the Kansas Forest Service to carry out its mission.

First printing, June 2010
Five-Year Revision, September 2015
Ten-Year Revision, June 2020



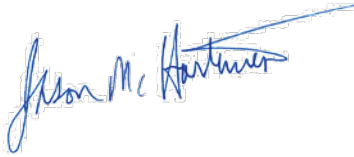
July 2020

Management of the forest and wildland fire resources of Kansas has a long and rich history. The staff of the Kansas Forest Service takes pride in our history while looking to our future with great anticipation. The pages of this, our Forest Action Plan, will be the basis to help guide and shape that future to make sure we guide the resources we are trusted with to their greatest benefit of the citizens of Kansas.

I want to thank the efforts of the staff, partners, and stakeholders in developing and being committed to continuous improvement of this Forest Action Plan.

These pages are an update to our original forest resource assessment and plan completed in 2010 and updated in 2015. New information, resources, and data are constantly becoming available, so this has and will continue to be a living document.

Our intent is to provide the reader an overview of Kansas forest resources, the issues these resources face and provide strategic guidance for focusing private, state and federal resources to the areas of the State of Kansas where they will be most effective.



Jason Hartman
State Forester



Contents

Chapter 1 — INTRODUCTION	1
1.1 Kansas' Approach and Timeline	1
1.2 The Geography of Kansas	3
1.3 Climate	6
1.4 Population	6
Chapter 2 — KANSAS FORESTS AND RELATED RESOURCES	11
2.1 Rural Forests	11
2.2 Agroforestry	15
2.3 Community and Rural Forested Landscapes	16
2.4 Climate Change Effects on Kansas Forests	19
Chapter 3 — ASSESSMENTS AND STRATEGIES	23
3.1 Forest Resource Threats	23
3.2 Forest Resource Benefits and Services	37
3.3 Summary of Kansas Forest Action Plan	49
3.4 Multi-State/Regional Issues and Priority Areas	51
Chapter 4 — KANSAS FOREST LEGACY PROGRAM	59
4.1 Forest Legacy Program Responsibility	59
4.2 Kansas Forest Legacy State Priority Area Map	62
REFERENCES and ADDITIONAL INFORMATION	73
ACRONYM GLOSSARY	77
APPENDIX A — FINAL GUIDANCE NATIONAL THEMES AND OBJECTIVES	79
APPENDIX B — COORDINATION AND STAKEHOLDER/PUBLIC INVOLVEMENT	89
APPENDIX C — INPUT DATA LAYERS	107
APPENDIX D — NATIONAL PRIORITIES, OBJECTIVES, STRATEGIES, AND PLAN IMPLEMENTATION	121
APPENDIX E — KANSAS LAND TRUSTS	139
APPENDIX F — FOREST LEGACY LEAD AGENCY DESIGNATION LETTER AND FOREST PLANNING AT BALDWIN WOODS	143
APPENDIX G — COMMUNITY WILDFIRE PROTECTION PLANS-COUNTY MAP	149
APPENDIX H — CONSERVATION EASEMENT STEWARDSHIP POLICY DISCUSSION GUIDE	153

INTRODUCTION

As part of the 2008 Farm Bill and as an integral component of the USDA Forest Service State and Private Forestry (S&PF) Redesign, each state was required to conduct a statewide assessment of forest resource conditions, threats, and priorities to be eligible to receive funds under the Cooperative Forestry Assistant Act (CFAA). The first Kansas Forest Action Plan was published in 2010 and updated in 2015. This edition represents a full revision of the original plan and was presented to the USDA Forest Service for approval in June 2020. Increased pressures on the health of the nation's forest resources from pests, diseases, and nonnative species, as well as a rapid increase in the conversion of forestlands to nonforest uses, have required a new approach for identifying areas most at risk. This new approach prioritizes and allocates funds and resources that produce the highest returns with respect to the ecological, social, and economic benefits derived from our nation's forests and Kansas forest resources.

To achieve this goal, Kansas has analyzed the condition and trends of its forest resources to identify priority areas where the Kansas Forest Service will focus its efforts. This plan provides long-term, comprehensive strategies for directing resources to address threats and opportunities within priority landscape areas. Annual reports are provided to the USDA Forest Service, Rocky Mountain Region 2, State and Private Forestry, to document the effectiveness of program funding to address the issues in the Kansas Forest Action Plan.



The suppression of wildland fire and the use of prescribed fire as a natural resource management tool are critical components of the Kansas Forest Action Plan

Direction and procedures for the Kansas Forest Action Plan originated from the Redesign Implementation Council¹ and the 2008 Farm Bill. The final guidance (Appendix A), includes three national themes with 11 underlying objectives and language requiring, at a minimum: analysis of present and future forest conditions, trends, and threats; identification of priority landscape areas; identification of multi-state/regional issues; proposal of resource allocation; and the creation of a timeline for project and program implementation.

The Kansas approach has combined the results of assessment and strategy into one document, which includes the Assessment of Needs required by the Forest Legacy Program².

1.1 Kansas' Approach and Timeline

1.1.1 Procedures, Stakeholders, and Public Involvement

Initial efforts on a full revision of the Kansas Forest Action Plan focused on updating and collecting data that best characterized the forest resources in Kansas as it pertained to the three national themes and 11 objectives as outlined in *Farm Bill Requirements & Redesign Components: State Assessments & Resource Strategies* (Appendix A). Data collection and evaluation continued throughout much of the spring and summer of 2019 (Table 1.1). Data sets were evaluated and, if necessary, combined with other data sets to better represent the goals of each of the 11 objectives. Oversight in the data evaluation and selection process was provided by the Rural Forestry Program Coordinator, the Community Forest Coordinator, the Fire Management Coordinator, the Forest Health Coordinator, and the State Forester.

Upon completion of the data collection period, these data sets were presented to the staff of the Kansas Forest Service for further input and evaluation. Staff were then asked to rank the data sets with respect to their value in assessing forest resources within the state. This initial set of weights was incorporated into the first draft statewide resource assessment analysis that

- ¹ *This committee has representatives from NASF and USDA Forest Service SP&F. Their purpose was to create the final guidance for statewide assessment strategy.*
- ² *For more information about the Forest Legacy Program, see <http://www.fs.fed.us/spfcoop/programs/loa/flp.shtml>*

was subsequently presented to the Kansas Technical Committee, State Forest Stewardship Coordinating Committee, and invited partners in late October 2019 (minutes from this meeting are provided in Appendix B). Input received at this meeting, as well as several additional data sets that had been obtained in the interim, was then incorporated into a second draft statewide resource assessment, which was reviewed internally at a Kansas Forest Service staff meeting in late December 2019. This initial set of weights were incorporated into the first draft statewide resource assessment analysis.

The public and stakeholder participation process began in July 2019 in preparation for the Kansas Technical Committee and State Forest Stewardship Coordinating Committee meeting in October where the first draft was presented and public input received. A draft was also posted on the web at the Kansas Forest Service homepage³. Public comment was then solicited through radio, news releases, newsletters, and a public survey on the Qualtrics platform on the web.

In preparation for the October meeting, copies of the draft were provided to all members of Kansas Technical Committee, which represents more than 70 different stakeholder groups including the state wildlife agency, tribes, and federal land management agencies. The State Forest Stewardship Coordinating Committee also was provided copies of the draft as were representatives of the stakeholders in the Fire Management and Urban and Community Forestry Programs.

A December meeting of Kansas Forest Service staff provided an opportunity to have staff re-weight data inputs. These final weights were then included in what would become the final draft of the statewide resource assessment map and associated priority areas.

The December 2019 meeting also represented a significant shift in the structure of the resource assessment and associated strategy. The Kansas Forest Action Plan is divided into two primary focus areas (Forest Resource Threats and Forest Resource Benefits) and seven issues (Table 1.2).

Input was solicited from stakeholders through May 2020 and a final document submitted to the USDA Rocky Mountain Regional Forester for approval and on to the Deputy Chief of State and Private Forestry for approval on behalf of the Secretary of Agriculture.

³ <http://www.kansasforests.org/>

Table 1.1. Kansas Forest Action Plan Time Line.

Discussion of approach	Jan-Feb 2019
Initial presentation to Kansas Forest Service staff	Feb 2019
Data collection, updating, and evaluation	Feb-Aug 2019
Data weighting and initial draft Assessment Map	Apr-Jun 2019
Presentation of initial draft to Kansas Technical Committee and State Forest Stewardship Coordinating Committee	April 2020
Presentation of second draft to Kansas Forest Service staff (reweighting)	May 2020
Posting and review of final report draft	July 2020
Final report due to Secretary of Agriculture (USDA)	Aug 2020

Table 1.2. Major Kansas Forest Resource Issues.

Threats	Benefits
<ul style="list-style-type: none"> • Wildfire risk • Issues that threaten Kansas forest health • Loss of Kansas forestland 	<ul style="list-style-type: none"> • Sustaining water quality and quantity • Protecting and restoring forest biodiversity and wildlife habitat • Sustaining and protecting forest and agroforestry ecosystems • Maintaining and protecting the economic benefits of woodlands

1.1.2 The Structure of the Kansas Forest Action Plan

The organizing structure presented in Table 1.2 provides the general structure to this report. A brief introduction to the geography of Kansas (Section 1.2) is followed by a more in-depth discussion of the composition and spatial distribution of forest resources within Kansas, including a look at the current conditions, trends and future conditions of forest resources (Chapter 2). Chapter 3 addresses the seven major forest resource issues identified through public input. These issues are categorized as threats or benefits to Kansas forest resources. The chapter introduces each issue, the data incorporated into the GIS analysis, and strategies to address the issues. It also includes the final methodology; delineation of priority resource areas; and multi-state or regional issues and areas. Chapter 4 defines and describes priority areas for protection with an assessment of needs required by the Forest Legacy Program.⁴

⁴ *The Forestry Legacy Program is a USDA Forest Service program that uses conservation easements to protect privately owned, at-risk forestlands from development.*

1.2 The Geography of Kansas

1.2.1 Ecoregions

From the western reaches of the Eastern Deciduous Forest, through the tallgrass prairies of the Flint Hills, across the central Great Plains to the open High Plains of western Kansas, the state of Kansas (Figure 1.1) represents several ecoregions (Figure 1.2). Grasslands, cropland, or livestock based agriculture dominate its land cover (Figure 1.3).

The eastern third of the state is dominated by regions either historically or currently under tallgrass prairie, or a mosaic of tallgrass prairie and either oak-hickory or oak-savanna. The most prominent is the Flint Hills — the largest remaining intact tallgrass prairie in North America. This ecosystem meets its western limit on the Great Plains. The eastern third of the state receives ample precipitation and cropland is most prominent along river valleys and glaciated plains where soils are fertile and rich. The expansive grassland in this region also provides forage and seasonal pasture for livestock. To the west, shortgrass prairies are the prominent natural vegetative cover, however, rainfed and irrigated agriculture play an increasing role, and in some areas dominate the landscape, especially in the wheat-growing regions of the central Great

Plains. These western ecoregions contain little to no natural woodland. Where natural woodlands occur, they tend to be in narrow riparian areas, where there is sufficient moisture to sustain trees.

The following Level III ecoregion descriptions are provided by the United States Environmental Protection Agency (Chapman et al., 2001) and based on the original map compilation by Omernik (1987). The numbers in parentheses in the following descriptions refer to their EPA Ecoregions (Figure 1.2).

Western Corn Belt Plains (47)

Once covered with tallgrass prairie, more than 90% of the Western Corn Belt Plains ecoregion is now used for cropland agriculture and much of the remainder is in forage for livestock. A combination of nearly level to gently rolling glaciated till plains and hilly loess plains; ample precipitation, mainly in the growing season; and fertile, warm, moist soils make this one of the most productive corn and soybean regions in the world. Agricultural practices have contributed to environmental concerns, including surface and groundwater contamination from soil erosion, fertilizer and pesticide applications, as well as livestock concentrations.

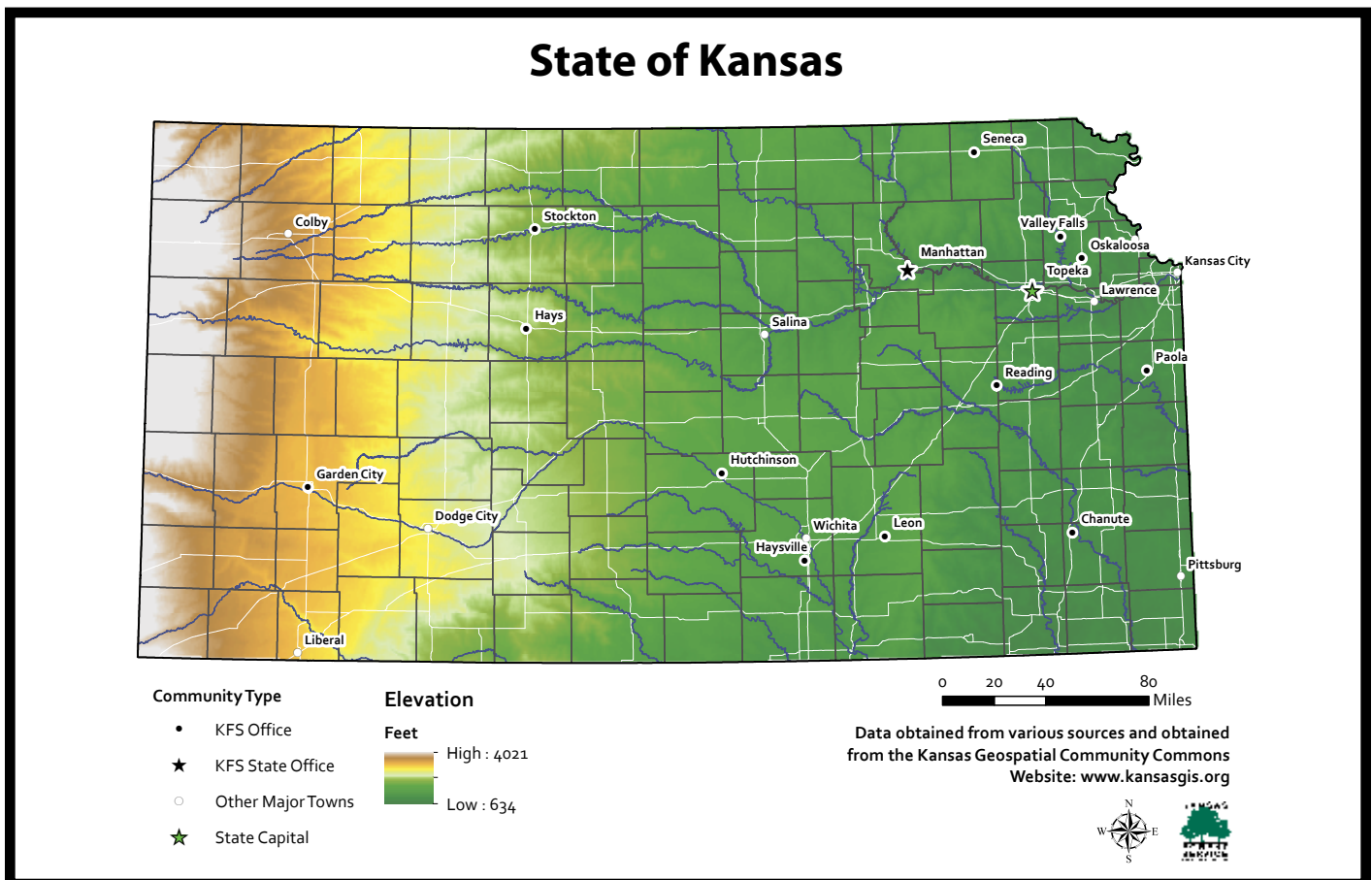


Figure 1.1. Kansas. For a map of county names, see Appendix G.

Kansas EPA Ecoregions

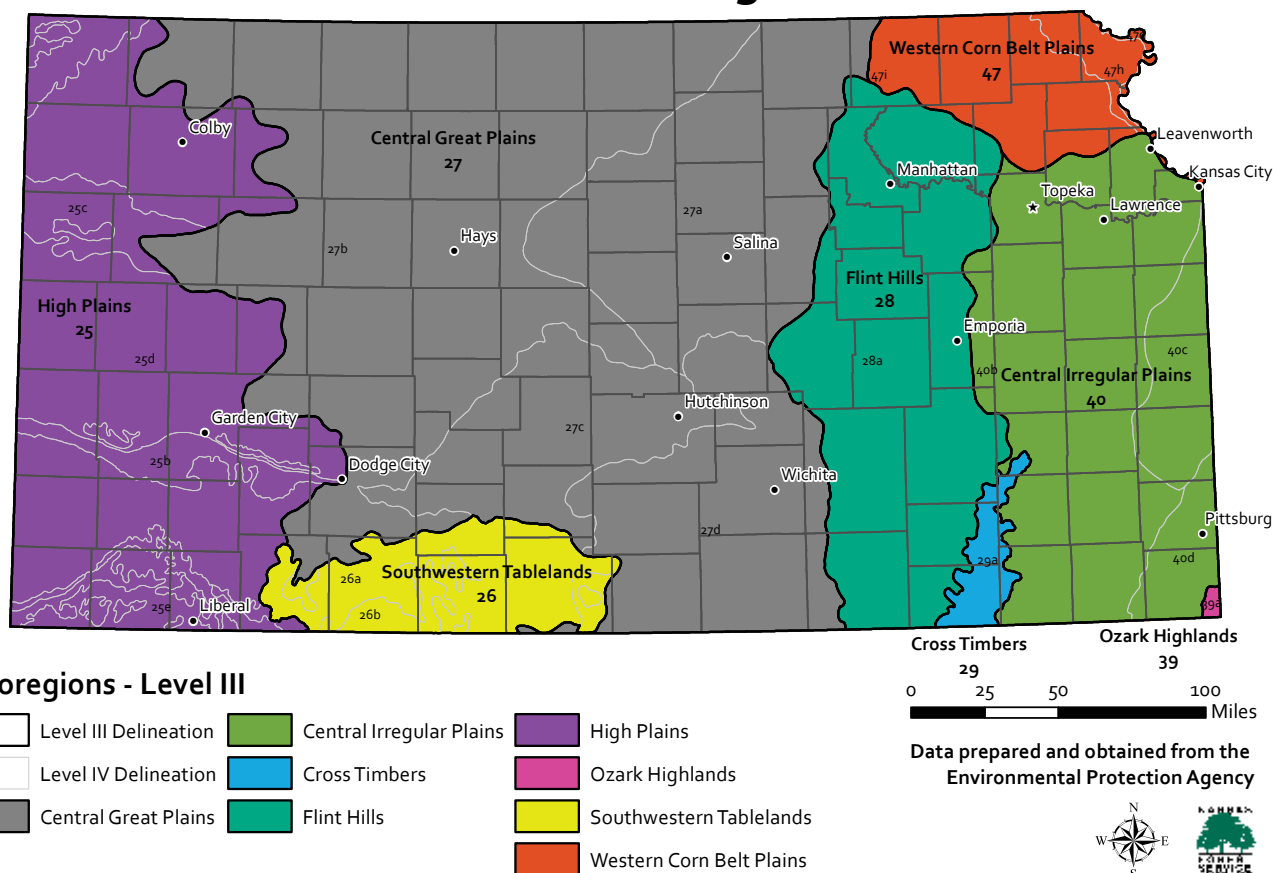


Figure 1.2. Kansas ecoregions.

Central Irregular Plains (40)

The Central Irregular Plains ecoregion has a variety of land use types and tends to be topographically more irregular than the Western Corn Belt Plains (47) to the north, where most of the land is in crops. The natural vegetation of the region is a mosaic of tallgrass prairie and oak-hickory forest, with more forested areas than the Western Corn Belt Plains. The climate is humid with rainfall averaging 28 to 40 inches per year, most of it falling during the growing season. Soils also differ from the Western Corn Belt Plains (47) mainly by the relative absence of glacial drift and a thinner loess mantle. The Pennsylvanian surface rock strata provide material for building stone and the manufacturing of cement and ceramics. Oil and gas fields are extensive in Kansas and Oklahoma and coal has been mined in numerous locations in the region.

Flint Hills (28)

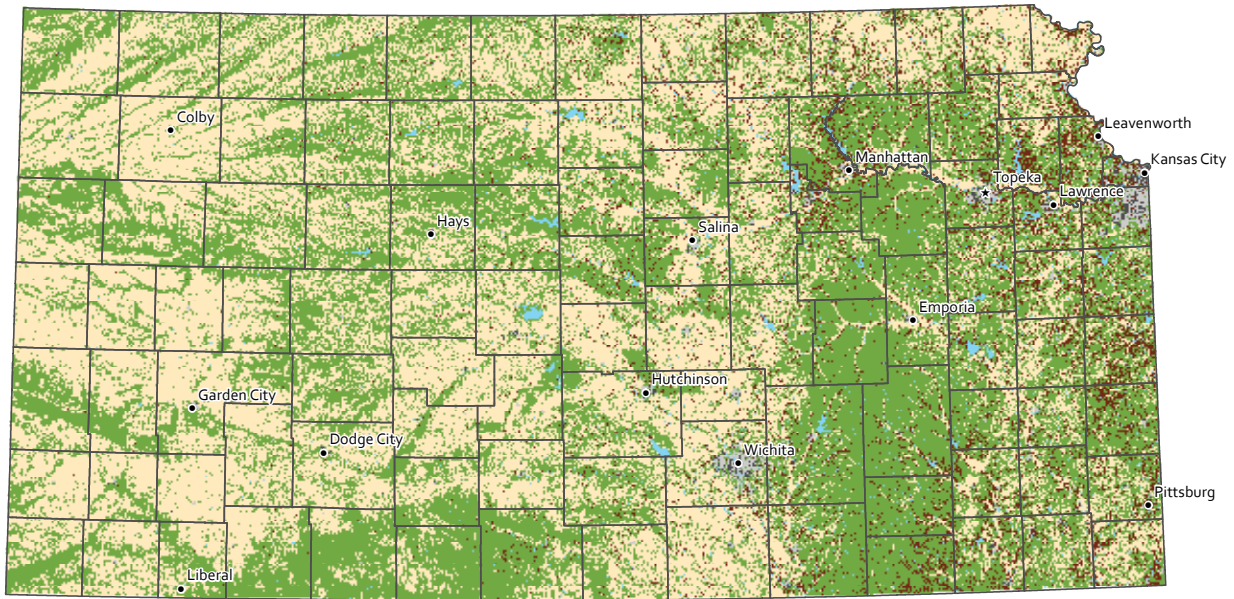
The Flint Hills ecoregion is the largest remaining intact tallgrass prairie in the Great Plains. This region is characterized by rolling hills composed of shale and cherty limestone, rocky soils, and by humid, wet summers. Average annual precipitation ranges from 28 to 35 inches. The Flint Hills marks the western edge of the tallgrass prairie. Erosion of the softer

Permian limestone has left the more resistant chert (or flint) deposits, producing the hilly topography and coarse soils of the area. This rocky surface is difficult to plow; consequently, the region has historically supported little cropland agriculture. The natural tallgrass prairie still exists in most areas and is used for range and pasture land. However, some cropland exists in river valleys and along the periphery of the Flint Hills, especially in the northwest corner where the topography is more level. This northwest edge is transitional between the cherty, rocky soils of the Flint Hills (28) and the silty, loamy, loess-formed soils of the Smoky Hills (27a).

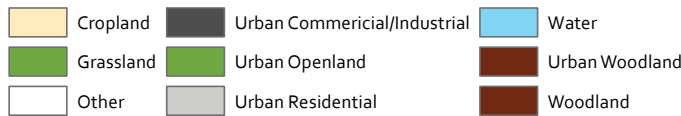
Cross Timbers (29)

The Cross Timbers ecoregion is a transitional area between prairie vegetation to the west and forested regions to the south. Kansas contains the northern extent of the region. Oak savanna and forests are common on the sandy, dry soils. The thick Pennsylvanian-aged sandstone has been eroded into a series of hills that exhibit more relief than the surrounding Osage Cuestas (40b) but less relief than the larger hills of the Flint Hills (28).

Kansas Land Cover



Kansas Land Cover Patterns (2015)



0 20 40 80 Miles

Data prepared and obtained from the Kansas Applied Remote Sensing (KARS) Program

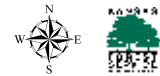


Figure 1.3. Kansas land cover.

Central Great Plains (27)

The Central Great Plains are slightly lower, receive more precipitation, and are somewhat more irregular than the western High Plains (25) to the west. Once a grassland, dominated by mixed-grass prairie with scattered low trees and shrubs in the south, much of this region is now in cropland, with the eastern boundary of the region marking the eastern limit of the major winter wheat growing area of the United States. Subsurface salt deposits and leaching contribute to the high salinity found in some streams.

Southwestern Tablelands (26)

During the Permian Period, several thousand feet of brickred shales, siltstone, sandstones, and gypsum were deposited in this region. Erosion has exposed these deposits giving the region its characteristic red butte and mesa appearance. Unlike most adjacent Great Plains ecoregions, little of this region is in cropland and much of its elevated tableland area is in sub-humid grassland and semiarid rangeland. The region has many spring-fed streams, and stream bottoms tend to be sandy, and the water is more mineralized than in adjacent regions.



Photo by Mike Blair

Oak-hickory Forest Type Group makes up 53% of Kansas forestland and occur in the eastern third of the state.



Photo by USDA NRCS

Kansas forests are often linear in nature and are interspersed between grassland and croplands.

High Plains (25)

In the rain shadow of the Rocky Mountains, the Western High Plains ecoregion is characterized by a semi-arid to arid climate, with annual precipitation ranging from 13 to 20 inches. Higher and drier than the Central Great Plains to the east, much of the Western High Plains comprises a smooth to slightly irregular plain having a high percentage of dryland agriculture. Potential natural vegetation is dominated by drought-tolerant shortgrass prairie and large areas of mixed grass prairie in the northwest. Center-pivot irrigation, relying on groundwater from the High Plains Aquifer, has increased dramatically in recent decades. Natural gas deposits, found in the south, yield a majority of natural gas produced in the Midwest.

1.3 Climate

As evidenced by the preceding ecoregion descriptions, climate plays an important role in the distribution and composition of natural vegetative cover, as well as the extent and intensification of agriculture throughout Kansas. Both temperature and precipitation patterns tend to follow a general gradient from southeast to west/northwest (Figures 1.4 and 1.5).

According to the Koppen climate classification, Kansas is represented by three climate types: humid continental (eastern third), humid subtropical (south central and southeastern), and semi-arid steppe (western High Plains). The humid continental areas are characterized by cool to cold winters and hot, often humid summers where the majority of precipitation tends to fall in the spring and summer, with moderate amounts of winter snowfall (15 to 25 inches). Those humid subtropical areas of Kansas tend to experience hotter, more humid summers; milder winters; and more precipitation than the rest of the state. However, they are not immune to snowfall, averaging around 10 to 15 inches per year. Finally, the semi-arid steppe regions that tend to cover the western third

of the state of Kansas can be characterized as having summers that are hot and generally less humid than the rest of the state, in some areas receiving as little as 16 inches of rainfall per year. Further exacerbating either low or moderate rainfall totals across portions of the state is the sometimes sporadic and intense nature of rainfall events that occur during the spring and summer months, thus necessitating the irrigation of many crops from aquifer sources in much of southwestern Kansas.

1.4 Population

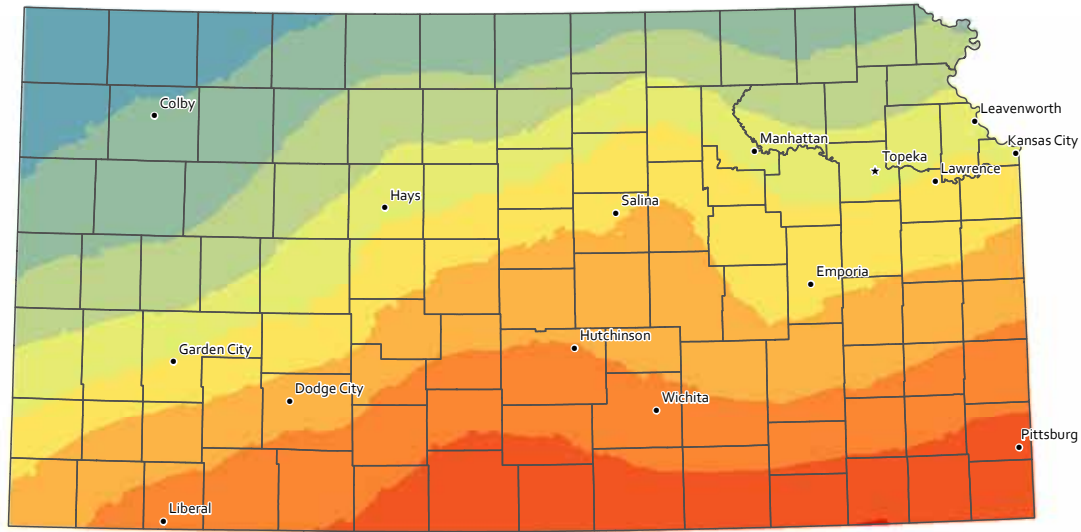
Kansas, geographically the 13th largest state in the nation covering an area of around 82,000 square miles, was estimated by the U.S. Census Bureau to have a population of 2,913,123 in 2017, making Kansas the 35th most populous state. Since 2010, Kansas has experienced an increase in population of some 2.1%, considerably less than the national average of 5.96%.

The majority of Kansans reside in the eastern third of the state, primarily centered in, and emanating from, the cities and towns of Kansas City, Lawrence, Topeka, Manhattan, and Wichita, and to a lesser degree Salina and Hutchinson (Figure 1.6a). Outside of these population centers and their respective counties, population densities are less than 100 people per square mile and in vast tracts of the state as low as one person per square mile (Figure 1.6b).

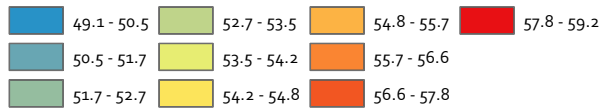
As a whole, since 2010, population growth in Kansas has been primarily an urban and suburban phenomenon, while areas outside of the metropolitan areas have generally seen a decrease in population (Figure 1.6c). According to the Institute for Policy and Social Research (2019), and based on data from the Center for Economic Development and Business Research at Wichita State University, this trend will continue, and possibly even intensify based on population projections, through 2044. During this time, Kansas as a whole will grow by more than 14.9% between 2014 and 2044, adding some 435,000 people to the state. This growth will be marked by a stark rural-urban contrast, with significant growth expected in the suburban areas surrounding the largest cities and towns of eastern Kansas, as well as within those smaller urban centers in the central and western portions of the state, but a considerable depopulation of rural counties throughout the state is expected (Figure 1.6d).

Some counties surrounding the Kansas City metro area are expected to grow at a rate close to or exceeding 50% between 2014 and 2044. Given the high demand for land that this growth will stimulate, and that the majority of the forests in Kansas exist in the eastern third of the state, this trend will place enormous pressures on the state's limited forest resources, as well as other natural resources.

Kansas Average Mean Temperature (1981 - 2010)



Average Annual Mean Temperatures 1981-2010 (Degree F)



0 25 50 100 Miles

Data obtained from the State Climatologist
Weather Data Library, KSU

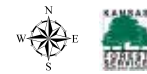
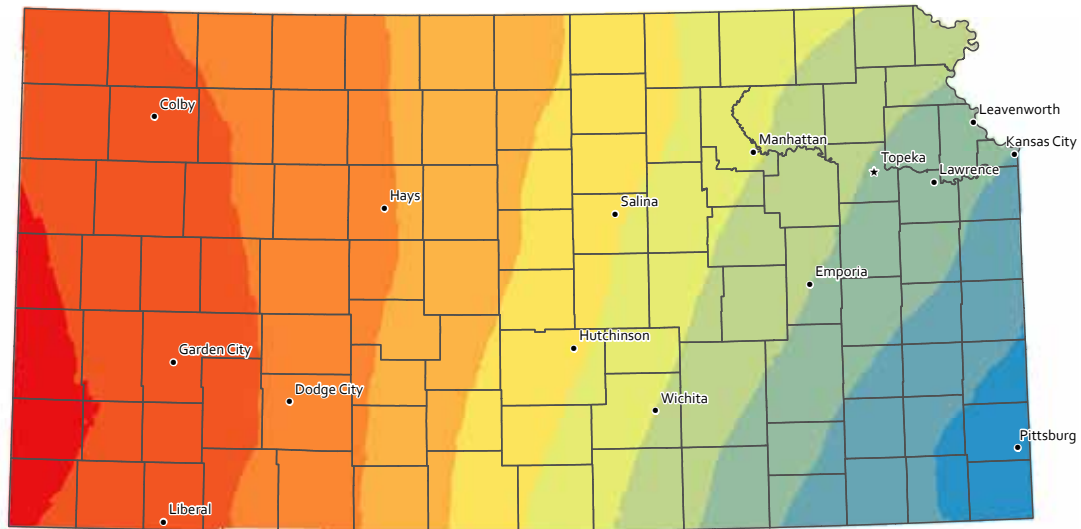
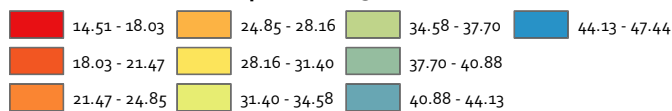


Figure 1.4. Kansas average annual mean temperature 1981-2000.

Kansas Annual Mean Precipitation (1981 - 2010)



Annual Normal Precipitation 1981-2010 (Inches)



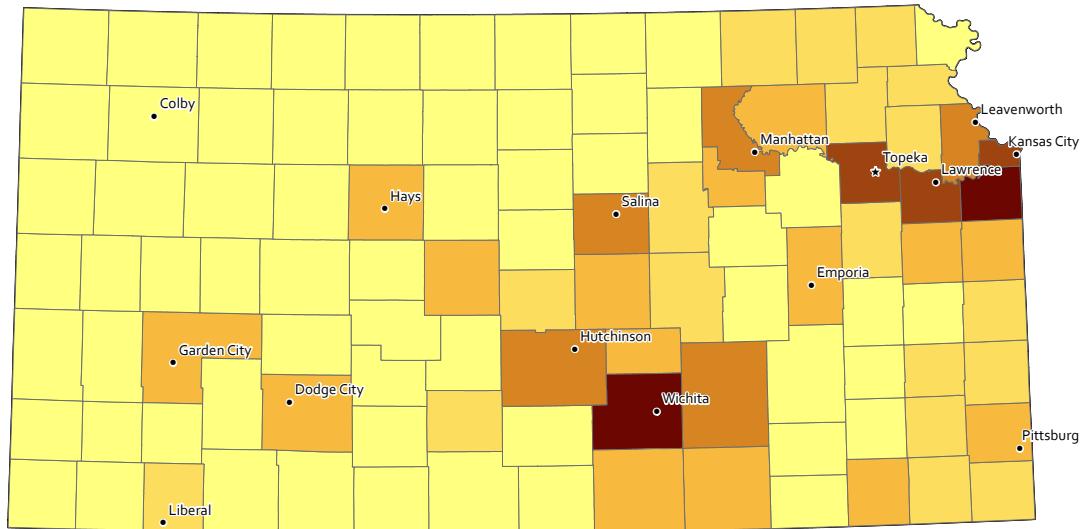
0 25 50 100 Miles

Data obtained from the State Climatologist
Weather Data Library, KSU

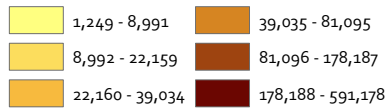


Figure 1.5. Annual mean precipitation 1981-2000.

Kansas County Population 2017



County Populations (2017)



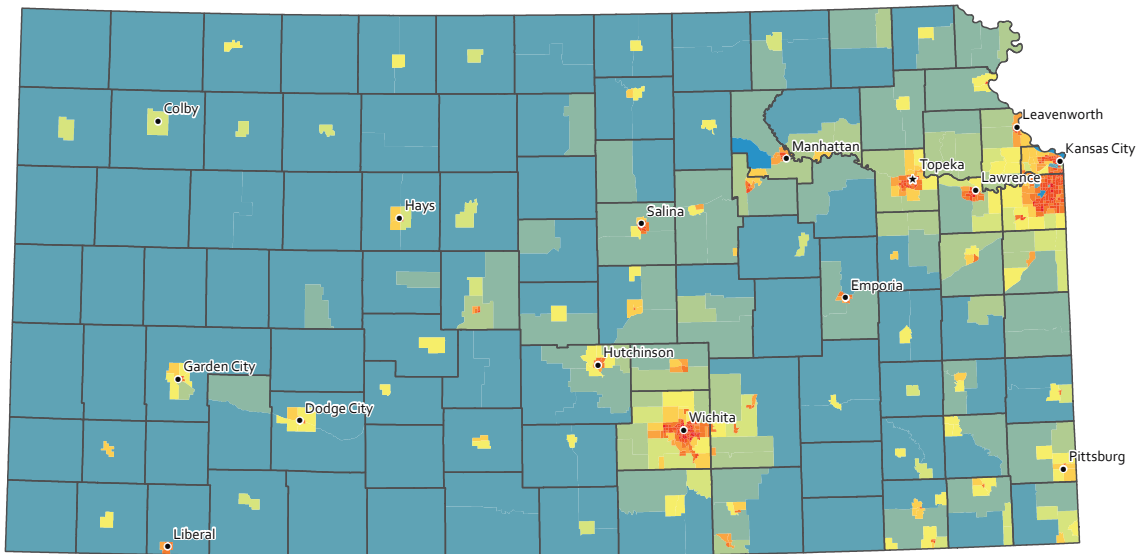
0 25 50 100 Miles

Data prepared by the US Census Bureau
and obtained from the Institute for Policy & Social Research,
University of Kansas

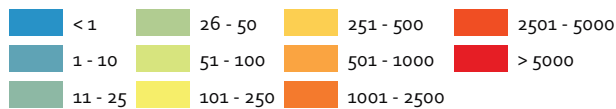


Figure 1.6a. *Kansas population characteristics.*

Kansas Population Density 2010



Population Density 2010 (per square mile)



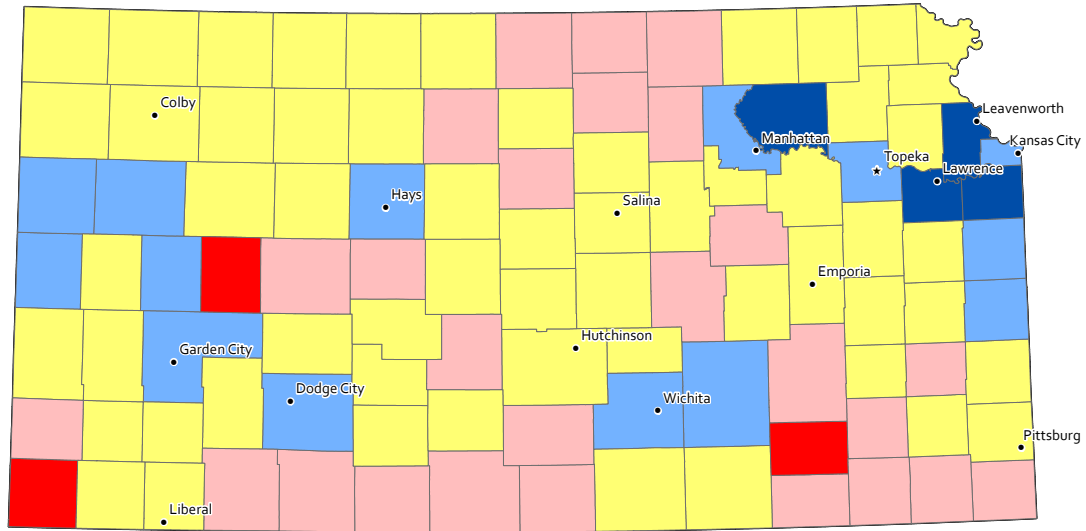
0 20 40 80 Miles

Data prepared by the US Census Bureau
Obtained from the Data Access & Support Center

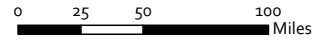
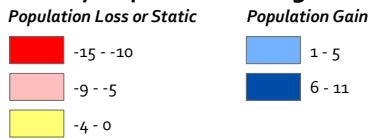


Figure 1.6b. *Kansas population characteristics.*

Kansas Population Change 2010 - 2017 (%)



County Population Change 2010 - 2017 (%)

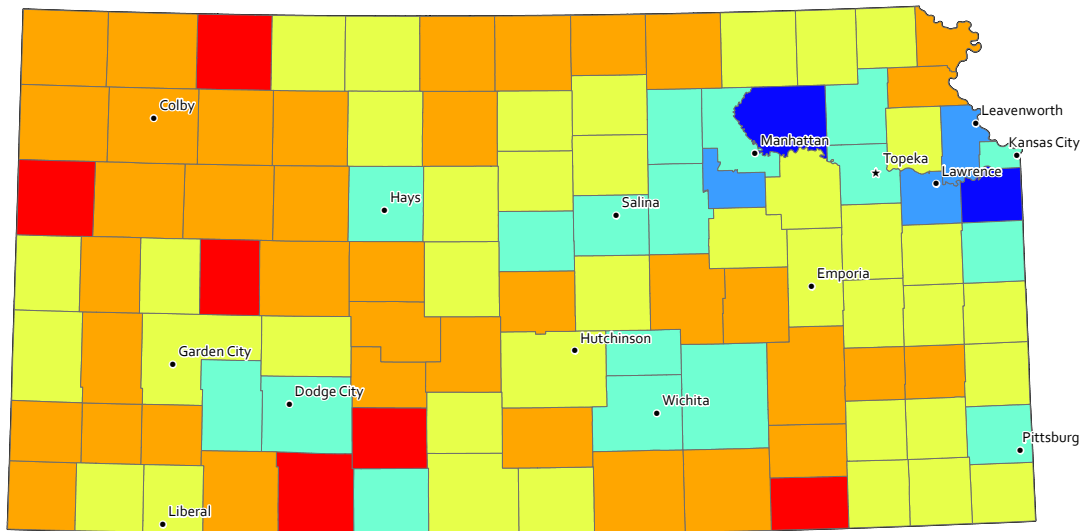


Data prepared by the US Census Bureau and obtained from the Institute for Policy & Social Research, University of Kansas

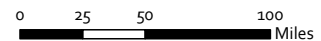
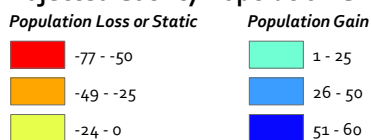


Figure 1.6c. *Kansas population characteristics.*

Kansas Projected Population Change 2014 - 2044 (%)



Projected County Population Change 2014 - 2044 (%)



Data prepared by the US Census Bureau and obtained from the Institute for Policy & Social Research, University of Kansas



Figure 1.6d. *Kansas population characteristics.*

KANSAS FORESTS AND RELATED RESOURCES

There are more than 800 million acres of rural forestland in the United States and an additional 130 million acres in our community forests. Most of our rural forests are privately owned and in need of protection and active management. Kansas rural forests comprise 2,483,060 acres (roughly 5% of the state's total land area) with 92.49% privately owned (Figure 2.1). There are an additional 337,239 acres of community and urban forests in Kansas. Forest area has remained remarkably stable and the amount of wood in forests is increasing. A changing climate, catastrophic fires, effects of development, and a three-fold increase in insect-induced mortality in the last decade threaten this resource. In Kansas, the invasive species emerald ash borer, bush honeysuckle, and tamarisk are affecting rural and community forests.

Kansas is primarily agricultural land (45,759,319 acres) with 21 million acres in harvested cropland and 14 million acres of pastureland for grazing livestock. Since agriculture dominates our landscape, agroforestry, particularly in the form of windbreaks and riparian forests, is a key conservation practice in Kansas. The linear nature of agroforests falls outside the USDA Forest Service, Forest Inventory and Analysis, definition of forestland, which is 1 acre in size, 120 feet wide and 10% stocked. Therefore, there is an additional 1,288,017 acres described as Trees Outside of Forests (TOF), which includes Kansas windbreaks, riparian forests, and other trees. Grasslands dominate Kansas with the Flint Hills hosting the largest remnant of Tall Grass prairie left on earth. Catastrophic wildfires in 2016 and 2017 and woody encroachment have made wildland fire management a critical issue in Kansas.

2.1 Rural Forests

2.1.1 Current Conditions and Trends

Rural forests are forests not included within municipal jurisdictional boundaries or “community” as defined by U.S. Census Bureau definitions. The majority of information in this section is taken from *Forests of Kansas, 2018*, *USDA Forest Service – Forest Inventory and Analysis and the National Woodland Owner Survey* (Butler 2011-2013). Collectively, 92.49% of Kansas rural forestland is privately owned with 4.72% federal and 2.79%

state and local. An estimated 62,000 families own the bulk of Kansas forests.

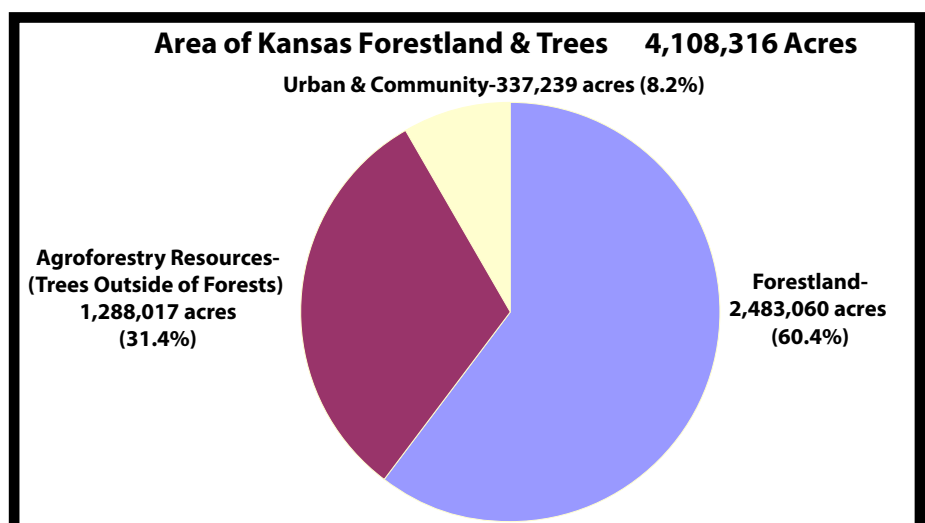
Slightly more than 40% of family forest owners hold between 10-49 acres of forestland, 30% between 100-499 acres, 20% between 50-99 acres and 10% own 500 acres or more.

Of farmland owners, 70% recognize the benefits of forestlands for a family legacy for wildlife, aesthetics, and protecting nature. Of those owning forestland, 80% is owned as part of a farming operation. Trespassing or poaching, keeping the land intact for future generations, and dumping or misuse of woodlands are the greatest concerns of landowners (Table 2.1).

Kansas is in an ecotone where the central hardwood forests of the United States transition into the grasslands of the Great Plains. Because of this, there will always be ongoing debate regarding the appropriate location of forests, woodlands, and windbreaks depending on cultural and societal values.

Before European settlement, forests may have covered up to 8% of the state's land area (Ware and Smith 1939). A. T. Andreas's *History of the State of Kansas* presents 1883 government land office survey records suggesting only 4.1% of the state was forested. Regardless, presettlement forests were located predominately in the eastern third of Kansas on rich alluvial bottomlands and on moist upland sites. Today's rural forests comprise an estimated 5% of the state (2.4 million acres) by the USDA Forest Service Forest Inventory and

Figure 2.1. Total Area of Kansas Forests and Trees



Analysis (FIA) definition (1 acre in size, 120 feet wide and 10% stocked). These forestlands are primarily located in the eastern third of the state (Figure 2.2, page 13). An additional 2.1 million acres do not meet that definition and could be described as riparian forests, windbreaks, and isolated trees.

Kansas forests steadily increased in area from the first official inventory in 1936 to 2013. During that time most of the increase in area has probably occurred in uplands and as woody encroachment into grasslands. Since 2013, the area of forestland has decreased with an estimated 61,466 acres being converted to nonforest annually. In 2013, 1.7 million cubic feet of trees were removed from Kansas forests. This increased to 13.4 million cubic feet in 2018. Loss of forestland can be explained by urban development, aggressive practices to remove eastern redcedar from grasslands, and competition for farmland along riparian areas.

Although eastern redcedar makes up 4.4% of forest types, it has increased in volume by 23,000% since 1965 and is the primary species of concern encroaching into grasslands. The Oak-Hickory Forest Type Group makes up 52.9% of forests and are located primarily in eastern Kansas (Figure 2.3). The elm/ash/cottonwood forest type dominates the central-western parts of the state where precipitation is less abundant. Kansas forests tend to be linear in shape following streams and rivers (Figure 2.4).

Forests have increased in volume by a billion cubic feet and in density by 106% since 1965 with an estimated 86.5 million dry tons of total biomass. Growing stock volume has been increasing steadily for the past 40 years. Forest stand improvement and timber harvest is accomplished on 6,925 acres each year while 14,614 acres are disturbed by fire and 4,690 acres by weather events like ice storms or tornados.

The top 15 tree species in thousands of trees (Figure 2.5) include hackberry (119,471.1), American elm (105,348.5), eastern redcedar (91,889.8), Osage orange (87,125.8), green ash (39,542), honeylocust (34,837.2) red mulberry (31,692.8), eastern redbud (28,370.7), post oak (21,900.1), Siberian elm (21,900), black walnut (21,563.8), bitternut hickory (18,552.9), chinkapin oak (17,573.9), sugar maple (13,209.8), and common persimmon (12,127.1). Increases in volume and tree numbers of shade-tolerant species like hackberry will continue to suppress oak regeneration, which has limited tolerance to shade. Although black walnut is not a significant species in terms of volume, it is the most economically valuable

Table 2.1. Top concerns of Kansas forestland owners represented by forestland ownership acres (2013).

Concern ^a	Area	
	Acres (thousands) ^b	Sampling error (percent)
Trespassing or Poaching	1,553	106
High Property Taxes	1,535	106
Keeping Land Intact for Future Generations	1,535	106
Dumping/Misuse	1,315	108
Invasive Species	1,206	108
Unwanted Insect/Disease	1,169	108
Drought/Lack of Water	1,096	107
Water Pollution	968	105
Wind or Ice Storms	877	103
Wildfire	786	100
Air Pollution	585	91
Global Climate Change	566	90
Development of Nearby Lands	548	89
Damage or Noise from Off-Road Vehicles	493	86
Damage from Animals	402	79

^a Categories are not exclusive.

^b Landowner's concerns estimated area (10+ acres) include ownerships that rated an issue a great concern or concern on a 5-point Likert scale, USDA Forest Service, NRS, NWOS.

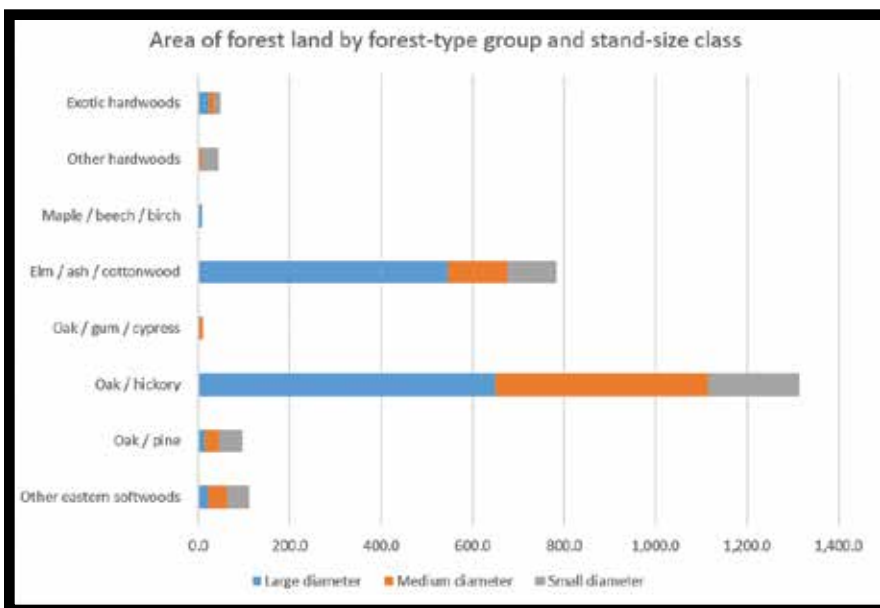


Figure 2.3. Area of timberland by forest type, according to FIA definitions, in thousands of acres and percent area, (oak-pine is primarily eastern redcedar/ hardwood), USDA Forest Service, NRS, FIA.

Percent Forest Cover in Kansas Counties

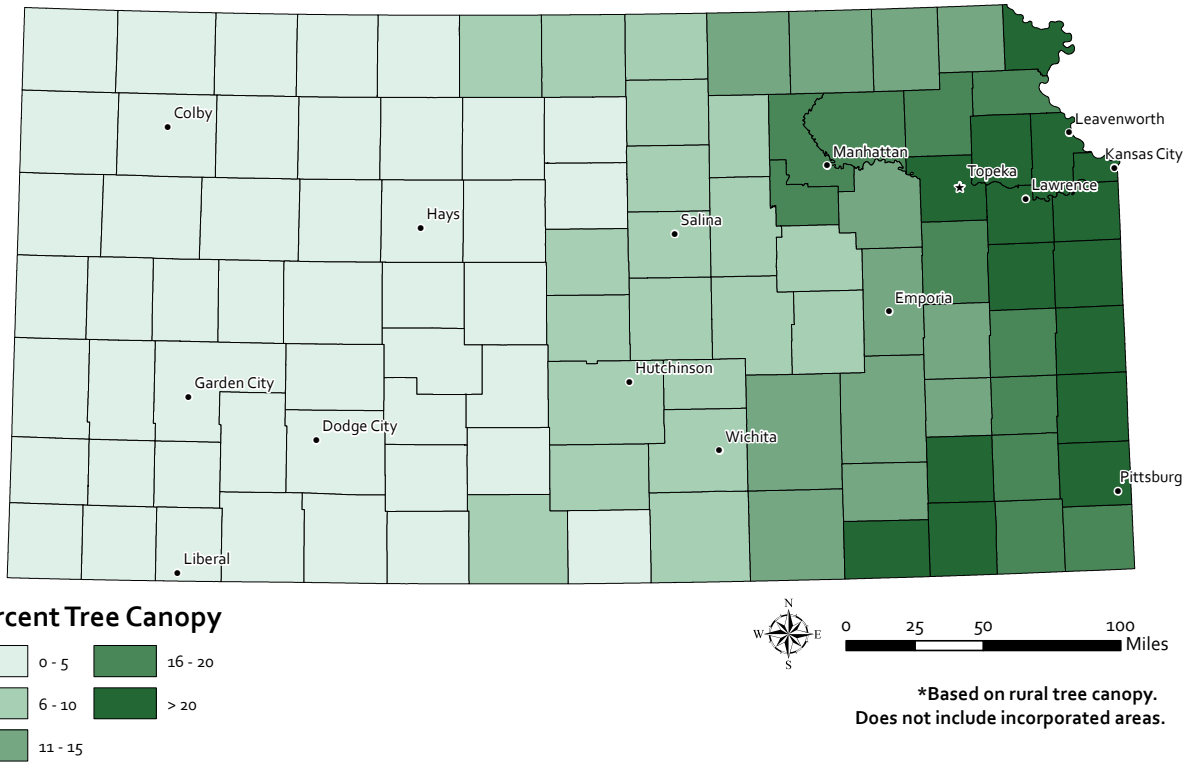


Figure 2.2. Percent of Kansas Counties under Forest Cover.

Woodland Distribution in Kansas

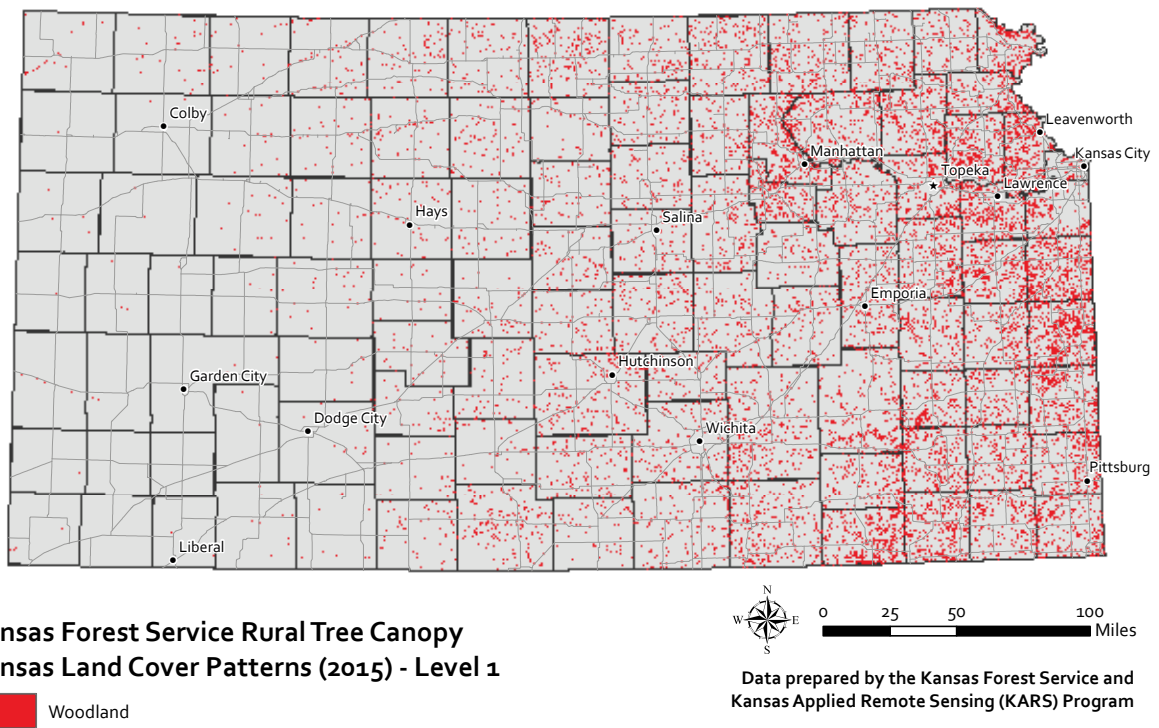


Figure 2.4. Kansas "Woodland" as identified by the Kansas Applied Remote Sensing Program's 2005 Kansas landcover dataset (Peterson et al., 2005).

tree species in Kansas. Half of the volume of black walnut occurs in fully stocked stands, which does not bode well for a species that requires full sunlight to regenerate. Since 1981, cottonwood, the state tree of Kansas, has not been regenerating in sufficient quantities to maintain the forest type, although growing stock volume has increased. In 2018 annual mortality and removals of live trees were at 80 million cubic feet. Even so, annual gross volume growth was 135 million cubic feet.

Kansas forests and forest industry contribute to the Kansas economy. The Kansas Forest Service maintains lists of more than 50 timber buyers and sawmills. More than 55% of 1.7 million cubic feet of timber harvested in Kansas was processed in state in 2009, (the most recent Timber Product Output survey). Most of our local timber, however, is used for pallets, boxes, and dunnage, although black walnut is sold as veneer and lumber. A 2014 economic impact analysis showed field and logging operations plus primary mills contribute \$51.6 million annually to the Kansas economy in 2016 dollars supporting 450 jobs at a payroll of \$13 million.¹ However, the Kansas forest industry has never really recovered from the global recession in 2009. Lack of kiln drying facilities and consistent sources of local wood prevent the increased use of native Kansas timber. In addition to the economic benefits, riparian forests, tree windbreaks, and urban and community forests provide valuable ecosystem services to Kansans in the form of energy savings, water quality, carbon sequestration, biodiversity, and recreation.

2.1.2 Future Conditions

Woody encroachment into grasslands and related factors have been indirectly responsible for population declines in grassland obligate species such as greater and lesser prairie chicken, and Henslow's sparrow due primarily to predation. The Kansas Wildlife Action Plan describes a complete list of Species of Greatest Conservation Need by region. If forest expansion into grasslands is not abated, grassland obligates will continue to decline in numbers as the prairie ecosystem transitions to woody plants. Forest succession will provide habitat for other species such as white tail deer, turkey, and a variety of mammals. However, dense stands of eastern redcedar will limit understory diversity and plant growth and increase the danger of wildfire.

¹ This information was provided by Tom Treiman, natural resource economist, Missouri Department of Conservation.

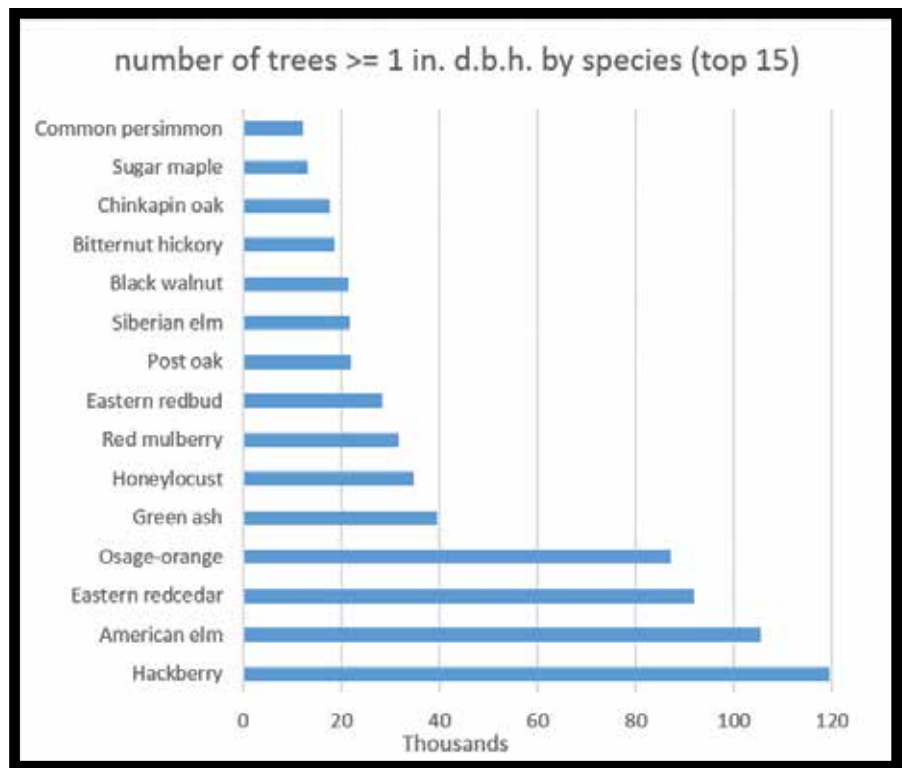


Figure 2.5. Volume of growing stock trees by forest type on timberland, USDA Forest Service, NRS, FIA.

The overall increase in tree volume and density of Kansas forests suggests that forest health problems are on the horizon along with increased opportunities for utilization of forest products. Use of woody biomass as an alternative energy source is one example. Overstocking, combined with a high volume of cull, suggests additional opportunity for forest stand improvement practices through programs like the Environmental Quality Incentives Program for Forestland Health.

However, almost half of Kansas timberland acreage falls in large diameter classes that may be more difficult to remove due to size and the fact that more than 50% of Kansas hardwood forests are classified as cull, which is unusable for merchantable products. On the flip side large diameter cull trees provide wildlife habitat. Without altering the density of forest stands through timber harvest, prescribed fire, or forest stand improvement practices, regeneration of desirable species like black walnut and oaks will be reduced, potentially changing forest composition to more shade-loving species. Declines in water tables, as a result of irrigation, drought, and changes in flood regimes, will continue to contribute to the reduction of cottonwood regeneration.²

According to the National Woodland Owner Survey, the majority of woodland owners plan to engage in an activity associated with invasive species, grazing and wildlife activities in the next five years. Many landowners will consider

² The report on the status of cottonwood forests along the Missouri River is available at: <http://www.moriverrecovery.org/mrrrp/>

selling since 43% of Kansas forests are owned by people 65 years or older. This large-scale intergenerational shift must be considered in encouraging and promoting the management and protection of forestland.

The economic value of Kansas forest products will continue to grow along with size, quality, and volume of forests. An inventory of woody biomass sources in Kansas suggests that 282,724 green tons of wood waste are produced annually with almost 66% already processed (187,000 tons) and potentially available as wood energy feedstocks. Additionally, 67,822 green tons are received at waste disposal sites each year with only 14% utilized. Although increasing biomass markets may provide benefits, care must be taken if wood waste supplies dwindle to the point that it becomes economically feasible to use high-quality standing timber for wood energy feedstocks. These timber stands could include environmentally important areas such as riparian buffers. At that point, sustainable forest management should focus on utilization of over-mature cull timber and woody species encroaching on grasslands.

With population anticipated to increase in the United States by 150 million people in the next 50 years, ecosystem services will become more relevant to Kansans. More people will depend on the services of sustainable, finite resources that must be functional. These resources provide ecosystem services, which include nonpriced amenities and market goods, which can be quantified or documented through forest certification. These services include water quality and quantity, carbon sequestration, and recreation.

2.2 Agroforestry

2.2.1 Current Conditions and Trends

Agroforestry is the integration of trees and shrubs into agricultural systems to maximize economic and conservation benefits. Windbreaks and riparian forests are an important resource to Kansans and the most common examples of agroforestry. Yet, most do not meet the traditional inventory definition for forestland and therefore we lack adequate information about the conditions and trends for windbreaks and riparian forests.

Recent inventories associated with the Great Plains Initiative (GPI) 1 and 2, have established a much-needed baseline on the size and condition of windbreaks. Statistics in this section are from a 2019 GPI 2 inventory.

Though not yet published, preliminary data from the USDA Forest Service, *Forest Inventory and Analysis*, estimates there are 118,037 windbreaks in Kansas that cover 260,943 acres and stretch 30,735 miles in length, which would cross the state east to west almost 77 times. Windbreaks protect an area two to five

times their height on the windward side and 10 to 30 times their height on the leeward side. Therefore, Kansas windbreaks provide wind protection to an additional 931,200 acres of land with 26% protecting fields, 62% surrounding farmsteads and homes, and 11% protecting livestock. Kansas windbreaks average about 2.2 acres in size and 1,375 feet in length, about four football fields.

An estimated 45% of these windbreaks are in good condition and 55% fair to poor (Figure 2.6). Drought, storms, trees unsuitable for the site, and age can all effect condition and sustainability of windbreaks. For example, 24% exceed 50 years old, which contributes to fair to poor condition classes while 44% are between 25 and 50 years, and 32% less than 25 years old. Eastern redcedar, the only native conifer in Kansas, makes up 54.4% of windbreaks. While eastern redcedar is an excellent windbreak species, its encroachment of grasslands has created issues for wildland fire, range health, and wildlife, especially grassland birds. Collectively 17% of Kansas windbreaks are made of Austrian, Scotch, and Ponderosa pines and blue spruce. This is a concern since none of these trees are native and mortality from pine wilt, tip and needle blights, and abiotic stresses will demand renovation to sustain this valuable resource.

In addition to environmental benefits, 2018 research using 57 crop years of yield monitoring data in Kansas suggests field windbreaks improved crop yields significantly for soybeans 46% of the time and wheat 30% of the time. Farmstead windbreaks also provide 20% annual savings in fuel costs protecting an estimated 577,344 acres. These statistics add up to multi-million-dollar annual savings for farmers and ranchers.

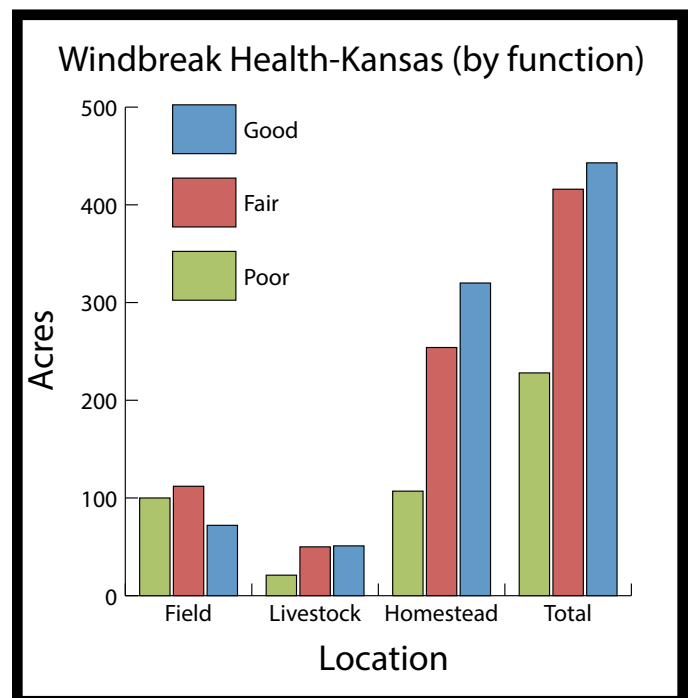


Figure 2.6. Kansas windbreak health by function.



Windbreaks in Kansas provide economic benefits ranchers, farmers, and homeowners.

Healthy riparian forests are critical to maintaining water quality and quantity; however, significant portions of riparian corridors are incised, unstable and in need of riparian forest restoration, management, and protection. There are an estimated 562,000 acres of riparian forests that border 23,731 miles of perennial streams and rivers nearly 27% of total timberland area. The Kansas Forest Service has completed a variety of riparian forest assessments in priority watersheds in eastern Kansas. These assessments reveal a majority of riparian forests classified as “forests in need of establishment” describing the miles and miles of rivers where crops are farmed immediately adjacent to streambanks and lack any forest cover. Currently the state of Kansas has no policy to protect riparian forests from conversion. Loss of windbreaks and riparian forests continue to be an issue and anecdotal information suggests they have been in decline since the 1970s, when pivot irrigation was introduced, and whenever commodity prices are high. It is expected that these trends will continue.

2.2.2 Future Conditions

According to the NRCS, 2.9 million acres (12%) of the 24.6 million acres of cultivated cropland is eroded by water and wind exceeding “tolerable limits.” This erosion does not include the phenomenal amounts of soil erosion coming directly from streambanks. For example, on the mainstem of a 210-mile stretch of the Cottonwood River and Neosho River an estimated 162,800 tons of sediment is transported annually into John Redmond Reservoir. These federal reservoirs serve as the source of municipal and industrial water for more than two-thirds of the state’s population. Without changes in the next 50 years, our reservoirs will be 40% filled with sediment and five out seven of our major river basins won’t meet demands during droughts.

Livestock and farmstead windbreaks are the most commonly planted windbreaks, but there is a need to promote the

establishment and renovation of field windbreaks and the crop yield benefits. These benefits have been documented by James Brandle’s research at the University of Nebraska.³ The issue of woody encroachment into grasslands, the incredible expansion of eastern redcedar, and water quantity issues have caused an “anti-tree” mentality throughout the state that must be overcome with good policy, increased prescribed burning where appropriate, prescribed burning and educational programs. Without changes in current trends (almost half of Kansas windbreaks are in fair to poor condition), one could expect to see a continued decline in the quality and area of windbreaks and riparian forests as both compete with valuable agricultural croplands.

2.3 Community and Rural Forested Landscapes

2.3.1 Current Conditions and Trends

Growth

The 2019 Kansas population is 2.9 million people, with 68% living in urban counties and 32% living in rural counties. USDA urban data reports 1.9 million people living in urban areas, a 12.2% increase from 1990. Land defined as urban has increased 14.1% since 1990.

2015 NRI Report

From 1982 to 2015 there was a 42,982 acre increase in developed land in Kansas, a 1,415 acre increase from 2012-2015.

Johnson, Wyandotte, and Leavenworth counties grew in population from 2015-2016 by 7,426 residents.

US Urban Stats, Values and Projections, Nowak and Greenfield, March 2018

Developed land is currently 623,000 acres (216,181 acres of actual forested land) and urban and community land is 1,113,000 acres (337,239 of actual forested land). Tree cover (2010) for urban land was 34.7% and for urban and community land was 30.3%. Urban land growth from 2000-2010 was 0.14% and urban and community land was 0.32%. Kansas projected urban land growth from 2010 to 2060 is 1.93%; however, three of the largest Kansas counties for projected urban land growth from 2010-2060 are: Sedgwick at 33.1%, Johnson at 35.4%, and Wyandotte at 34%.

In 2014, Kansas had 44.8 million community trees with 21.1 trees per capita. According to i-Tree (USDA Forest Service), the ecosystem benefits provided by urban trees include The ecosystem benefits these trees provide include 7.4 million tons

³ Additional information available at https://doi.org/10.1007/978-94-017-2424-1_5

of carbon storage valued at \$1 billion; sequestering 273 thousand tons of carbon valued at \$35.4 million per year; removing 2.8 thousand tons of air pollution valued at \$14.5 million per year; providing \$12.2 million of avoided energy use; and avoiding \$60.7 million of energy emissions.

UTC Study, Wichita, Kansas

On a local level, an Urban Canopy Study (UTC) for the City of Wichita, completed in 2017, yielded the following results: 22% tree canopy, 33% impervious surface, and 45% Potential Plantable Area (PPA) with 34% of the PPA currently in vegetation (primarily turfgrass). This study covered the city limits of 164 square miles (105,211 acres) and had a tree canopy cover of 22,994 acres. The ecosystem benefits using i-Tree are:

- Removes 2.9 million tons of air pollution annually valued at \$107 million.
- Provides \$4.6 million in stormwater runoff benefits.
- Stores 2.8 million tons of carbon valued at \$100.8 million.
- Absorbs and sequesters 101.4 million tons of carbon dioxide valued at \$3.6 million per year.

The city's 22% tree canopy is close to average for the Great Plains. A comparable Midwest town is Des Moines, Iowa, with a canopy cover of 27%. The UTC study allows the city to set canopy goals, highlight priority planting areas, provide information for green infrastructure, improve watershed function and smart growth principles, and to promote the ecosystem benefits of the current and future canopy to city officials and the general public. This study fulfills most of the needs for baseline data in the greater Wichita metro area.

Species and Age Diversity

Data from tree inventories from across the state's ecoregions over the last 10 years show:

- The top three species are elm, silver maple, and pin oak.
- The top three species on average make up 41% of the overall canopy.
- 59% of the overall canopy are in the fair to poor condition class.
- Many rural communities possess a mature to over-mature canopy.

The Kansas Forest Service will continue to address species diversity, age, and condition via educational outreach, workshops, technical assistance, publications, and tree species tree trials.

Community Canopy Loss

The mature to over-mature canopy has been further degraded by repetitive storms, drought, flooding over the last decade, and pending and impending insect and disease issues. This declining canopy continues to increase the number of defective and potentially hazardous public trees. The City of Wichita removed 55,000 public trees due to drought stress issues in 2011-2012; and continues to remove 4,000 to 7,000 trees per year. Suburban areas continue to suffer forestland loss due to development. This issue is also compounded by the lack of species diversity and the dominance of undesirable species. Data from communities enrolled in the Arbor Day Foundation's Tree City USA program show an increase in tree removals versus new tree plantings, with tree removals outnumbering new plantings by nearly 40,000 trees over the last 10 years. This is due in part to limited budgets and the need to concentrate on removals addressing increasing insect and disease issues and extreme environmental events. An increase of \$4.5 million in annual spending over the last 10 years, to roughly \$20.8 million in 2018, indicates increased interest and investment in managing community tree resources.

Workforce Development

Currently in Kansas there are 70 ISA certified arborists and 266 Kansas certified arborists (with approximately half of those being municipal employees). A horticultural survey completed in 2006 concluded the arboriculture industry in Kansas is a \$61-million industry. To become a Kansas certified arborist, applicants must attend and pass the Arborist Training Course, which is a weeklong course held every fall with an enrollment of 40 individuals. Since 1974, the course has been a partnership between the Kansas Forest Service and Kansas Arborist Association (KAA). Over the course of those 46 years, approximately 2,000 green industry professionals have completed the course. The Kansas Forest Service will continue this partnership as an avenue to increase the number of trained professionals within Kansas municipalities. The course is usually attended by an even representation of municipal and commercial employees. Professional staffing is an outcome reported in Community Accomplishment Reporting System (CARS) and promotes progress of developing and managing communities.

Rural Landscapes

Kansas has nine cities with a population greater than 50,000, making rural community landscapes a priority for the Community Forestry program. Landscape Scale Restoration Grants have funded larger ecosystems projects in the larger metro areas, but a large portion of our technical assistance is prioritized and directed to the smaller rural community landscapes. Many of our smaller rural communities require technical assistance and educational programming due to the lack of forestry professionals within local government staffing.

Comparison of Tree Cover in County Subdivisions

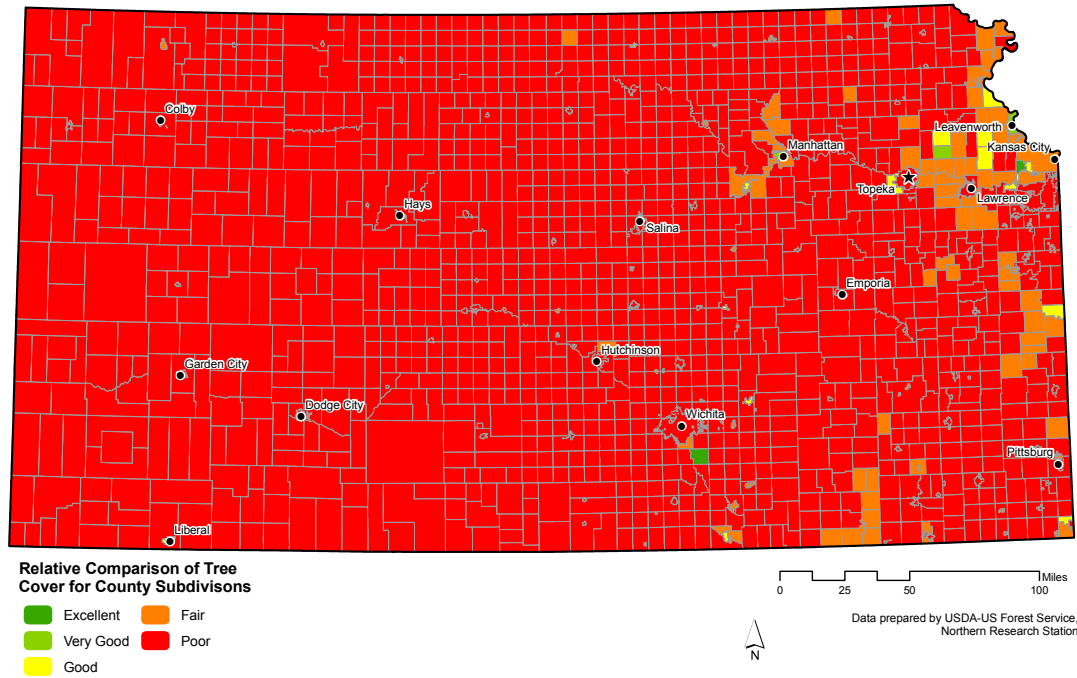


Figure 2.7. Relative comparisons of tree cover for county subdivisions (Nowak and Greenfield, 2010).

Planting Priority Index for County Subdivisions

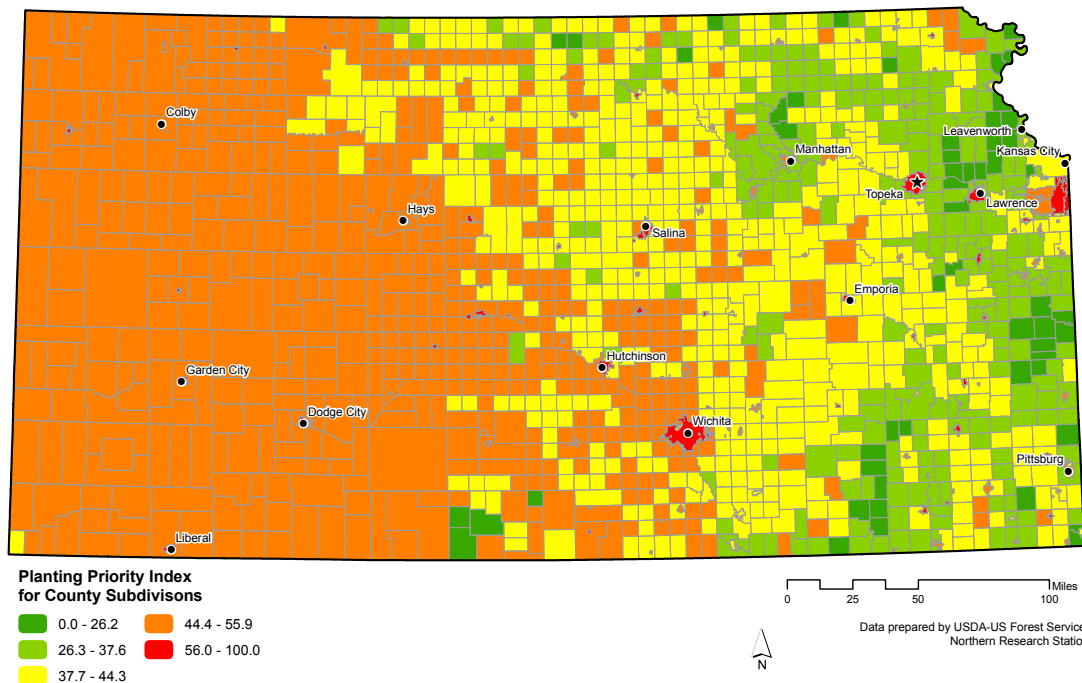


Figure 2.8. Planting priority index for county subdivisions. The higher the index value, the greater priority for planting (Nowak and Greenfield, 2010).

2.3.2 Future Conditions

Growth

The population of Kansas is expected to grow 22% by 2064 and will increase to 3.5 million people. The Mid-America Regional Council (MARC) predicts that the Kansas City region (nine metro counties in both Kansas and Missouri) will increase by 400,000 residents by 2040. By 2044, 22 counties are expected to grow in population. The four largest counties for population growth in Kansas will be: Johnson County (57.5%), Douglas County (42%), Leavenworth County (34.4%), and Sedgwick County (18.3%). By 2044, Johnson and Sedgwick counties will have 47% of the state's population. With the projected growth in population and developed land use, the principles of smart growth and green infrastructure will become even more vital in preventing forest loss, preserving forests, reducing forest fragmentation, reducing the risk of wildland fire interface issues, improving watershed function, lessening the disruption of wildlife corridors, and protecting threatened and endangered species.

Outreach/Workforce Development

Kansas Forest Service statewide trainings, workshops, public speaking events, and technical assistance will highlight the following subjects: tree species and age diversity, benefits of tree canopy, risk management, defective and hazardous trees, tree planting and maintenance, green infrastructure, and community/rural watershed improvements. These events will serve as public education, promotion of green industry professionals, ISA CEU's, and workforce development. The Kansas Forest Service will continue its partnership with the Kansas Arborist Association to provide professional urban forestry training to 40 Kansans annually via the Arborist Training Course. This will increase the number of certified professional staff working in the state; thus, increasing the quality of management of community tree canopies.

Partnerships

Along with state, regional and national partnerships (KAA, KNLA, MW-ISA, and ISA), the Kansas Forest Service works closely with a Kansas City nonprofit, Heartland Tree Alliance, and Evergy, the major electric utility in the state. The work with Heartland Tree Alliance and its volunteers includes teaching proper tree planting and maintenance practices, educating the public about the benefits of trees, and advocating for a healthy, sustainable, and resilient community forest. The work with Evergy's Green Team includes tree planting projects in rural communities that have suffered storm damage or when trees are otherwise absent. We also foster partnerships with K-State Research and Extension and Kansas Department of Agriculture in forest health, species selection and diversity, and tree planting and maintenance. Our work with the Arbor Day Foundation and the TCUSA program assists in creating more developing and managing



Photo by Eric Berg
Community trees in Kansas sequester million of pounds of CO₂ each year.

communities. Currently the Kansas Forest Service engages with 93 TCUSA communities, ranging in population from the City of Wichita at 395,000 to Formoso at 110. These partnerships are universally working to conserve, protect, and enhance community and rural landscapes canopies. The Kansas Forest Service will continue pursuing and building additional traditional and nontraditional partnerships with regional and state green industry, nongovernmental organizations, corporations, and civic organizations.

Technology

The Kansas Forest Service will continue to use the advancements in technology available, mainly i-Tree and UTC studies, to protect, enhance, and improve urban and rural community landscapes. Kansas Forest Service will use i-Tree County Benefit reports to communicate the ecological, environmental, economic, social and health benefits of the existing canopy, and to encourage increased canopy goals. Work is already underway by the Kansas Forest Service GIS staff to complete tree canopy studies for all 631 Kansas communities. Tree inventory projects, assessments and management plans will promote biodiversity of age and tree species, mitigate invasive species, reduce risk from insect and disease infestations, and provide the required information for developing healthier, resilient canopies adaptable to climate change.

2.4 Climate Change Effects on Kansas Forests

The Role of Kansas Forests

This section incorporates information from the Society of American Foresters' position statement on climate change. Kansas forests and the Kansas Forest Service play an important role in decreasing greenhouse gas (GHG) emissions by 1) encouraging the use of wood products instead of nonrenewable

materials, including biochar, 2) creating strategies to market woody biomass as an energy source, reducing fossil fuel energy use, and 3) decreasing wildfires and conversion of forests to other land-uses. Sustainably managing Kansas forests also will reduce GHG concentrations by sequestering atmospheric carbon in trees; and by storing carbon in soil and wood products made from harvested trees. Changes in long-term patterns of temperature and precipitation have affected Kansas forests growth and mortality. Longer growing and wildfire seasons, increased incidence of pest and disease, and climate-related mortality associated with drought and flooding are some examples. These changes are associated with increasing concentrations of atmospheric carbon dioxide (CO₂) and other GHG.

Carbon Stocks in Kansas Forests

According to *Northern Great Plains Forests 2015*, USDA Forest Service Northern Research Station, there are an estimated 146,787,666 metric tons of carbon stored in Kansas forests and forest soils (Figure 2.9). Table 2.2 lists metric tons of carbon stocks by forest type and where it is stored.

Why Kansas Forests are Important to Mitigate Climate Change

It is now clear that rapid development of wind, solar and other renewable, low- and no-carbon energy sources are not enough to meet the widely shared goal of keeping global average surface temperature from rising more than 2 degrees Celsius (3.6 degrees Fahrenheit) above pre-industrial levels. At current rates of emissions, the planet is on track to warm at least 3.5 degrees Celsius (6.3 degrees Fahrenheit) by the end of the century. High-tech carbon capture and storage technologies have not, and will not, be scaled up in time to make a significant contribution to carbon emissions reduction goals of 50% by 2030 established by the Intergovernmental Panel on Climate Change.

Removing carbon from the atmosphere is, however, a necessary component of any comprehensive strategy to address climate change. Fortunately, there are a range of practices that function as natural climate solutions that are based on protecting and restoring terrestrial ecosystems. These practices are relatively inexpensive, safe, and proven effective. Protecting existing healthy forest and wetland ecosystems and restoring degraded forests and wetlands have great potential to sequester significant quantities of carbon by moving carbon dioxide from the atmosphere into plants and soils through photosynthesis. Protection and restoration of these and our Kansas native grasslands also have multiple related ecological and social benefits. Intact ecosystems enhance water quality, protect against drought and flooding, enhance soil health and protect and enhance biological diversity.

Kansas Forest Service foresters and other natural resource professionals are in key strategic positions to directly impact land management practices to enhance carbon sequestration, long-term carbon storage and preservation of biological diversity. Shifting focus slightly from maximizing income from timber and other forest products to an emphasis on carbon sequestration, carbon storage and the long-term ecological health and diversity of forested land does not require a wholesale change in training and practice. It may require a qualitative shift in emphasis and possibly some education of landowners and colleagues.

Carbon markets and carbon offset programs appropriate for the smaller forestland ownerships in Kansas such as Carbon Works are beginning to emerge as an incentive to protect and enhance forest and soil carbon. These programs pay landowners to preserve forest carbon and expand new tree plantings and land management practices to address climate change. Participation in carbon markets may increase as markets improve and government policies catch up. Meantime, shifting forestry practices to longer rotations, active forest stand improvement thinnings, maintaining species diversity and preserving most

Table 2.2. *Carbon stocks in the top two forest types and the importance of forest soils.*

Forest type group	Carbon Content (Million Metric Tons)				
	Live Biomass	Dead Wood	Litter	Soil	Total
Oak / hickory	26,000,984	3,550,186	3,643,984	45,454,877	78,650,031
Elm / ash / cottonwood	20,885,391	3,302,990	2,102,335	25,053,130	51,343,846
Other eastern softwoods	872,054	165,834	1,166,576	2,678,632	4,883,096
Oak / pine	920,241	129,072	774,233	2,663,933	4,487,479
Exotic hardwoods	796,340	119,768	104,045	1,620,859	2,641,012
Nonstocked	97,853	82,708	125,120	1,263,146	1,568,827
Other hardwoods	225,165	53,472	80,253	1,177,102	1,535,992
Maple / beech / birch	331,628	46,014	80,277	360,269	818,188
Oak / gum / cypress	283,716	40,471	34,924	337,131	696,242
White / red / jack pine	60,404	13,309	17,144	71,931	162,788

large, long-lived trees are proven methods of enhancing carbon storage in intact forests. Planting a variety of long-lived resilient native species like bur oak to restore previously degraded forested land will store carbon more effectively than plantations of a single or few species on land not previously forested. Reforesting riparian areas stores carbon, prevents streambank erosion, improves water quality and creates important wildlife habitat. These natural climate solutions are proven effective, readily available and relatively inexpensive. Often overlooked and underappreciated, these practices remove carbon from the atmosphere and provide multiple ecological benefits. Kansas foresters and other natural resource professionals are our front-line resource for natural climate solutions.

Tree Planting

Research from the American Academy for the Advancement of Science indicates planting one trillion trees across the world could sequester 205 gigatonnes of carbon, the equivalent of two-thirds of all manmade carbon since the Industrial Revolution. Tree planting is on the list of climate-fighting strategies from the nonprofit Project Drawdown, a worldwide network of scientists proposing solutions to global warming. In Kansas, tree planting should be focused in communities with inadequate canopy cover and in riparian areas to improve water quality and provide streambank stabilization. Agroforestry practices like windbreaks can sequester carbon while reducing soil erosion, increasing crop yields, protecting livestock and providing energy savings to farmsteads. GIS data layers for Sustaining Water Quality and Quantity and Sustaining Forest

and Agroforestry Ecosystems should be used to prioritize efforts. Kansas Forest Service will work closely with USDA Forest Service and other partners to create a tree planting initiative to implement the Trillion Trees Act.

Planting tree species that will be resilient to projected changes in climate is an important strategy. Models like the USDA Forest Service, Northern Research Station's, Tree Atlas (www.nrs.fs.fed.us/atlas/tree/#) will help guide the promotion of species like bur oak, American basswood, American plum and pecan who appear on the "winner's list" for climate adaptability (Table 2.3). Tree Atlas assesses current status (2000) and potential future status (2100) of tree species following climate change. Tree Atlas uses USDA Forest Service Forest Inventory and Analysis data with 38 environmental variables to generate models of current suitable habitat for each species. Then they change the climate according to a General Circulation Model (GCM) from Mild, an average of 3 GCMs under low carbon emissions where there is active human intervention to curb carbon emissions, to Harsh with an average of 3 GCMs under high carbon emission or business as usual. The table below shows the mean change in Importance Value (IV - relative abundance) for each species from current modelled to the future Harsh scenario/business as usual. This provides the difference in Importance Value (IV) from the current to the modelled scenario and the winners and losers. The specific table below identifies winners in a high carbon scenario based on change in relative abundance.

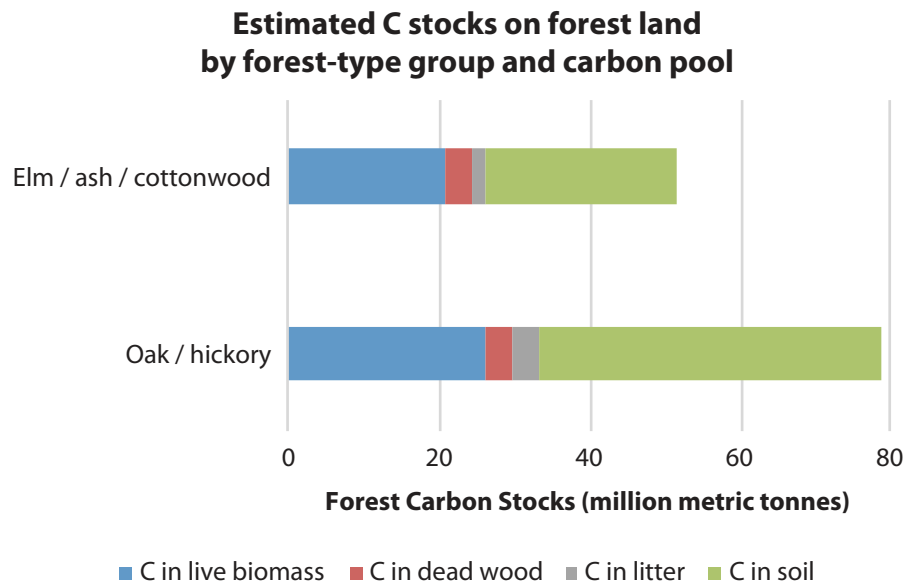


Figure 2.9. An estimated 146,787,666 metric tons of carbon are stored in Kansas forests and forest soils (USDA Forest Service Northern Research Station, 2018)

Table 2.3. *Gcm3AvgHiDif* column (General Climate Model 3, Average High Difference), represents trees predicted to be “Winners” — those that will increase in abundance, using the average of three climate models: Hadley, Parallel, and Geophysical Fluid Dynamics. A high-carbon scenario was used since the current carbon emission pathway is more aligned to a harsh scenario. The trees are listed in descending order by percent change in predicted relative abundance by the year 2100. The table shows the mean change in Importance value (IV)/relative abundance, for each species in the state from the current model year 2000 to the year 2100.

Spp#	Species Common Name	Species Scientific Name	Gcm3AvgHiDif
313	Boxelder	<i>Acer negundo</i>	3.47
823	Bur Oak	<i>Quercus macrocarpa</i>	2
971	Winged Elm	<i>Ulmus alata</i>	0.85
835	Post Oak	<i>Quercus stellata</i>	0.6
951	American Basswood	<i>Tilia americana</i>	0.54
461	Sugarberry	<i>Celtis laevigata</i>	0.48
766	Wild Plum	<i>Prunus americana</i>	0.41
452	Northern Catalpa	<i>Catalpa speciosa</i>	0.38
373	River Birch	<i>Betula nigra</i>	0.33
824	Blackjack Oak	<i>Quercus marilandica</i>	0.29
921	Peachleaf Willow	<i>Salix amygdaloides</i>	0.27
809	Northern Pin Oak	<i>Quercus ellipsoidalis</i>	0.25
922	Black Willow	<i>Salix nigra</i>	0.2
827	Water Oak	<i>Quercus nigra</i>	0.16
131	Loblolly Pine	<i>Pinus taeda</i>	0.15
408	Black Hickory	<i>Carya texana</i>	0.09
404	Pecan	<i>Carya illinoensis</i>	0.07
746	Quaking Aspen	<i>Populus tremuloides</i>	0.07
901	Black Locust	<i>Robinia pseudoacacia</i>	0.06
110	Shortleaf Pine	<i>Pinus echinata</i>	0.04
317	Silver Maple	<i>Acer saccharinum</i>	0.04
409	Mockernut Hickory	<i>Carya tomentosa</i>	0.04
973	Cedar Elm	<i>Ulmus crassifolia</i>	0.04
94	White Spruce	<i>Picea glauca</i>	0.03
129	Eastern White Pine	<i>Pinus strobus</i>	0.03
834	Shumard Oak	<i>Quercus shumardii</i>	0.02
611	Sweetgum	<i>Liquidambar styraciflua</i>	0.01
741	Balsam Poplar	<i>Populus balsamifera</i>	0.01
812	Southern Red Oak	<i>Quercus falcata var.falcata</i>	0.01

ASSESSMENTS AND STRATEGIES

The *Kansas Forest Action Plan* helps focus and leverage limited financial resources to address priority issues that threaten or benefit the forest and agroforestry resources of Kansas. The specific economic and environmental benefits of these resources are described in detail throughout this chapter along with the issues that threaten them.

This chapter is organized by the major threats and benefits facing Kansas forest resources and seven priority issues categorized under them. Each section explains why each issue has been selected. This is followed by a description of GIS methods used to identify priority areas. Composite maps, which may include multiple layers, have been created for each of the seven issues. The three issues under threats and the four issues under benefits are used to create summary composite maps for threats and benefits. Strategies of how each issue will be addressed follow the GIS methodology. Each strategy identifies priority landscapes where the issue will be addressed; national objectives associated with the issue; applicable USDA Forest Service S&PF Programs; necessary resources; and performance measures to determine success.

The next section includes an assessment and strategy summary that describes how the threats and benefits composite maps are combined into a final map identifying priority areas. These priority areas have been further grouped into priority landscapes and named (Figure 3.17). Summary threats and benefits matrices for each issue have been included in Appendix D for quick reference.

The chapter ends with a map of seven multi-state areas of regional priority and a description of each area. This information will facilitate project collaboration across state boundaries.

GIS Methodology

Several environmental settings and procedural processes were applied throughout the data creation process and are described below. The data analysis input layers and composite layers described and depicted in the 'Forest Resource Threats,' 'Forest Resource Benefits and Services,' and 'Final Statewide Composite Methods' sections follow the general procedure used in the Kansas Forest Stewardship Program Spatial Analysis Project (Hutchinson et al. 2008), and observe the suggestions put forth in the *State Assessments & Resource Strategies: Final Guidance* (Appendix A). Data was processed to, and



Kansas forests provide many valuable ecosystem services.

analysis was performed at, a 30 square meter resolution using several geoprocessing tools.

3.1 Forest Resource Threats

3.1.1 Issues that Threaten Kansas Forest Health

The issues that threaten forest health in Kansas are diverse in their form, intensity, distribution, and impact. In addition, these issues do not operate independently of each other, but instead interact and contribute to an overall situation that can be described as challenging.

Among the most notable of the insect and disease risks to Kansas forests are emerald ash borer, pine wilt, and thousand cankers disease of black walnut. These relatively recent threats join long-standing problems such as bagworms, pine tip blight, pine needle blight, oak wilt, and anthracnose. These



Emerald ash borer trees marked for removal in Roeland Park, Kansas.



Emerald ash borer damaged trees in Paola, Kansas.



The emerald ash borer has been found as close to Kansas as Wayne County, Missouri. It has the potential to kill millions of Kansas ash trees.

pests and diseases are facilitated and magnified by the various abiotic stressors that are a reality of the Great Plains; including drought, flooding, extreme weather events, and highly alkaline soils. Finally, otherwise functional forests and ecosystems face disruptive pressure from invasive plants such as Asian bush honeysuckle, tamarisk, Russian-olive, and Callery pear.

Emerald Ash Borer

Since it was first detected in Kansas in 2012, the emerald ash borer has made a slow march across northeast Kansas, and as of 2020 it has been detected in 10 total counties, all contiguous within the Kansas City – Topeka corridor.

The slow progression suggests success in long-term “Don’t Move Firewood” outreach, as human-aided movement is

known to be the major risk factor for the rapid spread of emerald ash borer and many other insect pests.

Though only 10 of Kansas’s 105 counties are currently known to have emerald ash borer populations as of 2020, there remains a large resource at risk of emerald ash borer-caused mortality. By volume, ash is the fourth-largest tree resource in the state, with 251.7 million cubic feet contained in more than 50 million live trees greater than 1-inch diameter (USDA FS Resource Update FS-172, Meneguzzo).

In addition, within the critically important and highly functional riparian systems and windbreaks of Kansas, there are an estimated 15 million ash trees. A recent study suggests that these trees are a major component of riparian systems in Kansas and across the Great Plains, as much as 64% of all trees in natural riparian forest buffers (Summary of Findings from the *Great Plains Tree and Forest Invasives Initiative*, Meneguzzo et al.).

With pending federal deregulation of emerald ash borer, the Kansas Forest Service and partners formed a unified plan to maintain outreach messaging, survey & detection, and technical support for Kansas communities going forward. These efforts will help blunt the impact of emerald ash borer, as the compensatory value of urban ash in Kansas is more than \$1.3 billion (USDA FS NRS-71, Nowak et al.). The Kansas Forest Service continues to assist communities with transitioning to a more diverse canopy, with less risk from future threats.

Asian Bush Honeysuckle

Anecdotal evidence suggests that since its introduction in the late 1800s, Asian bush honeysuckles (*Lonicera maackii*, *L. morrowii*, *L. tatarica*, *L. x bella*) were widely planted for ornamental and conservation purposes. They have since become well-established in the landscape and are responsible for the degradation of ecosystem function through the creation of a



Asian bush honeysuckle.

monoculture across much of the central part of the United States, including much of eastern and central Kansas.

While Asian bush honeysuckle is far from the only woody invasive plant that disrupts Kansas landscapes, it is among the most detrimental and widespread. By allelopathic suppression of native species germination, and by shading out competitors with an extended leaf-out season, bush honeysuckles create monocultures that eliminate forest regeneration and harm nesting success of native birds.

In parts of Kansas where emerald ash borer has begun to see increased mortality on native stands of ash, bush honeysuckle is being released from the understory near now dead ash and is further impacting the native forest land.

A 2016-2017 project, “Aerial Survey and Classification of Bush Honeysuckle,” a partnership between the Kansas Forest Service and Kansas State Polytechnic, funded in part by a USDA Forest Service grant, attempted to assess the distribution of bush honeysuckle in five major Kansas cities known to be infested.

This assessment estimated that significant acreage of bush honeysuckle existed within Lawrence (7.5% of mapped area within the city), Hutchinson (0.9%), Manhattan (1.7%), Topeka (10.0%), and Wichita (1.6%). These numbers are estimates based on classification, but the resultant maps assisted local land managers with making strategic decisions on areas to focus treatment efforts.

Pine Wilt

For decades, Scotch pine (*Pinus sylvestris*) and Austrian pine (*Pinus nigra*) were widely planted across the Great Plains in windbreaks, living snow fences, homesteads, and cities. These trees, while not native to the state, performed extremely well in the harsh conditions.



Pine wilt.

Beginning in 1978 in southeast Kansas, pine wilt has now spread throughout much of the eastern two thirds of the state. This disease, caused by the pine wilt nematode and vectored by the pine sawyer beetle, causes rapid decline and death of susceptible pines; including Scotch and Austrian pines. Pine wilt nematodes have been found in stressed and declining ponderosa pine and eastern white pine, but have not been implicated as a sole or major cause of mortality in these native species of pine.

Current estimates suggest that there are roughly 126,000 live Scotch pines and 117,000 live Austrian pines remaining in Kansas, with many of these likely in extant functioning windbreaks across Kansas where they provide significant benefits for livestock, cropland, and homes (USDA Forest Service Resource Update FS-172, Meneguzzo).

In some cities, such as Hays, Dodge City, Norton, and others in the western third of Kansas, significant numbers of susceptible pines remain as a large component of the urban forest. In the most recent survey conducted in Hays by the Kansas Forest Service, Kansas State University Research and Extension, and the Kansas Department of Agriculture, 7,850 remaining pines were found within the city limits after years of systemic removals of pine wilt positive trees. This work has clearly led to the extended life, and extended benefits provided by, the pines of Hays.

Table 3.1. Kansas Department of Agriculture helicopter survey results of estimated tamarisk infestation along the Arkansas River and Cimarron River corridor by county (survey includes portions of Chikaskia River, Crooked Creek, Medicine River, and Meridin River) (Kansas Water Office, 2005).

County	Total Acres Tamarisk	Percent Tamarisk Infestation	County	Total Acres Tamarisk	Percent Tamarisk Infestation
Hamilton	5,606	75	Sumner	<1	0
Kearny	3,644	71	Cowley	<1	0
Finney	1,804	58	Barber	1,513	68
Gray	960	41	Comanche	3,550	84
Ford	1,798	41	Clark	9,389	95
Edwards	989	53	Meade	4,104	89
Pawnee	492	27	Seward	3,642	61
Barton	58	6	Stevens	553	25
Rice	628	29	Morton	5,732	67
Reno	1,376	34	Grant	300	24

Tamarisk

Tamarisk, or salt-cedar, is a non-native phreatophyte that has seriously impacted riparian lands in Kansas. Tamarisk is a shrub or small tree with a deep root system and a tendency to increase soil salinity and decrease available water as it pushes out native woody vegetation such as cottonwoods and willows.

This invasive plant is well-established along several watersheds in western and central Kansas, with the Arkansas, Cimarron, and Rattlesnake among the most heavily impacted. The most recent (2005) comprehensive survey indicates that there are 52,927 acres of tamarisk infestation in Kansas. Estimates indicated that 56% (16,500 acres) of the Arkansas river riparian corridor from the Kansas-Colorado state line to Hutchinson is infested with tamarisk. Major infestations are present in Meade (14,400 acres), Hamilton (5,605), Comanche (3,810), Kearny (3,644), Morton (2,637), Finney (1,803), Ford (1,797), and Phillips (1,520) counties.

There have been successful treatment projects in Kansas, with removal along the Rattlesnake Creek watershed being particularly successful in restoring native habitat and stream-flow. However, up-to-date data on tamarisk infestation extent,

coupled with other local factors, has slowed progress in other parts of the state.

Thousand Cankers Disease of Black Walnut

First described in 2008 in Colorado, thousand cankers disease of black walnut has spread across much of the West, and it has been detected in parts of the black walnut’s native range in the East as well. As of this publication, thousand cankers disease has not been detected in either Kansas or Missouri, but several known infestations in eastern Colorado persist and threaten the walnuts growing at the edge of their range in Kansas. This disease kills black walnuts through mass attack of the walnut twig beetle carrying the *Geosmithia morbida* fungus.

Doniphan, Bourbon, Franklin, Osage, Linn, Leavenworth, and Pottawatomie counties contain the largest number of black walnut trees in Kansas. Overall, there are more than 21.5 million live walnut trees in the state, containing an estimated volume of 383.2 million board feet of valuable black walnut lumber. In terms of this resource, thousand cankers disease poses a potential threat of the direct loss of at least 50 jobs and \$160 million in economic loss over the next 20 years if it becomes established in Kansas.



Tamarisk in Morton County, Kansas.



Thousand cankers disease of black walnut. Karen Snover-Clift, Cornell University, Bugwood.org.

Issues that Threaten Kansas Forest Health — Composite Map

Asian Bush Honeysuckle, Emerald Ash Borer, Pine Wilt, Tamarisk and Thousand Cankers Disease

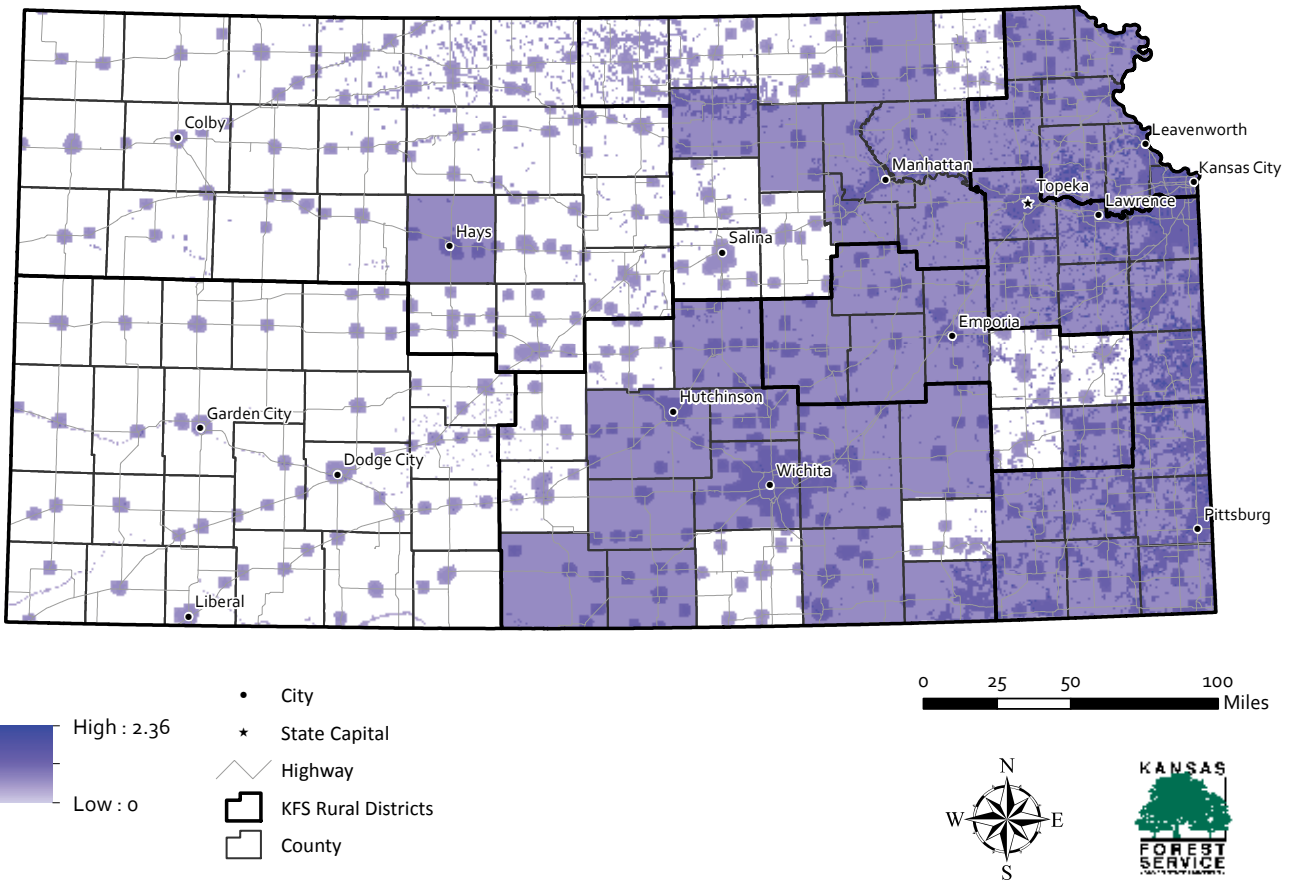


Figure 3.1. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: Bush Honeysuckle, Emerald Ash Borer risk (high and moderate), Pine Wilt status (absent, present, and transition), tamarisk, and Thousand Cankers Disease.

GIS Methodology — Issues that Threaten Kansas Forest Health

The ‘Issues that Threaten a Healthy Forest’ composite layer was created using a ‘Weighted Sum’ analysis to combine eight individual data layers derived from four separate datasets. The four base datasets, 1) Emerald Ash Borer Risk, 2) Forest Inventory and Analysis Pine, 3) Pine Wilt Presence Assessment, 4) Tamarisk, were processed into EAB ‘High,’ EAB ‘Moderate,’ Pine Wilt ‘Present,’ Pine Wilt ‘Transition,’ Pine Wilt ‘Absent,’ and Tamarisk, 5) FIA Black Walnut, 6) Bush Honeysuckle Presence, and 7) Thousand Canker Disease.

Bush Honeysuckle

Several species of bush honeysuckle have been infesting Kansas’s forestland. Staff used the Early Detection and Distribution Mapping System to create a layer of counties with a reported sighting of one of the Honeysuckle species including Amur, Tatarian and Bell’s. The layer was confirmed by the Forest Health forester and then the layer was put into raster

format. All counties with a confirmed report of bush honeysuckle was assigned a value of ‘1’ and all other counties were assigned a value of ‘0’.

Emerald Ash Borer Risk (Two Input Layers)

Emerald Ash Borer Risk data were obtained from the USDA APHIS Cooperative Emerald Ash Borer Project as raster dataset covering North Dakota, South Dakota, Nebraska and Kansas. Risk of emerald ash borer introduction and establishment is defined as a geographic function of four characteristics: preferred home range, community ash forests, proximity of community ash forest to natural forests and phloem insect interceptions at U.S. ports of entry (citation needed). The original 750 x 750 meter resolution dataset contained 11 risk values (0 (low) – 10 (high)); areas of highest risk were those dominated by ash stands or community areas, with risk levels lowering in concentric gradient away from community areas. To create the emerald ash borer data layers used in production of the Issues that Threaten a Healthy Forest composite layer, the original values of ‘9’ and ‘10’ were reclassified as ‘1’ to create an emerald ash borer ‘High’ data layer; all other areas

were assigned '0'. Values '6', '7' and '8' were classified as '1' to create the emerald ash borer 'Moderate' data layer; all other original data values were classified as '0'.

Pine Wilt Status (Three Input Layers)

Pine wilt status information was obtained from the Kansas Department of Agriculture, State Plant Pathologist Gaelle Hollandbeck. Three zones were identified with this work: a present zone, a transition zone, and a zone where the disease is absent. With this information, a raster was created for each zone with the zone assigned a value of '1' and the area outside the zone assigned a value of '0'.

To further refine this data layer input, pine data from the U.S. Forest Service, Rocky Mountain Research Station were obtained. The data is a 250 x 250 meter resolution modeled raster of live tree species basal area. Pine wilt only impacts Scotch and Austrian Pine species so they were selected and combined. Any cell with a value greater than '0' was assigned a value of '1' and values of '0' maintained their value of '0'.

To create the final pine wilt layers for analysis, we combined the pine wilt zone rasters with the Rocky Mountain Research Station pine raster. Cells where the pine data overlapped with the pine wilt present zone were reclassified to '1' and all other values were '0'. The same methodology continued with the pine data and the two other pine wilt zones: transition and absent. Three rasters were created representing pine in the 'Present Zone', 'Transition Zone' and 'Absent Zone'.

Wilson, Barry Tyler; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. Live tree species basal area of the contiguous United States (2000-2009). Newtown Square, PA: USDA Forest Service, Rocky Mountain Research Station. <https://doi.org/10.2737/RDS-2013-0013>

Tamarisk

Tamarisk data was recreated from a map published by the Kansas Water Office and Kansas Department of Agriculture from a tamarisk survey done in 2004. The map estimated acres of tamarisk as reported in the Western States Quarterquad Survey. This single polygon layer was then converted to a raster layer. Due to the ability of tamarisk to out compete native species, the Tamarisk analysis layer incorporates all quarterquads with more than one acre of tamarisk. The areas were then subsequently reclassified with a value of '1,' while all zero values received a value of '0.'

Kansas Water Office. (2005). 10 year strategic plan for the comprehensive control of tamarisk and other non-native phreatophytes, Topeka, Kansas, December 2005.

Thousand Canker Disease

Thousand Canker Disease threatens the most economically important tree species in Kansas. Unfortunately, there is not geospatial data representing this risk, but incorporating an analysis input data layer portraying black walnut information was a priority. Modeled live volume (basal area) black walnut data were obtained from U.S. Forest Service, Forest Inventory and Analysis program at a 250 x 250 meter cell resolution. All cells with values greater than five square feet were reclassified to a value of '1' and cells with values less than or equal to 5 square feet per acre were assigned a value of '0'.

Wilson, Barry Tyler; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. Live tree species basal area of the contiguous United States (2000-2009). Newtown Square, PA: USDA Forest Service, Rocky Mountain Research Station. <https://doi.org/10.2737/RDS-2013-0013>

Issues that Threaten Kansas Forest Health — Composite Map

After developing the eight individual analysis data layers described above, a 'Weighted Sum' analysis was performed, in which each '0', '1' analysis raster is assigned a weight (Table 3.2) based on an average of data value returns from 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 2.36 (Figure 3.1). These values were later combined with similarly produced values from the 'Wildfire Risk' (Section 3.1.2) and 'Loss of Kansas Forestland' (Section 3.1.3) threats to produce a composite 'Forest Threats' layer (Figure 3.5).

Strategy for Forest Health Threats

This Forest Action Plan is intended to guide strategies dealing with identified threats by assessing the potential impact of each threat and responding to the highest priorities with effective mitigation and restoration strategies.

While these threats do not represent an exclusive list of factors that negatively affect forest health and tree vigor in Kansas, they are representative of the factors that have been identified as highest priorities, and the factors that have feasible mitigation strategies that could be employed.

This process aligns with the national objective of "identifying, managing, and reducing threats to forest and ecosystem health." Resources available from the USDA Forest Service that can support the Kansas efforts to address these issues can be found within the State and Private Forestry programs such as Forest Health Management, Forest Stewardship Program and the Urban and Community Forestry Program.

State partners that can play a critical supporting role in achieving objectives related to forest health threats include Kansas State University Research and Extension, Kansas

Table 3.2. Kansas Forest Service Staff Average Ranking of Forest Issues/Data Layers

	Analysis Weight (Average Score)
Threats	
Issues that Threaten Forest Health	
Bush Honeysuckle	0.68
Emerald Ash Borer High Risk	0.68
Emerald Ash Borer Moderate Risk	0.56
Pine Wilt Absent	0.34
Pine Wilt Present	0.35
Pine Wilt Transition	0.39
Tamarisk	0.51
Thousand Cankers Disease	0.61
Wildfire Risk	
Conservation Reserve Program	0.54
Eastern Red Cedar in Grassland	0.59
Historic Fires	0.50
Insurance Services Office Fire Station Coverage Gaps	0.50
Wildland Fire Occurrence	0.68
Wildland Fire Potential High	0.59
Wildland Fire Potential Very High	0.66
Wildland Urban Interface	0.69
Loss of Kansas Forestland	
High Risk for Development	0.48
Moderate Risk for Development	0.43
Forest Fragmentation	0.56
Urban & Community Forest Index	0.59
Benefits	
Sustaining Water Quality and Quantity	
High SSURGO Runoff Riparian Areas within WRAPS Active Watersheds	0.69
High SSURGO Runoff Riparian Areas within WRAPS Partnership Watersheds	0.63
KDWPT Aquatic Ecological Focus Areas	0.58
Stream Order 1-3 with State Owned Storage	0.69
Protecting and Restoring Forest Biodiversity and Wildlife Habitat	
Departure Index 2014	0.49
Forest Patches ≥ 40 acres	0.63
KDWPT Terrestrial Ecological Focus Areas	0.66
Kansas Natural Heritage Inventory Rare Species	0.69
Mean Fire Return Interval 0-5 years	0.44
Mean Fire Return Interval 6-10 years	0.44
Mean Fire Return Interval 11-15 years	0.49
Sustaining and Protecting Forest and Agroforestry Ecosystems	
Agroforestry Potential	0.48
Forest Adjacent to Protected and Managed Areas	0.54
Management Plan Properties	0.58
Non-Forest Stewardship Program High Stewardship Potential Private Forests	0.68
Potential High-Quality Forests	0.69
Tree Shrub Suitability	0.61
Community Woodland	0.45
Maintaining and Protecting Economic Benefits of Woodlands	
Biomass	0.56
Black Walnut	0.63
Forests within Mill Average Haul Areas Mills Overlap 1-5	0.54
Forests within Mill Average Haul Areas Mills Overlap 6-10	0.50
Forests within Mill Average Haul Areas Mills Overlap 11+	0.52

Occurrence of Eastern Redcedar by Volume

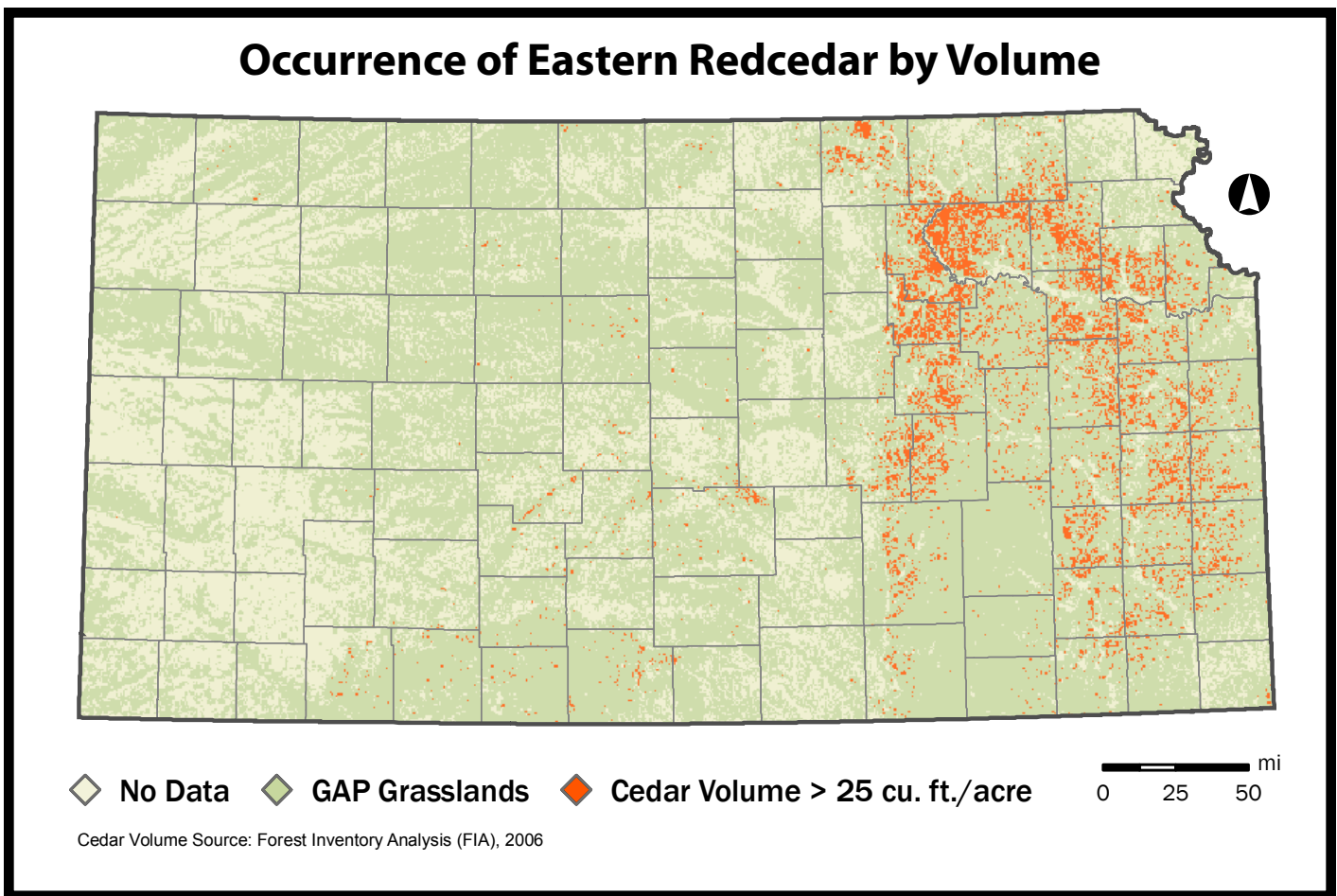


Figure 3.2. Occurrence of Eastern Redcedar in Kansas by volume (cubic feet per acre).

Department of Agriculture, and Kansas Department of Wildlife, Parks and Tourism.

Additional partners, especially land managers on the local level, need to be engaged in order to achieve meaningful and sustainable outcomes on the ground.

While state quarantines are in place for thousand canker disease and emerald ash borer, these will need to be revisited and updated as new regulations and new science has changed our understanding of best management tactics for these pests. Key components of effective regulation and partnership still include a focus on limiting firewood movement, early detection and delimitation of infestations, and coordinated public outreach on detection and treatment. Partnerships with other agencies will continue in monitoring forest health conditions, including support for field survey and detection work done by Kansas Department of Agriculture specialists. This includes trapping and surveying for emerald ash borer, thousand canker disease, pine wilt, and other novel threats as they emerge. Increased and sustained engagement with local Kansas State Research and Extension county and/or district extension agents is also a priority.

Support for community and rural tree inventories and surveys will help reduce the risk of latent infestations and undetected spread of several pests including emerald ash borer, thousand cankers disease, pine wilt, and others. Data from previous Community Tree Assessment Protocol (CTAP) inventories of pine, walnut, and ash in Kansas communities can be used to estimate removal and replacement costs due to these insect and disease threats. Community inventories of tree species should be updated, with the Kansas Forest Service Community Forestry program, and local communities across the state. Communities with high proportions of susceptible species (ash, walnut, pine, etc.) can receive prioritized service and guidance to reduce risks to their community forest resource.

A focus on effective outreach to the public will continue, with outreach efforts going beyond workshops and publications. Interactive remote training facilitated through technology will be prioritized to reach Kansans not able to attend regional in-person events. Engaging citizen science through a pest detectors program can assist with monitoring for new pest infestations and outbreaks. Reporting infestations of invasive plants can also guide outreach and prioritize efforts to assist landowners in areas of greatest need.

Participation in regional forest health initiatives and collaborative information-sharing will continue, as these efforts have resulted in leveraged partnerships in the past in response to regional forest health threats such as emerald ash borer, thousand cankers disease, and invasive tamarisk. For threats not yet present in Kansas, working with regional specialists to bring hands-on training to Kansas resource professionals (such as thousand cankers disease in Colorado) increases expertise available to respond to future Kansas threats.

Strategic plans developed with broad partnerships will be revisited and revised for all known forest health threats, including emerald ash borer, thousand cankers disease, and tamarisk and/or invasive plants. These plans must be up-to-date and actionable for partners to have meaningful participation and buy-in.

Southwestern Kansas will be the focus of tamarisk control along the mainstem and tributaries of the Arkansas River and Cimarron River and specifically in the Cimarron Breaks Priority Landscape. This regional priority will require coordination and collaboration with Colorado-based resources to be most effective. A multistate priority area on control of tamarisk and other invasives is shared with Nebraska and includes the Republican River basin. Additional and updated inventory efforts are needed to identify target areas for tamarisk and Russian-olive control. Management will include inventory/mapping, control, regeneration, monitoring, and maintenance.

An Exotic Invasive Species Committee for plants could be appointed by the Governor's Natural Resource Subcabinet to coordinate and develop policy and guidelines to address invasive plant issues, including representation from natural resource agencies, university researchers, and local agencies such as county weed directors.

Resources Required / Performance Measures

The Kansas Forest Service has largely operated in response to forest health threats in a highly distributed manner, with leadership housed in the state office and outreach, reporting, and program delivery spread between Kansas Forest Service field foresters and partners in Kansas State Research and Extension specialists and staff with the Kansas Department of Agriculture Plant Protection and Weed Control division.

These partnerships have resulted in meaningful outcomes not likely attainable through a unilateral Kansas Forest Service effort. However, limited resources have also led to only the highest-priority issues being effectively addressed, and in many cases, short-term grant funding has made sustaining these efforts impossible. Predictable and sustainable funding to address these concerns would result in better outcomes for the resources and the stakeholders in the long term.

Table 3.3. *KARS 2005 Kansas land cover dataset level 1 and 2 classes (Nowak and Greenfield, 2010).*

Level I and II Class Codes and Names
10. Urban
11. Urban Commercial/Industrial
12. Urban Residential
13. Urban Openland (Golf courses, cemeteries, parks)
14. Urban Woodland
15. Urban Water
20. Cropland
30. Grassland (Includes rangeland and pasture)
31. Conservation Reserve Program (CRP)
40. Woodland
50. Water
60. Other (Sandbars, quarries, segments of major highways)

Support for internal Kansas Forest Service capacity and sustained partnerships will result in continued successes in such areas as invasive insect and disease survey and detection, delimitation and mapping of invasive plants, and tracking of objective forest health condition data as opposed to anecdotal condition reports.

Important responses to forest health threats that have been only partially served include education and outreach regarding threats to the entire state, current condition reporting to the public for management decisions, and applied research and case study tracking to determine best practices for invasive plant control. In order to sufficiently respond to the prioritized threats to Kansas forests, additional resources must be identified to deliver these services.

Performance measures for these responses would include metrics including landowner technical assistance visits from rural foresters, community tree inventories completed, members of the public participating in trainings, acreage of invasive plant infestations controlled with assistance from Kansas Forest service personnel and equipment resources, survey summaries from partners at the Kansas Department of Agriculture, acreage of forestland treated for invasive plants through practice plans written by Kansas Forest Service foresters, and other objective measures as they become available.

3.1.2 Issues that Create Wildfire Risk

Except for eastern redcedar/hardwood, most forest types in Kansas do not pose the greatest fire management issues for the state; however, grasslands are a different story. Range and pasture lands make up more than 18 million acres or about 35% of the land area in Kansas with about 14% of that area

Issues that Create Wildfire Risk — Composite Map

Conservation Reserve Program, Eastern Redcedar in Grass,
Fire Potential Risk, Wildland Urban Interface and Fire Occurrence

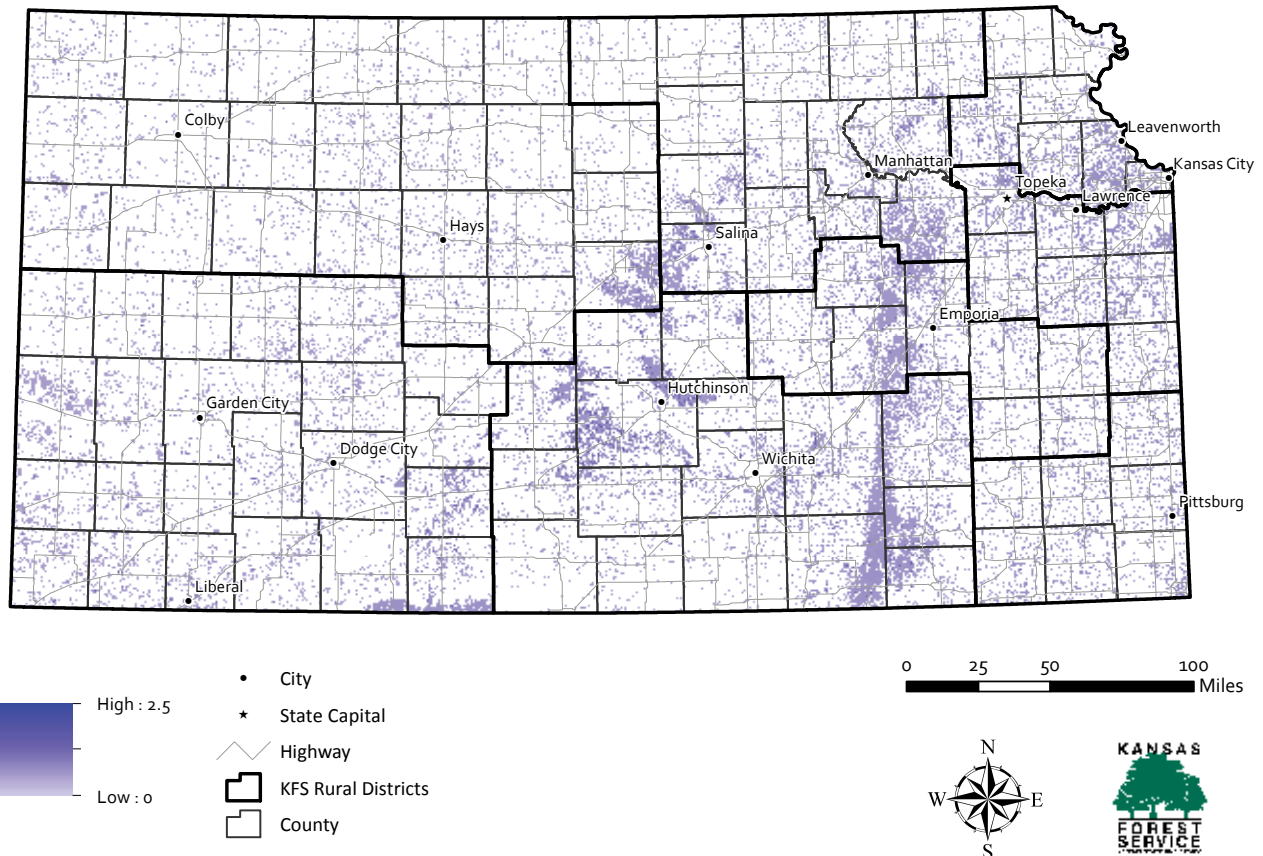


Figure 3.3. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following six datasets: Conservation Reserve Program Lands, Eastern Redcedar in Grasslands, Fire Occurrences, USFS Wildland Fire Potential (high and moderate), And Wildland-Urban Interface.

comprising Conservation Reserve Program lands. These areas and wildland-urban interface areas where development has occurred are the focus of wildland fire management issues in Kansas. Trends include larger fires, a shift in fuel characteristics with the expansion of eastern redcedar into grasslands, multi-operational period fires, and consolidation of fire departments.

Lack of prescribed fire as a land management tool in Kansas prairies is largely responsible for the 23,000% increase in eastern redcedar volume, and encroachment by other woody species over the last 45 years. This situation is indirectly responsible for population declines of “species of greatest conservation need” as identified in the Kansas State Wildlife Action Plan.

Conversely, the annual landscape scale burning common in the Kansas Flint Hills has raised EPA air-quality concerns in some Kansas and regional metropolitan areas. An estimated 1.5 to 2 million acres of Flint Hills prairie are burned

annually. In some years, the ecological, cultural, and/or weather conditions limit the opportunity to conduct these burns to only a few days. The emissions resulting from such temporally concentrated large-scale burning is a challenge that is addressed by December 2010 State of Kansas Flint Hills Smoke Management Plan. It is important to note the referenced smoke management plan is only for the Flint Hills region and not a statewide plan.

Current lack of local level, (i.e. fire district or county), requirements and a past lack of enforcement of state statutes has led to a lack of fire occurrence data for both prescribed and wildfire being available in Kansas. An increase in funding at the Kansas Department of Health and Environment to monitor satellite images provides a more accurate number of acres due to prescribed fire, which will give the Kansas Forest Service a much greater opportunity to begin using real-time fire occurrence data to assist in making the best fire management decisions.

Changes in fuel characteristics and continued development and fragmentation of rural areas suggests increased hazards and expense associated with wildland fire suppression.

After the historical fires in 2016 and 2017, a legislative audit was produced, *Kansas Wildfire Management: Evaluating the Adequacy of Kansas Wildfire Suppression System*. The audit pointed out that the Kansas Forest Service has the expertise but not the financial resources to provide additional training and firefighting resources to assist local fire authorities. An estimated 40% of Kansans are protected by volunteer rural firefighters.

In 2019, the Kansas Legislature approved a state budget that included a line item of \$650,000 to the Kansas Forest Service for Wildfire Suppression. The additional funding resulted in two district fire management officers, one assistant fire management officer, and a fire business specialist. The fire management officers core duties are to provide training, resource management, fire suppression assistance, and to promote prescribed fire throughout the state.

Additionally, the audit pointed out that the legislators also needed to authorize one agency as the lead authority, which at the time of publication has not been addressed. There is a need to create a system that tracks endemic areas of fire origin from a historical prospective and geographically identify large fires. Such information would foster strategic placement of suppression resources.

GIS Methodology — Issues that Create Wildfire Risk

The 'Wildfire Risk' composite layer was developed using a 'Weighted Sum' analysis to combine six data layers produced from a combination of eight separate datasets. In close consultation with the Kansas Forest Service's Fire Management Coordinator, and other Fire Management staff six data inputs were developed to represent Wildfire Risk in Kansas: 1) Wildland Urban Interface; 2) Fire Occurrences; 3) Conservation Reserve Program Lands; 4) Eastern Redcedar in Grasslands; 5) 'Moderate' Fire Potential risk and; 6) 'High' Fire Potential risk.

Conservation Reserve Program Lands

CRP land was identified by the Fire Management Program staff as critical land for wildfire fuel. CRP parcel data, current as of January 2019, were obtained from the Farm Service Agency. The polygon layer was converted to a raster layer with CRP parcels receiving a value of '1', and all non-CRP land receiving a value of '0'.

Eastern Redcedar in Grassland

Eastern redcedar, a species that has been encroaching into grasslands and interface areas throughout Kansas, was identified as a fire threat by Fire Management Program staff.

Modeled live volume (basal area) Eastern redcedar data were obtained from the U.S. Forest Service, Forest and Inventory Analysis at a 250 x 250 meter resolution. All cells with a greater than or equal to five square meters were reclassified to '1' and the other values were reclassified to '0'. The raster was then resampled to a 30 x 30 meter resolution.

The Kansas Applied Remote Sensing (KARS) program 2015 Kansas Landcover Dataset is the most recent available landcover dataset for Kansas and is used in land cover based layer creation throughout this Statewide Assessment. The layer has a resolution of 30 x 30 meter. Both warm-season grassland and cool-season grassland were reclassified at '1' and all other values were reclassified to '0'.

Cell Statistics was run on the resampled Eastern redcedar raster and grassland raster. The values of '0' and '1' were reclassified to '0' and the value '2' was classified as '1' as this showed the overlap in Eastern redcedar and grasslands.

Wilson, Barry Tyler; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. Live tree species basal area of the contiguous United States (2000-2009). Newtown Square, PA: USDA Forest Service, Rocky Mountain Research Station. <https://doi.org/10.2737/RDS-2013-0013>

Wildland Fire Occurrences (2009 – 2018)

Wildland fire occurrences are an important addition to the 2020 Forest Action Plan. Fire districts are required to report fires. This data was obtained through the Fire Marshal's office, geocoded and then reviewed for quality control. The 'Collect Events' tool was used to identify points stacked in one location. Staff reviewed all locations with 10 or more points and moved occurrences if there was more relevant data in the attribute table.

Once staff finished the review, the 'Point to Raster' tool was used to create a 30x30 meter resolution raster. All cells with a fire occurrence were classified with a '1' and the remaining cells were classified as '0'.

Wildland Fire Potential (Two Input Layers)

Wildland Fire Potential was characterized at a one-kilometer square cell size from 'Very Low' to 'Very High' based on fire intensity, frequency, weather and size. To create the 'Very High Wildland Fire Potential' data layer cells containing original data values of 'Very High' were reclassified to '1' while all other original values were classified to '0'. Similarly, cells containing original values of 'High' were reclassified to a value of '1', while all other original values were reclassified to '0' in order to create the 'High Wildland Fire Potential' layer.

Dillon, Gregory K. 2018. Wildfire Hazard Potential (WHP) for the conterminous United States (270-m GRID), version 2018 classified. 2nd Edition. Fort Collins, CO: Forest Service Research Data Archive. <https://doi.org/10.2737/RDS-2015-0046-2>

Wildland-Urban Interface (WUI)

In 2013, the West Wide Risk Assessment (WWA) was completed for the western states including Kansas. As part of the research, a wildland development area layer was created. This layer is more detailed than other WUI datasets (i.e. USFS Silvis, Theobald) because it uses LANDSCAN data which provide a better spatial delineation of wildland population patterns. The WWA provided several wildland development area layers, the Response Function Score layer was chosen as this was the final layer used in further WWA analysis. All areas with a value were assigned a value of '1' and areas of no data were given a value of '0'.

Issues that Create Wildfire Risk — Composite Map

The six data layer inputs described above were combined using a 'Weighted Sum' analysis, using, again, the weights (Table 3.2) based on average weights assigned by 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 2.5 (Figure 3.3). These values were later combined with similarly produced values from the 'Issues that Threaten a Healthy Forest' (Section 3.1.1) and 'Loss of Kansas Forestland' (Section 3.1.3) threats to produce a 'Forest Threats' composite layer and map (Figure 3.5).

Strategy for Issues that Create Wildfire Risk

Issues that create wildfire risk support the national objective of "Restoring fire-adapted lands and reducing wildfire impacts." Cooperative Fire Program is the main USDA Forest Service State and Private Forestry program that supports this objective. Areas where fire exclusion has led to an increase in eastern redcedar and other woody species will be identified and assessed geospatially. Local Community Wildfire Protection Plans (CWPP)¹ will further target priority areas to restore native prairie and mitigate wildfire impacts. New curriculum has been developed on basic firefighting techniques to be delivered by fire department personnel. A major focus of the Kansas wildfire risk strategy will be empowering stakeholders in the use of prescribed fire for prairie management and wildfire prevention in priority areas identified by Community Wildfire Protection Plans. The Kansas Forest Service will provide training and information on management of cedar and other undesirable species via prescribed fire and other suitable means at every opportunity. FireWise© and similar fire prevention programs will be implemented in wildland-urban interface priority areas as defined by Community Wildfire Protection Plans. Strategy must include exploring incentives with rural fire departments and the Kansas State Fire Marshal to improve quality, timeliness and availability of fire occurrence data for planning purposes. The Kansas Mesonet,

1 *Community Wildfire Protection Plan (CWPP) makes a community eligible to receive matching grant funding to do fuel reduction, prevention education and future planning within the community. (https://www.kansasforests.org/fire_management/fireplanning.html)*

Remote Automated Weather Stations and the 2016 National Fire Danger Rating System integrates weather and historic fire occurrence data to identify fire trends, danger, and forecasts.

Resources Required and Performance Measures for Issues that Create Wildfire Risk

Fire departments, RC&D's, emergency managers, landowners, conservation districts, Kansas State Firefighters Association, public land management agencies, rural/suburban development and/or residential improvement district homeowners' associations are all important partners to work with to accomplish the strategy. Additionally, assistance from county governments, RC&D's, local emergency planning committees and emergency managers, and contractors developing hazard mitigation plans, rural/suburban development and/or residential improvement district homeowners' associations can help deal with the wildland urban interface issues. The State Fire Marshal, National Weather Service, and K-State/State Climatologist can help establish a baseline and system to collect data on fire occurrence, weather and fuel conditions. Performance measures may include: 1) increasing the number of acres treated to restore fire-adapted ecosystems and maintaining those acres in desired conditions; 2) total acres treated to reduce hazardous fuels on state and private lands through the State Fire Assistance Program; 3) percent of at-risk communities that increase suppression capacity by increasing the number of trained/certified fire fighters; and 4) upgrading fire-suppression equipment or formation of a new department or expansion of existing ones.

3.1.3 Loss of Kansas Forestland

Each year an estimated 1 million acres of forestland is lost to development nationally.² Since 1992 urban areas in Kansas have expanded by 170,000 acres permanently converting significant areas of forestland to other uses. Conversion and fragmentation of forestland to development will continue with an estimated increase of our national population by 120 million in the next 50 years. The Kansas City metro area alone is projected to increase by 350,000 people in the next 20 years converting an estimated 400,000 acres of land to urban use. Of that 400,000 acres, 22% is described as having "good to high ecological value." Of the ecologically good to high rated land, 18% is forests and woodlands.

Riparian forests are generally located in areas where the most valuable agricultural crops are grown and often where prime urban development opportunities exist. Although no good trend data exists, experience and observation suggest that significant areas of riparian forest are converted to cropland and urban development each year adversely impacting water

2 *A newsletter with more information on this topic is available at: <http://www.fs.fed.us/pnw/science/fs/cifi88.pdf>*

Loss of Kansas Forestland — Composite Map

Risk for Development, Forest Fragmentation, Urban and Community Forest Index

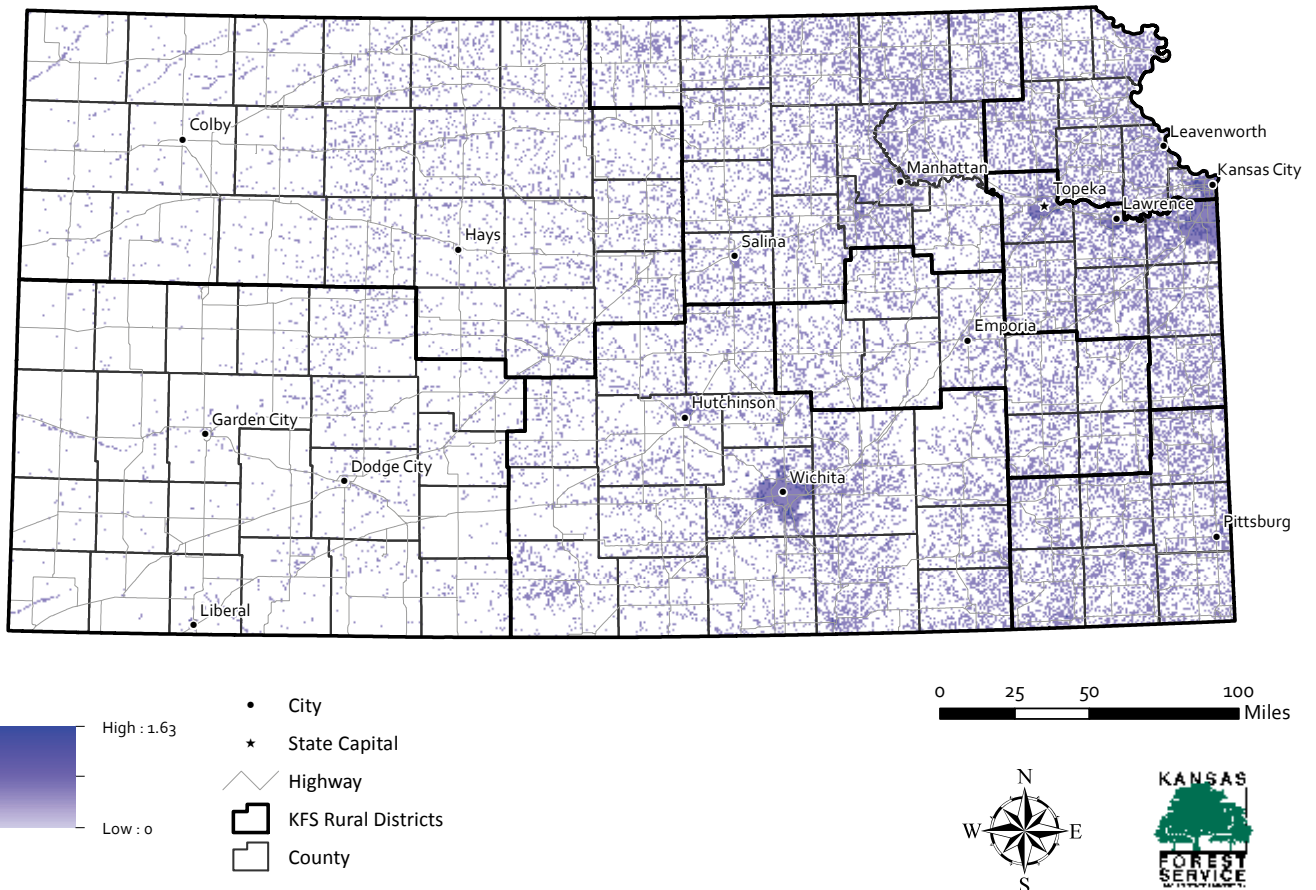


Figure 3.4. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: Development Risk (high and moderate) Forest Fragmentation, and Urban and Community Forestry Index,.

quality, aquatic and terrestrial species, and other benefits riparian forests provide.

There currently is a need for effective programs in Kansas that provide long-term protection of riparian forests. The Forest Legacy Program, other easement programs, increased use of stream setback ordinances, and emerging carbon markets could address these needs.

GIS Methodology — Loss of Kansas Forestland

The ‘Loss of Kansas Forestland’ composite layer was developed using a ‘Weighted Sum’ analysis to combine four data layers produced from a combination of five datasets. Urban forestry, development, and fragmentation issues are addressed through four data layers: 1) Urban and Community Forestry Index; 2) Forest Fragmentation; 3) ‘Moderate’ Development Risk and; 4) High Development Risk.

Development Risk (Two Input Layers)

Development Risk is one of the seven layers that were created for the U.S. Forest Service National Assessment. It was provided as a dataset for statewide assessments through the FSGeodata Clearinghouse. This dataset is intended to emphasize areas that are projected to experience increased housing development through 2030. One-kilometer square cells are classified from ‘no risk’ through to ‘very high risk’ of development. No areas of very high development risk are present in Kansas. For the final analysis, two development risk layers were created: ‘High’ and ‘Moderate.’ For the ‘High’ development risk category, cells from the original dataset containing a value of ‘high’ were reclassified to a value of ‘1,’ while all other cells were assigned a value of ‘0.’ Similarly, the ‘Moderate’ development risk category was created by reclassifying those original dataset cells containing a ‘moderate’ value to a value of ‘1,’ while all other cells were assigned a value of ‘0.’ <https://usfs.maps.arcgis.com/home/item.html?id=6d53dbb57c984e91a473a0c4b50c0714>

Summary of Forest Resource Threats — Composite Map

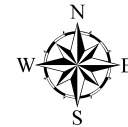
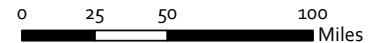
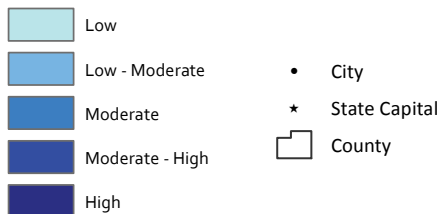
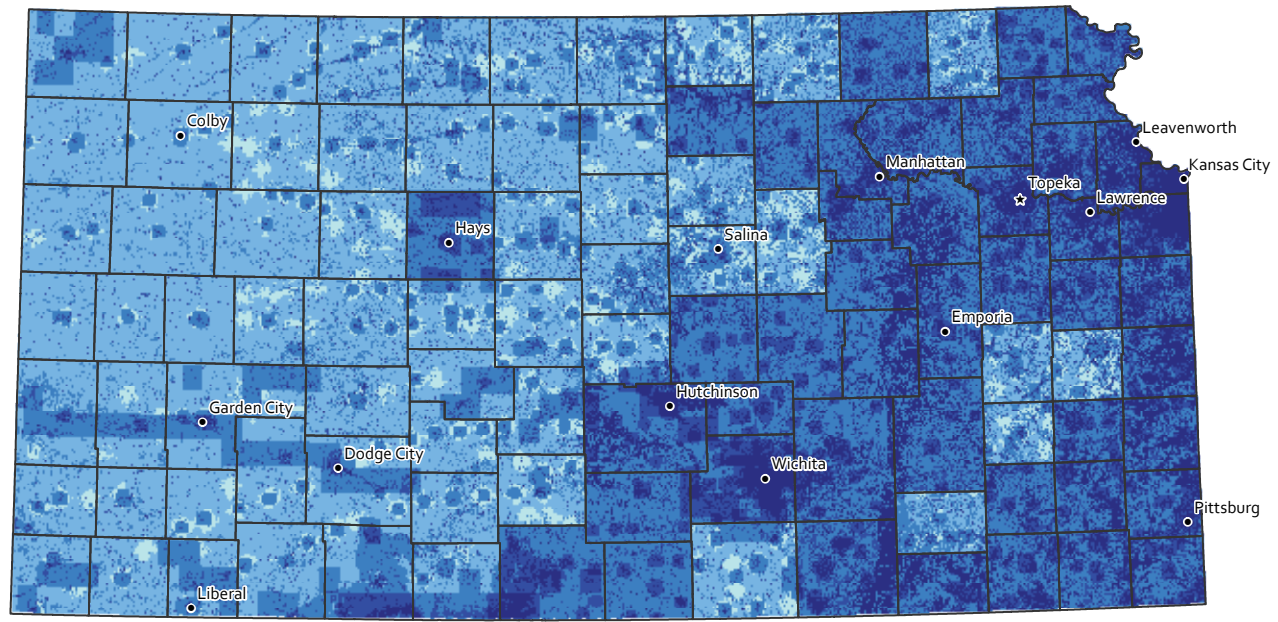


Figure 3.5. A five-class quantile reclassification of the weighted sum analysis combining the composite maps for: *Issues that Threaten a Healthy Forest, Issues that Create Wildfire Risk, and Loss of Forestland to Development.*

Forest Fragmentation

Forest Fragmentation in the state of Kansas is captured by the National Park Service NPScape. The data used the 2011 National Landcover Dataset and classified forest density into six categories: rare, patchy, transitional, dominant, interior and intact. For this analysis, the values rare, patchy and transitional were reclassified to '1' and dominant, interior, intact and all other values were classified to '0'. <https://irma.nps.gov/DataStore/Reference/Profile/2184565>

Urban and Community Forestry Index

The Urban and Community Forestry Index (UCF-i) is designed to identify areas where urban tree planting should be targeted as a function of inverse tree canopy percentage, impervious surface percentage and percentage urban for each census block group. The data came from i-Tree Landscape Tools and the land cover was 2011 National Land Cover Dataset. Percent urban was set at 40% priority, and both percent inverse tree canopy and percent impervious surface were weighted at 30%. Using the 'Natural Breaks' classification and choosing seven breaks, the data made a nice break for the top three at 60.6. This was rounded down to 60 so all 30 x

30-meter cells with a value greater than 60 was classified as '1' and any cells equal to or less than 60 was assigned a value of '0'.

Loss of Kansas Forestland — Composite Map

The four analysis data layers described above were combined in a 'Weighted Sum' analysis, using, again, the weights (Table 3.2) based on average data weight value returns from 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 1.63 (Figure 3.4). These values were later combined with similarly produced values from the 'Issues that Threaten a Healthy Forest' (Section 3.1.1) and 'Wildfire Risk' (Section 3.1.2) threats to produce a 'Forest Threats' composite layer (Figure 3.5).

Strategy for Loss of Kansas Forestland

Loss of Kansas forestland supports the national objective of "Identifying and conserving high priority forest ecosystems and landscapes." USDA Forest Service State and Private Forestry programs that address this issue include Forest Legacy Program, Forest Stewardship Program, and the Urban and Community Forestry Program. The Glaciated Region is the Priority Landscape where this strategy will be focused

followed by the Wooded Plains, Flint Hills and Lower Kansas. Forest inventory will be conducted to identify areas in need of protection and ecosystem service values will be assigned to forestland as a catalyst for protection policy development. The i-Tree Eco and i-Tree Hydro models will predict ecosystems financial values. Grow Out and Paint the Town models will be employed to predict future trends. The Natural Resource Inventory³ developed by the Mid-America Regional Council (MARC) will be used to target forests with high ecological values in the KC Metro area for protection. Tree preservation ordinances and green infrastructure conservation strategies should be integrated into municipal land use, parks, transportation and watershed master plans. Forest Stewardship and urban forestry plans will be developed for these areas to sustain forest health by thinning and tree planting. Trees will be integrated into engineering and site design for watershed management, erosion control and energy conservation. Long-term goals are the adoption of planning guidelines, principles, specifications, and ordinances that facilitate green infrastructure conservation.

The Kansas Water Plan, A Long-term Vision for the Future of Water Supply In Kansas, Kansas River Reservoirs Flood and Sediment Study and the Kansas Sustainable Rivers Program (SRP) will guide long-term strategy. Kansas will continue development of a comprehensive wetland and riparian area protection program using conservation easements, tax incentives, and possible regulation. This will require increased funding and state participation.

Resources Required and Performance Measures for Loss of Kansas Forestland

The Governor's Natural Resource Sub-cabinet and associated agencies are the key partnerships to obtaining resources necessary to address the issue. Legislative authority to create effective regulation and the funding to support the establishment and maintenance of easements is necessary. Forest Legacy and other easement programs also have potential to support the strategy along with EQIP, ACEP, WRP and CCRP. Performance measures may include acres of high priority forest ecosystems and landscapes protected from conversion, Forest Legacy Program success stories, areas protected as a result of Forest Stewardship or Urban and Community Forestry Management Plans and the rate of green infrastructure policy adoption by municipalities.

Summary – Forest Resource Threats Composite Map

The final Forest Threats Composite data layer and map represents the results of a 'Weighted Sum' analysis combining the full suite of data layers across all three sub-issues. Table 3.2 shows the weights assigned to each data set in this Forest

3 For more information about the Natural Resource Inventory, see: <http://www.marc.org/Environment/>

Threats composite. No additional weights were assigned to the three sub-issue composite maps. This weighted sum resulted in an output raster with values between 0 and 2.36. The resulting raster dataset was then reclassified using a five-class quantile classification scheme. Given this quantile classification is based on a uniform cell size (30 x 30 meter) across the state, the five classes also represent five equal areas. The resulting classes (Figure 3.5) have been termed 'low,' 'low-moderate,' 'moderate,' 'moderate-high,' and 'high.'

3.2 Forest Resource Benefits and Services

3.2.1 Sustaining Water Quality and Quantity

Kansas federal reservoirs provide municipal and industrial water supply to two-thirds of the state's population. The state of Kansas owns storage in 13 of these reservoirs, which average 51 years of age and are operated by the U.S. Army Corps of Engineers. However, sedimentation from streambank erosion has reduced storage capacity and life span of federal reservoirs by 50 to 100 years. Without changes in the next 50 years Kansas reservoirs will be 40% filled with sediment and 5 out of 7 of our major river basins will not meet demands during droughts.

Additionally 90% of Kansas surface waters are impaired in rural and urban landscapes based on Clean Water Act Section 303(d) listing of Total Maximum Daily Loads (TMDLs).⁴ Nitrogen, phosphorus and fecal coliform bacteria, all carried by sediment, are some of the most common pollutants that exceed water quality standards.

According to Kansas State University research following the 1993 flood, riparian forests were more efficient than other vegetation at stabilizing Kansas streambanks and keeping sediment out of streams, rivers and subsequently federal reservoirs. Research also suggests that most sedimentation occurs during high-flow events and originates from streambanks (Geyer, W. 1998).⁵

Several Kansas communities need to continue to work on coming into compliance with the Clean Water Act, National Pollutant Discharge Elimination System (NPDES) storm-water permits.

4 For more information about total maximum daily loads, see: <http://www.kdbeks.gov/tmdl/basic.htm#tmdl>

5 Available at: <https://newprairiepress.org/kaesrr/vol0/iss12/103/>

Federal Reservoirs in Kansas Original vs. Current Capacity

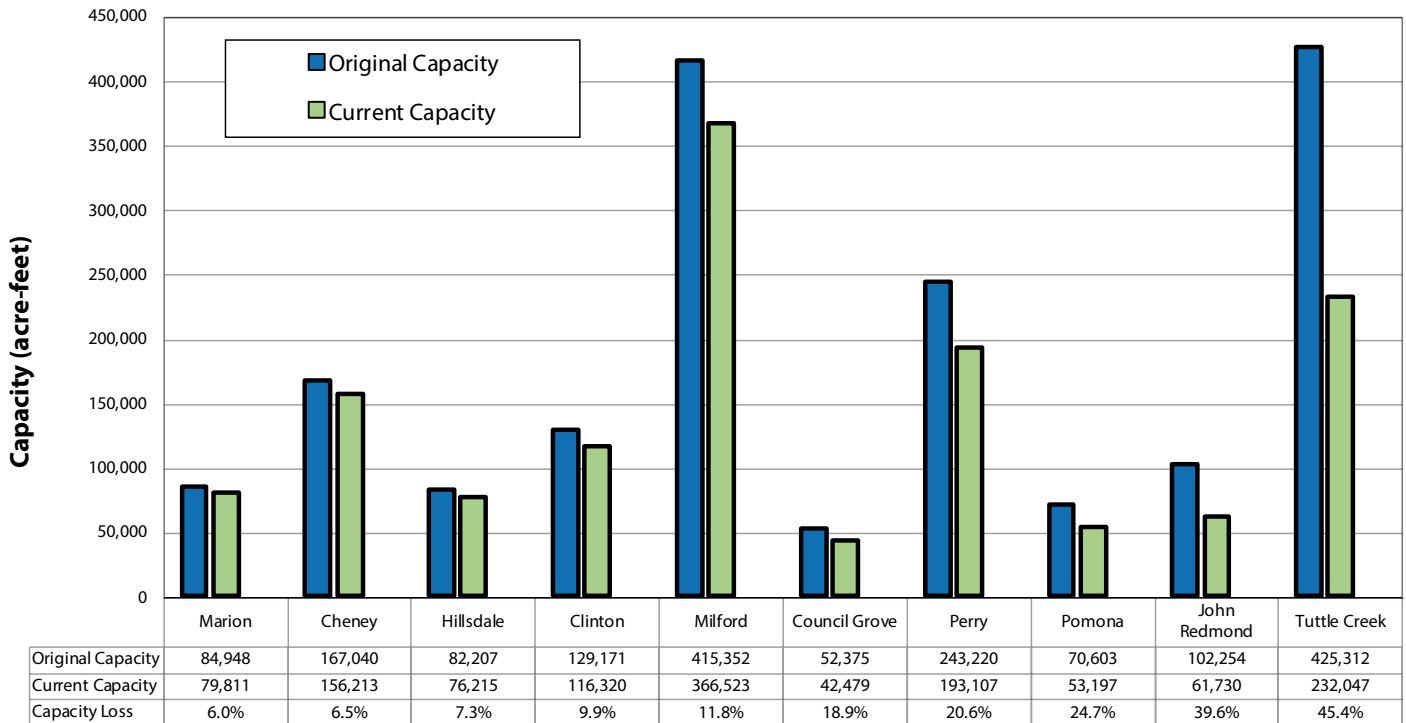


Figure 3.6. *Within the next 50 years federal reservoirs will be 40% filled with sediment and 5 out of 7 major river basins won't meet demands during droughts.*

GIS Methodology — Sustaining Water Quality and Quantity

The 'Sustaining Water Quality and Quantity' forest resource benefit layer was created using a 'Weighted Sum' analysis combining four individual data layers generated from seven separate data sets. Forest benefits for water quality and quantity are addressed through: 1) High Soil Survey Geographic (SSURGO) Database Runoff Riparian Areas within Active WRAPS Watersheds, 2) High SSURGO Runoff Riparian Areas within Partnership Watershed Restoration and Protection Strategy (WRAPS) Watersheds, 3) KDWPT Aquatic Ecological Focus Areas, and 4) Stream Orders 1-3 with State-Owned Storage.

High SSURGO Runoff Riparian Areas within WRAPS Active Watersheds

This analysis input data layer was created by combining SSURGO Runoff, U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) Flowline and the Kansas Department of Health and Environment, Bureau of Water, Watershed Restoration and Protection Strategy (WRAPS) Active Watersheds.

A statewide Kansas SSURGO soil map unit boundary polygon feature class was joined to the component tabular data table (the table containing the runoff data values). The values of 'very high' and 'high' were selected and a new soils layer was created with just these values.

The newly created soils layer was clipped to the 'Active' watersheds and then exported out as raster (30-meter cell resolution). The cells with 'very high' or 'high' within the 'Active' watersheds were listed as '1'. All other cells were classified as '0'.

A Kansas NHD flowline feature class was buffered on either side by 45 meters to create a statewide riparian area polygon layer. The buffered layer was then converted to a raster data layer (30-meter cell resolution) in which cells within the riparian polygons were assigned a value of '1' and cells outside the polygons received a value of '0'.

To create the final 'High SSURGO Runoff Riparian Areas within WRAPS Active Watersheds' analysis input layer, the two previously described layers were added together using 'Cell Statistics'. The resulting layer was composed of cell values '0', '1', and '2'. The value '2' was reclassified to '1' while '0' and '1' were reclassified to '0'.

High SSURGO Runoff Riparian Areas within WRAPS Partnership Watersheds

This analysis input data layer was created by combining SSURGO Runoff, U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) Flowline and the Kansas Department of Health and Environment, Bureau of Water, Watershed Restoration and Protection Strategy (WRAPS) Partnership Watersheds.

Sustaining Water Quality and Quantity — Composite Map

KDWPT Aquatic Ecological Focus Areas, Stream Order 1-3 with State-Owned Storage, High SSURGO Runoff Riparian Areas with Active and Partnership Watersheds

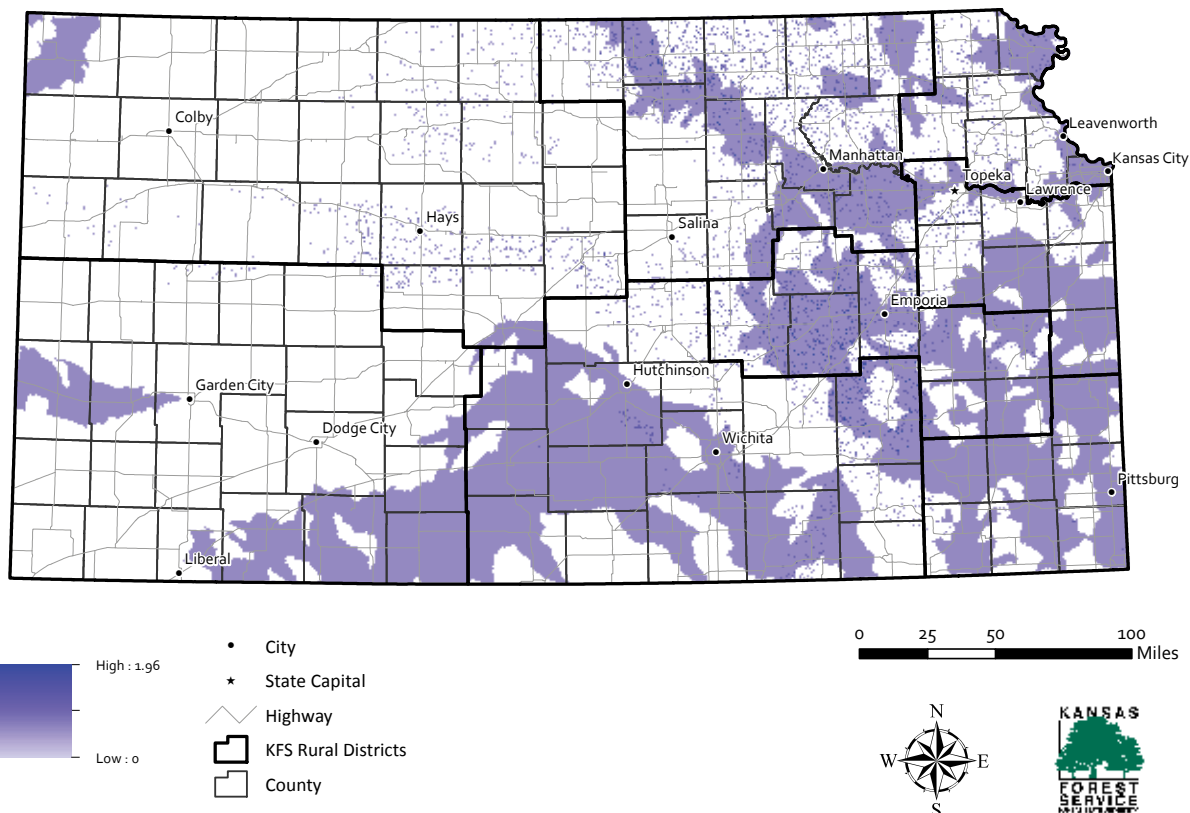


Figure 3.7. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: KDWPT Aquatic Ecological Focus Areas, High SSURGO Runoff Riparian Areas within High Total Maximum Daily Load Watersheds, High SSURGO Runoff Riparian Areas within Top 20 Watershed Restoration and Protection Strategy (WRAPS) Watersheds, and High Stewardship Potential within Kansas Federal Reservoir Drainage Areas ('With State-Owned Storage' and 'Without State-Owned Storage').

This analysis was done the same as the 'Active Watersheds' layer except that 'Partnership Watersheds' were used. The resulting final raster is at a 30-meter cell resolution with values of '1' and '0'.

Kansas Department of Wildlife, Parks and Tourism Aquatic Ecological Focus Areas

The Kansas Department of Wildlife, Parks and Tourism (KDWPT) authored the Kansas State Wildlife Action Plan in 2015. In the plan, they established 'Aquatic Ecological Focus Areas' across the state including the Upper Republican, Upper Arkansas, Cimarron, Lower Arkansas, Walnut, Verdigris, Neosho, Smoky Hill, Lower Republican, Missouri, and Marais des Cygnes. KDWPT provided a shapefile of the EFAs. That shapefile was converted into a raster at a 30 x 30 meter cell resolution. Areas in the Aquatic EFAs were classified as '1' and all other cells were classified as '0'.

Stream Orders 1-3 with State-Owned Storage

The priority for planting riparian buffers and stream stabilization projects has been set as Strahler stream order 1, 2 and 3 above Federal reservoirs with state-owned storage. The vector stream data for streams classified as Strahler 1, 2, 3 were merged together into one layer. This layer was converted into a raster at 30 x 30 meter cell resolution. All the stream cells were classified as '1' and other cells were classified as '0'.

Sustaining Water Quality and Quantity — Composite Map

After developing the four analysis input data layers described above a 'Weighted Sum' analysis was performed in which each '0', '1' analysis raster is assigned a weight (Table 3.2) based on an average weight determined by 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 1.96 (Figure 3.7). These values were later combined with similarly produced values from the 'Protecting and Restoring Forest Biodiversity and Wildlife Habitat' (Section 3.2.2), 'Sustaining and Protecting Forest and Agroforestry Ecosystems' (Section

3.2.3) and ‘Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands’ (Section 3.2.4) benefits to produce a composite ‘Forest Resource Benefits and Services’ layer (Figure 3.12).

Strategy for Sustaining Water Quality and Quantity

Sustaining water quality and quantity supports the national objective of “Protecting and enhancing water quality and quantity.” Interagency Streambank Protection Team, the Forest Stewardship Program, Urban and Community Forestry, and Forest Legacy Program will be the USDA Forest Service State and Private Forestry Programs that address this issue. Watershed Restoration and Protection Strategy (WRAPS) stakeholder groups in priority TMDL watersheds and their strategies will guide the protection, management, and establishment of riparian forests. Functioning condition of riparian forests will be classified through local Watershed Protection and Restoration Strategy (WRAPS) stakeholder groups in priority TMDL watersheds with remote sensing and forest inventory. Local WRAPS groups land ownership will be targeted based on priority areas identified in WRAPS plans. Land ownership GIS data layers will be created when needed to facilitate the process. Forest Stewardship Management plans will guide implementation of BMPs on contiguous ownership within targeted watersheds. The Forest Legacy Program will be used to bring targeted riparian forests under protection. The Kansas Water Plan, The Long-term Vision for the Future of Water Supply in Kansas and the Kansas Water Office’s Streambank Stabilization Projects programs will guide strategies for sustaining water quality and quantity.

Resources Required and Performance Measures for Sustaining Water Quality and Quantity

Funding sources include Kansas Department of Wildlife and Parks, CWA and KWO State Water Plan funding through KDHE’s WRAPS program, EPA Region 7 Wetland Developmental Grant, NRCS TSP, State and Private Forestry programs. General performance measures are Kansas forests in priority watersheds that protect surface and ground water are healthy and being sustained. Acres and percent of forest management plans, Forest Legacy easements and forest health projects in priority watersheds will be the specific performance measure metrics.

3.2.2 Protecting and Restoring Forest Biodiversity and Wildlife Habitat

Rationale and strategy for this issue are taken directly from *Kansas State Wildlife Action Plan*.⁶ With well over a thousand wildlife species in Kansas, 285 have been identified as “Species

⁶ This plan can be found at: <https://ksoutdoors.com/Services/Kansas-SWAP#:~:text=Kansas%20State%20Wildlife%20Action%20Plan,%20wildlife%20and%20wildlife%20habitats>

in Need of Conservation” with 29 listed as threatened and 22 endangered state species. In the shortgrass and central mixed grass prairie ecosystems, riparian forests, and shrubs are declining due to a lowering water table from surface water and groundwater depletion. In the Eastern Tall Grass Prairie there is lack of active management and conservation of deciduous forests and floodplain habitats. Lack of management, protection, and loss of habitat create issues in sustaining populations for targeted forest and woodland species.

GIS Methodology — Protecting and Restoring Forest Biodiversity and Wildlife Habitat

The ‘Protecting and Restoring Forest Biodiversity and Wildlife Habitat’ forest resource benefit layer was generated using a ‘Weighted Sum’ analysis combining four individual data layers generated from four separate data sets. Biodiversity and wildlife habitat needs are addressed in this analysis by: 1) Kansas Natural Heritage Inventory Rare Species, 2) Forest Patches Greater than or Equal to 40 acres, 3) LANDFIRE Departure Index, 4) LANDFIRE Simulated Historical Mean Fire Interval, and 5) KDWPT Terrestrial EFA.

Departure Index 2014

This is a modeled dataset created by the LANDFIRE Project (a cooperative project of the U.S. Forest Service, U.S. Geological Survey, The Nature Conservancy and the Department of the Interior) and was obtained as 30 x 30 meter raster dataset for the state of Kansas.

For this analysis, a Fire Department Index score between 83 and 100 was selected, representing the top 20% of values present in Kansas. Those cells were reclassified ‘1’ and all other cells were classified as ‘0’.
<https://www.landfire.gov/vdep.php>

Forest Patches Greater than or Equal to 40 acres

The 40-acre patch layer is a layer composed of large continuous tracts of forestland that are rare in Kansas, especially in the semi-arid western part of the state. Where large tracts do exist the benefit of management activities can be maximized. The minimum patch size was set at 40 acres (16 hectares). Forty acres (a 16th of a section) seemed an appropriate size to complement the statewide scale of analysis as it is a common land ownership unit in Kansas.

The analysis used the 2015 rural tree canopy. The first step was to resample the rural canopy layer from 1 x 1 meter cells to 30 x 30 meter cells. The resampled layer was group forested pixels using the Region Group tool. Tracts 40 acres and larger were reclassified as ‘1’ and all other tracts were classified as ‘0’.

Protecting and Restoring Forest Biodiversity and Wildlife Habitat — Composite Map

LANDFIRE Departure Index, Forest Patches > 40 acres, KDWPT Terrestrial Ecological Focus Areas,
Mean Fire Return Interval and KNHI Rare Species

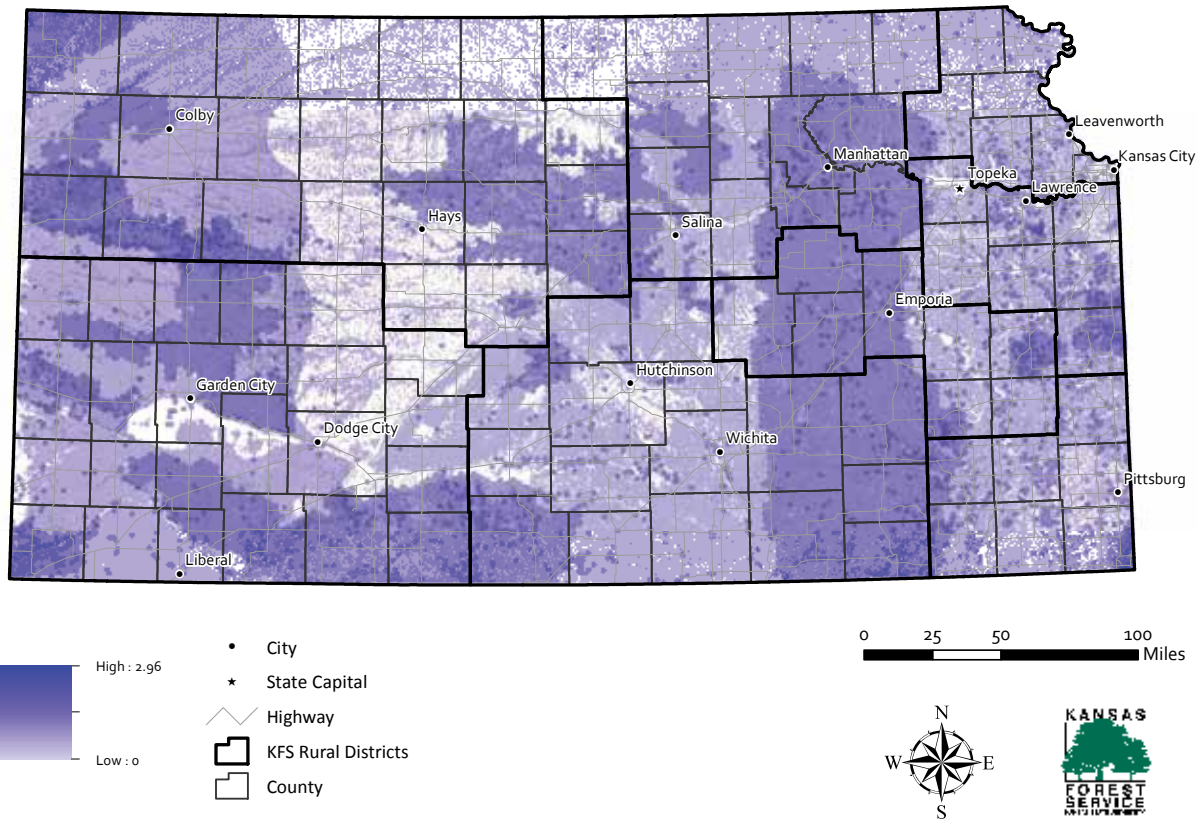


Figure 3.8. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: Kansas Natural Heritage Inventory Rare Species, Forest Patches Greater than or Equal to 40 acres, LANDFIRE Departure Index, and LANDFIRE Simulated Historical Mean Fire Return Interval.

Kansas Department of Wildlife, Parks and Tourism Terrestrial EFA

The Kansas Department of Wildlife, Parks and Tourism (KDWPT) authored the Kansas State Wildlife Action Plan in 2015. In the plan, they established ‘Terrestrial Ecological Focus Areas’ across the state including the Arikaree Breaks, Playa Landscape, Smoky Hill River Breaks, Arkansas River Sandstone Prairie, Cimarron Grasslands, Red Hills, Quivira, Cheyenne Bottoms, Smoky Hills, Flint Hills, Chautauqua Hills, Eastern Tallgrass Prairies, Eastern Forests, and Ozark Plateau. KDWPT provided a shapefile of the EFAs. That shapefile was converted into a raster at a 30x30 meter cell resolution. Areas in the Terrestrial EFAs were classified as ‘1’. Areas outside of the polygons were classified as ‘0’.

Kansas Natural Heritage Inventory Rare Species

The Kansas Natural Heritage Inventory Rare Species layer was obtained from the Kansas Biological Survey. According to the dataset metadata:

“This layer shows buffered locations of plants and animals considered to be Species of Concern in Kansas with observation dates 1975 - 2017. The layer includes location data for 168 species of wildlife (terrestrial and aquatic) designated as Species of Greatest Conservation Need (SGCN) in the State Wildlife Action Plan (SWAP), and 17 plant taxa with a Global Conservation Status rank of G1-G3. All state and federal listed Endangered and Threatened wildlife, and all wildlife designated as Species In Need of Conservation (SINC), are on the SGCN list as well as other rare and/or declining species.”

This vector layer was converted to a raster with the polygons being assigned a value of ‘1’. Areas outside of the polygons were classified as ‘0’.

Mean Fire Return Interval 2010

This is a modeled dataset created by the LANDFIRE Project and was obtained as a 30 x 30 meter raster dataset of the contiguous United States. To address the needs of the various grasslands in Kansas, three layers were made.

The first layer focused on the 0 - 5 years return interval. All cells with 0 - 5 were reclassified as '1' and other values were assigned '0'. A similar process was performed on the 6 - 10 years interval and 11 - 15 years interval. <https://www.landfire.gov/fire regime.php>

Protecting and Restoring Forest Biodiversity and Wildlife Habitat — Composite Map

After developing the seven analysis input data layers described above, a 'Weighted Sum' analysis was performed, in which each '0', '1' analysis raster is assigned a weight (Table 3.2) based on an average weight determined by 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 2.96 (Figure 3.8). These values were later combined with similarly produced values from the 'Sustaining Water Quality and Quantity' (Section 3.2.1), 'Sustaining and Protecting Forest and Agroforestry Ecosystems' (Section 3.2.3) and 'Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands' (Section 3.2.4) benefits to produce a composite 'Forest Resource Benefits and Services' layer (Figure 3.12).

Resources Required and Performance Measures for Protecting and Restoring Forest Biodiversity and Wildlife Habitat

Acres and percent of priority habitat areas where State and Private Forestry activities are protecting, conserving and enhancing wildlife and fish habitat and acres of connected forests resulting from State and Private Forestry investments will serve as performance measures.

Strategy for Protecting and Restoring Forest Biodiversity and Wildlife Habitat

Protecting and Restoring Forest Biodiversity and Wildlife Habitat supports the national objective of "Protecting, conserving and enhancing wildlife and fish habitat." The Forest Stewardship Program and Forest Legacy Program are the main USDA Forest Service State and Private Forestry programs that address this issue. All of the priority landscapes listed in Section 4.2 *Kansas Forest Legacy State Priority Area Map* are relevant areas to invest program resources. Riparian forest and shrub habitat will be conserved and established for priority species in priority habitats that have some dependency on forested areas or trees. In the shortgrass prairie Ecological Focus Areas (EFA), targeted species include Bell's vireo, bald eagle, red-headed woodpecker, rusty blackbird, Brewer's blackbird and the eastern spotted skunk (threatened). The mixed grass prairie EFAs targets the eastern spotted skunk (threatened), red-spotted toad and pallid bat. Forests and woodlands located within EFAs in eastern Kansas such as Eastern Forest, Ozark Plateau, Verdigris, Neosho, and Marais des Cygnes will be actively managed and protected in priority landscapes to sustain or increase populations of the following species — **Birds:** rusty blackbird, cerulean warbler, whip-poor-will,

yellow-throated warbler, Kentucky warbler; **Mammals:** eastern spotted skunk (threatened), little brown myotis, gray myotis (Endangered), southern flying squirrel; **Reptiles:** timber rattlesnake, redbelly snake (threatened), smooth earth snake; **Amphibians:** green frog, northern cricket frog, Oklahoma salamander; **Insects:** Ozark emerald (damselfly), American burying beetle (endangered), gray petaltail (damselfly).

3.2.3 Sustaining and Protecting Forest and Agroforestry Ecosystems

Of the 24.6 million acres of cultivated cropland in Kansas approximately 2.9 million acres (12%) exceed "tolerable limits" for erosion.⁷ Windbreaks are recognized as a way to reduce erosion on cropland and yet, in Kansas, 55% of windbreaks are in fair to poor condition and in need of renovation⁸. The Kansas urban and community forest is mature to over-mature with declining canopies that continue to be degraded by environmental events and current impending insect and disease issues as indicated in Section 2.3. From statewide data the urban canopy is 59% fair to poor condition class. Top three species are: silver maple, elm and pin oak; with those 3 species comprising 41% of the overall canopy. Historic data from 40 Northwest Kansas communities and 76 CF Action Plans over the last 50 years indicate a definite shift of species age and distribution. In commonality these indicate the top five tree species to be: Siberian elm, honeylocust, American elm, hackberry and green ash; with those being mature to over-mature and declining. The data also shows a decline in the number of street trees by 50%. Of Kansas rural hardwood forests, 51.5% are classified as cull. Fluvial geomorphic dynamics (declines in sandbars and active flood plains) and land use conversions have reduced cottonwood regeneration, which is evidenced in decline of trees in smaller diameter classes (1 to 3 inches) and the majority of volume occurring in larger diameter classes (17 inches or larger). Although oak volume, tree numbers, and density have all increased, oak forests are not replacing themselves, which is evidenced with the overwhelming proportion making up the overstory canopy in the oak-hickory forest type.

GIS Methodology — Sustaining and Protecting Forest and Agroforestry Ecosystems

The 'Sustaining and Protecting Forest and Agroforestry Ecosystems' forest resource benefit layer was generated using a 'Weighted Sum' analysis combining seven individual data layers generated from seven separate data sets. Biodiversity and wildlife habitat needs are addressed in this analysis by: 1) Potential High-Quality Forest, 2) Management Plans, 3) Forest Adjacent to Protected and Managed Areas, 4)

⁷ *Natural Resource Inventory, NRCS: <http://www.nrcs.usda.gov/technical/NRI/>*

⁸ *Great Plains Initiative Inventory 2008 - 2009: <http://www.nfs.unl.edu/documents/GPI%20Fact%20Sheet%20May%202009.pdf>*

Sustaining and Protecting Forest and Agroforestry Ecosystems — Composite Map

Potential High-Quality Forest, Management Plans, Forest Adjacent to Protected and Managed Areas, Non-Forest Stewardship Program High Stewardship Potential Private Forest, Community Woodland, Agroforestry Potential and Tree and Shrub Suitability

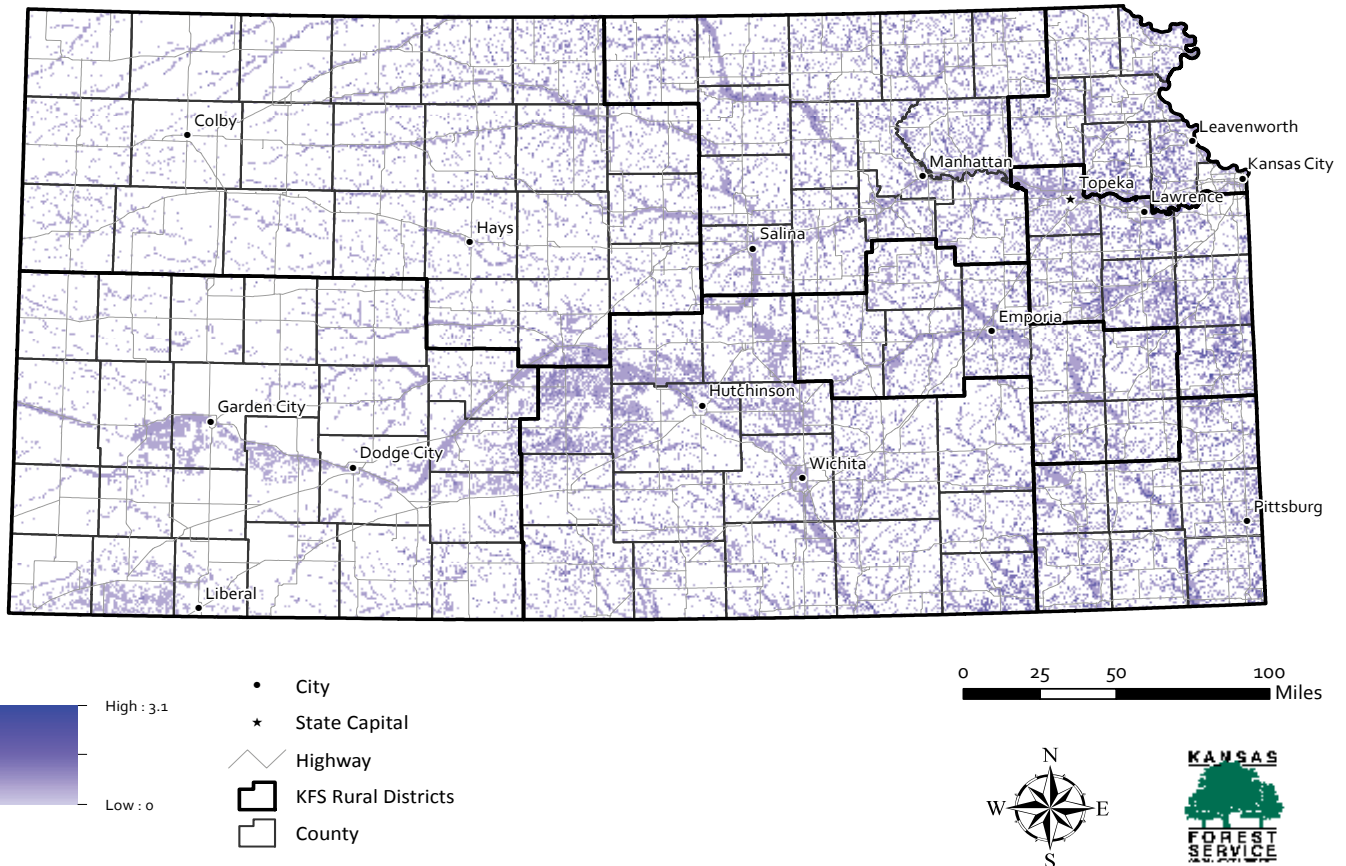


Figure 3.9. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: Kansas Natural Heritage Inventory Natural Forest Communities, Forest Stewardship Program Properties, Forest Adjacent to Protected and Managed Areas, Non-Forest Stewardship Program High Stewardship Potential Private Forests, Community Woodland, Agroforestry Potential, and Tree and Shrub Suitability.

Non-Forest Stewardship Program High Stewardship Potential Private Forests, 5) Urban Woodland, 6) Agroforestry Potential, and 7) Tree and Shrub Suitability.

Agroforestry Potential

The 'Agroforestry Potential' layer was created using the 2015 Kansas Land Cover Patterns Level III layer created by the Kansas Applied Remote Sensing research program at the Kansas Biological Survey. The following attributes 'Corn', 'Soybean', 'Sorghum', 'Winter Wheat', 'Alfalfa', 'Fallow' and 'Double Crop' were reclassified to the value of '1'. All other attributes were reclassified to '0'.

Using the gSSURGO soils layer from the Natural Resources Conservation Service, the 'Wind Erodibility Index' values

greater than '86' were set as '1' while the other soils were set as '0'. The Land Cover and Wind Erodibility Index layers were overlaid and added together. Any cell with the value of '2' was set as '1' and the cells with '0' or '1' were set as '0'.

Forest Adjacent to Protected and Managed Areas

To address the need to preserve large tracts of forest where possible, the 'Forest Adjacent to Protected and Managed Areas' layer was created using forest within buffers around currently protected and managed lands. The analysis input layer was created from four separate layers: 2015 Rural Tree Canopy, Kansas Protected Areas, Active Forest Stewardship Program properties (10 years) and Practice Plan properties (January 1, 2015 – September 30, 2018).

The rural 2015 tree canopy was used as the forested lands in Kansas.

A dataset of Kansas Protected Areas is maintained by the Kansas Biological Survey. Protected areas included in the dataset include Kansas's public lands (Army Corps of Engineers, Kansas Department of Wildlife, Parks and Tourism, U.S. Fish and Wildlife Service, U.S. National Park Service, U.S. Forest Service, local city and county governments, etc.) and lands held privately by nongovernmental organizations, nonprofit organizations and those held in conservation easements.

The 'Management Plan Properties' analysis data layer was incorporated as land currently under management.

To complete this analysis layer, the protected areas and management plan properties were buffered using a one-half mile radius to target areas potentially containing forest that are adjacent to currently protected forest and would therefore create larger tracts of protected forests. The newly buffered polygon clipped the 2015 rural tree canopy to create a raster dataset of forest adjacent to protected and managed areas. The new raster dataset kept the assigned value as '1' and areas outside of the adjacent forest are classified as '0'.

Management Plan Properties

Management plans were downloaded from the Stewardship Mapping and Reporting Tool (SMART). Active Forest Stewardship Plans (10 years) and Practice Plans (January 1, 2015 – September 30, 2018) were identified as the management plans. For this analysis input layer, the management plans were converted from a polygon to a raster and assigned a value of '1'. All areas outside of the polygons were classified as '0'.

Non-Forest Stewardship Program High Stewardship Potential Private Forests

Currently enrolled Forest Stewardship and Practice Plan properties are targeted with an analysis input layer, this analysis input layer was produced to incorporate areas that should be targeted. The 2015 Rural Tree Canopy raster was the base layer. First, public lands were masked from the layer and then the Forest Stewardship and Practice Plan properties were masked. This left the rural canopy outside of public lands and current plans. The layer was exported to a 30 x 30 meter resolution raster with the tree canopy labeled as '1' and all other cells as '0'.

Potential High-Quality Forest

The Kansas Forest Service with the assistance of the United States Forest Service – Northern Research Station created a rural tree canopy based on 2015 tree canopy. The Kansas Biological Survey created a Historic Forest by digitizing Public Land Office Surveys from the 1800s. The 2015 Rural Tree

Canopy was clipped down to the Historic Forest polygon to create the 'Potential High-Quality Forest' layer. The polygon layer was then transformed into a 30 x 30 meter resolution raster with the forest classified as '1' and all other values classified as '0'.

Tree and Shrub Suitability

Working with the Natural Resource Conservation Service (NRCS), a soil layer was completed with all the soils identified with a value for Tree and Shrub Suitability. This polygon layer was converted into a raster with all soils identified as '1' or '2' being reclassified as '1'. All other values were classified as '0'. This data layer has been incorporated into this analysis to further address areas for potential agroforestry activities.

Urban Woodland

The 'Urban Woodland' layer was created using 2015 Kansas Land Cover Patterns Level III layer created by the Kansas Applied Remote Sensing research program at the Kansas Biological Survey. The 'Urban Woodland' attribute was reclassified to the value of '1' and all other attributes were reclassified to the value of '0'.

Sustaining and Protecting Forest and Agroforestry Ecosystems — Composite Map

After developing the seven analysis input data layers described above, a 'Weighted Sum' analysis was performed, in which each '0', '1' analysis raster is assigned a weight (Table 3.2) based on an average weight determined by 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 3.1 (Figure 3.9). These values were later combined with similarly produced values from the 'Sustaining Water Quality and Quantity' (Section 3.2.1), 'Protecting and Restoring Forest Biodiversity and Wildlife Habitat' (Section 3.2.2) and 'Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands' (Section 3.2.4) benefits to produce a composite 'Forest Resource Benefits and Services' layer (Figure 3.11).

Strategy for Sustaining and Protecting Forests and Agroforestry Ecosystems

Sustaining and protecting forest and agroforestry ecosystems supports the national objectives of "Actively and sustainably managing forests and identifying and conserving high-priority forest ecosystems and landscapes." The USDA Forest Service State and Private Forestry Programs that address this issue include the Forest Stewardship Program, Urban and Community Forestry Program, and Cooperative Fire Programs. All priority landscape areas are appropriate areas to apply this strategy.

The data set for agroforestry potential has identified 916,437 acres of cultivated cropland with a wind erodibility index greater than 86, which is one of the requirements for CRP participation for field windbreak establishment. Working through local

RC&D's and conservation districts, landowners will be identified in this area and contacted to promote the establishment of field windbreaks.

Research from crop yield studies confirms yield benefits associated with field windbreaks. This data will be used to promote windbreak adoption. Windbreak assessments identifying condition and location have been completed in 14 counties. This information will be used to identify landowners with windbreaks in fair to poor condition to promote windbreak renovation.

The Great Plains Initiative 2 has also created windbreak outreach plans for targeted five-county areas in each of the four central and western districts to engage farmers' and ranchers' participation. EQIP will be the financial incentive program to promote adoption.

Landowners located in areas with high Forest Stewardship Program potential/high-priority resources will be invited to participate in the Forest Stewardship Program.

The urban and community forest will be assessed through inventory to target defective and hazardous trees for removal. Mitigation pruning of defects from the canopy to prevent or delay trees from becoming hazardous and a tree planting program will be initiated to increase species diversity. Training will be provided on hazard tree identification, assessment, risk management, mitigation pruning, removals, utilization, tree selection and replacement. Technical assistance will be focused on smaller communities that lack resources to accomplish the strategy. Urban Tree Canopy Assessments like the City of Wichita's will be used in our larger cities to identify tree planting opportunities and ecosystem services values for the purpose of protecting and promoting green infrastructure.

Riparian forestry will be expanded through a partnership with Kansas Department of Agriculture's Division of Conservation through the Riparian Quality Enhancement Initiative (REQI) to provide financial support for forestry practices to improve water quality through County Conservation Districts.

Development of new biomass markets for cull material will be pursued to improve forest health.

The number of forestry contractors that provide forest stand improvement and tree planting services will be increased.

Areas where river dynamics support the silvicultural conditions needed for cottonwood regeneration will be identified geospatially. An initiative to promote the regeneration of cottonwood in these target areas will be developed using existing USDA conservation programs.

Areas of the state will be identified where oak regeneration efforts will be focused. The USDA Forest Service Northern Research Station will assist with the refinement of silvicultural techniques to increase light through timber stand improvement and prescribed burning. The Kansas Department of Wildlife and Parks and the National Wild Turkey Federation will be close partners.

Resources Required and Performance Measures for Sustaining and Protecting Forest and Agroforestry Ecosystems

NRCS, National Agroforestry Center, University of Missouri Center for Agroforestry, USDA Forest Service Northern Research Station, Tree Boards, Tree City USA, and the Kansas Arborists Association are all important resources and partners that can help accomplish these strategies. Kansas Forest Service needs state funding support for 2 water quality foresters' positions currently supported by temporary federal grant dollars to provide program continuity and to employ strategies. Performance measures will be developed to invest Forest Stewardship program dollars in counties identified in the FSP priority areas.

3.2.4 Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands

Data from the USDA Forest Service, Forest Inventory and Analysis Timber Products Output and the U.S. Bureau of Labor and Statistics suggests that in 2016 there was over \$330 million in wages earned and 7,456 jobs in Kansas associated with the wood products industry. In 2012, 20 million cubic feet (240 million board feet) of timber was harvested in Kansas. The forest products industry contributes \$1.3 billion annually to the Kansas economy in 2016 dollars, supporting more than 6,400 jobs at a payroll of about \$386 million. The forest industry is also responsible for generating \$39 million in state taxes and another \$63 million in federal taxes. Currently only one-third of green woody biomass produced annually by wood manufacturing is available for use as a wood energy feedstock (Camas Creek Enterprises). Models are needed to assign ecosystem service values to forest and agroforestry resources. Biomass markets related to utilizing eastern redcedar, tamarisk, other less desired species, and wood waste will be explored. In 2010, Kansas had 5.4 billion board feet of saw timber, a 125% increase since 1981 (Moser et al. 2008) Cottonwood and hackberry were the most common species (Figure 3.10).

Productive timber markets occur mainly in the eastern third of Kansas. In FFY 2017 the Kansas Forest Service prepared 1,305 forest management plans that provided forestry recommendations for 169,393 acres in counties with productive timber markets. These estimates are based upon an economic impact analysis approach using the input-output IMPLAN model. The grand total includes not only the direct effect

Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands — Composite Map

Black Walnut, Biomass, and Forests within Mill Average Haul Areas

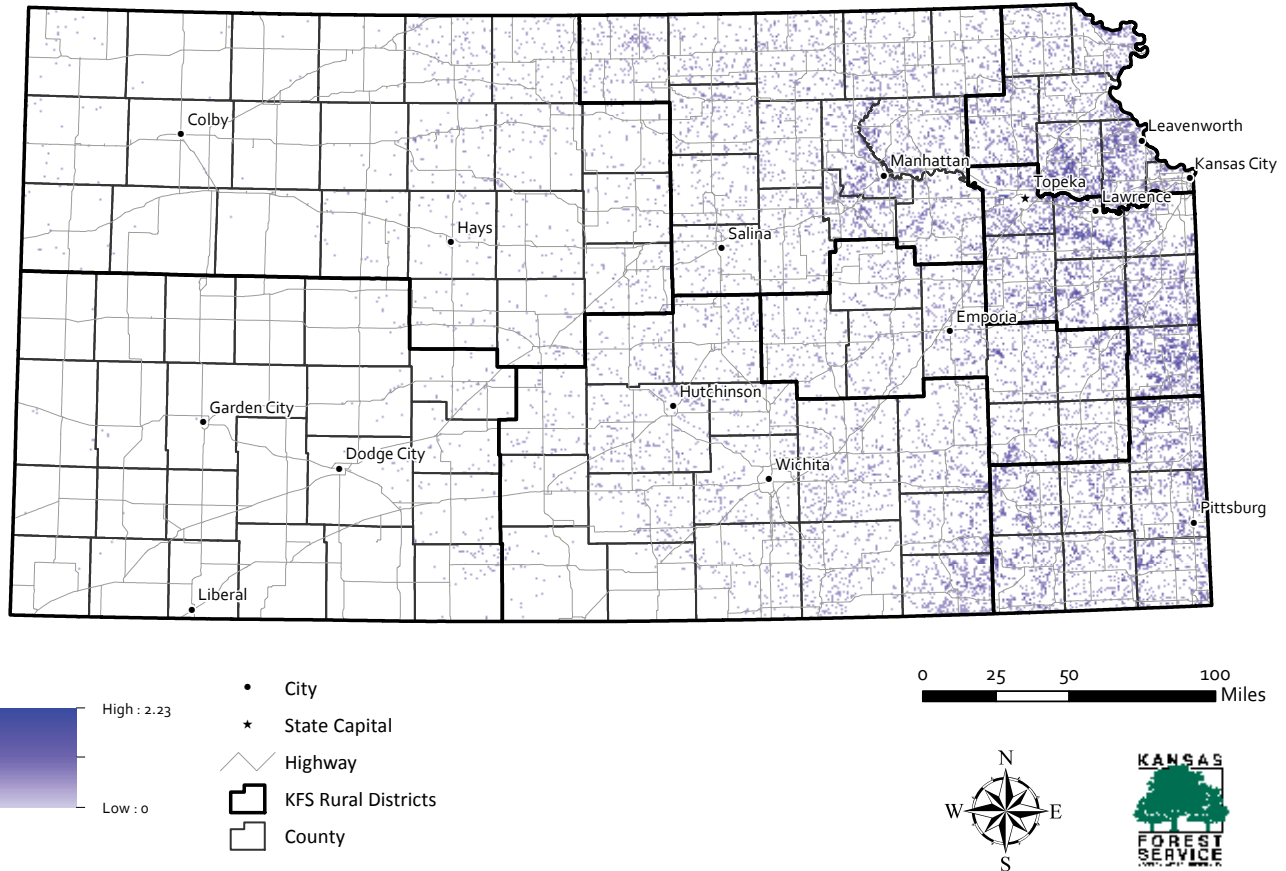


Figure 3.11. The result of a weighted sum analysis on all cells combining the assigned weights (from Table 3.2) for the following datasets: Black Walnut, Biomass, and Forest within Mill Average Haul Areas ('No Overlap,' 'Two Mill Overlap,' and 'Three Mill Overlap').

of jobs in the industry but secondary effects in the entire economy. Secondary effects are changes in economic activity from subsequent rounds of re-spending primary dollars. There are two types of secondary effects: 1) indirect effects which are the changes in sales, income, or employment within Kansas in industries supplying goods and services to forest products industry and 2) induced effects which are the increased sales within Kansas from household spending of the income earned in the forest products and supporting industries. Forest products employees spend the income they earn on housing, utilities, groceries, and other consumer goods and services. This generates sales, income and employment throughout the Kansas economy. Kansas Forest Service maintains a list of over 50 active timber buyers and about 50 sawmills most

of which are portable bandsaws. Kansas harvests about 1.7 million cubic feet or 20.4 million board feet annually. Black walnut generally drives most sawlog sales in Kansas for furniture and veneer while most other species are used for crates, dunnage or small dimension specialty items.

GIS Methodology for Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands

The 'Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands' forest resource benefit layer was generated using a 'Weighted Sum' analysis combining five individual data layers generated from four separate data sets. Forestry economic issues are addressed in this analysis by: 1)

Table 3.4. Economic impacts of the Kansas forest industry.

Kansas	Forestry & Logging	Sawmills & Wood Products	Pulp & Paper	Totals
Wages (\$)	\$51,125,039	\$150,722,279	\$128,323,807	\$330,297,125
# Jobs	1,263	4,216	1,977	7,456

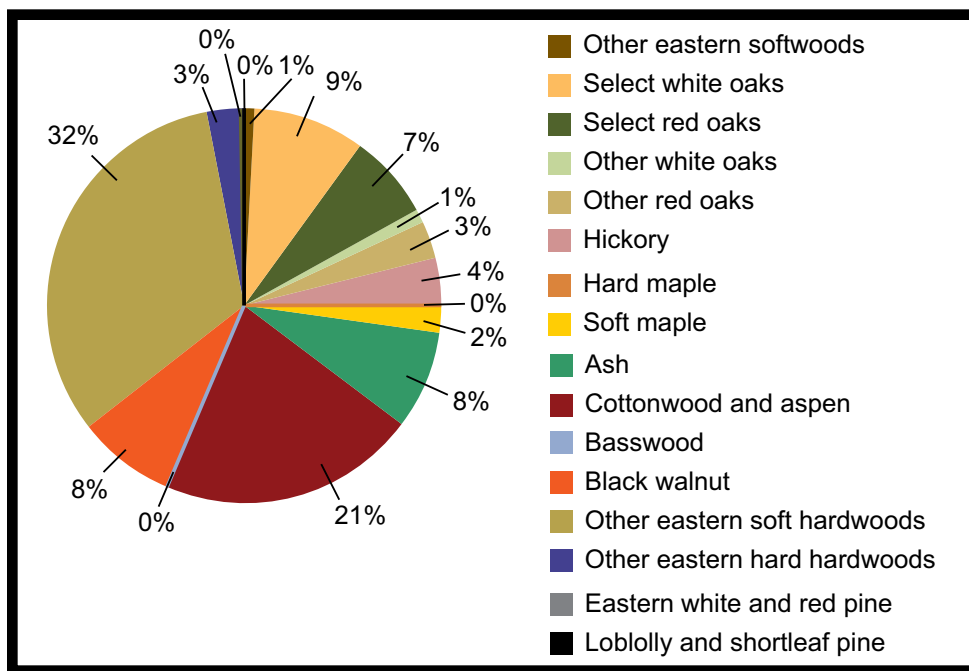


Figure 3.10. Volume of sawtimber by species in millions of board feet, Kansas Forests 2005 (Moser et al. 2008).

Black Walnut, 2) Biomass, and 3) Forest within Mill Average Haul Areas.

Biomass

To approximate other potentially harvestable forest, Biomass data were obtained from FIA in the form of a 250 x 250 meter raster representing dry tons per acre. Cells with greater than 30 tons per acre were classified as '1', all other cells were reclassified as '0'.

Black Walnut

As the most economically important tree species in Kansas, incorporating an analysis input data layer portraying black walnut information was a priority. Modeled live volume (basal area) black walnut data were obtained from U.S. Forest Service, Forest Inventory and Analysis program at a 250 x 250 meter cell resolution. All cells with values greater than five square feet were reclassified to a value of '1' and cells with values less than or equal to 5 square feet per acre were assigned a value of '0'. Wilson, Barry Tyler; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. *Live tree species basal area of the contiguous United States (2000-2009)*. Newtown Square, PA: USDA Forest Service, Rocky Mountain Research Station. <https://doi.org/10.2737/RDS-2013-0013>

Forest within Mill Average Haul Areas ('1-5 Mills Overlap', '6-10 Mills Overlap', and 'Greater than 10 Mills Overlap')

To generate this analysis input data layers, the Kansas Forest Service contacted Ronald Piva at the U.S. Forest Service, Northern Research Station to calculate the mill average haul areas across the state. Based on his analysis, he provided 50.8 miles.

As of February 2019, David Bruton, Marketing and Utilization Forester at the Kansas Forest Service, knew of 52 sawmills across the state. A GIS driving distance analysis was performed on the 52 sawmills. This created 52 polygons and each of those polygons was exported out to a raster with a 30 x 30 meter cell resolution setting the value to '1' in the driving distance area and '0' outside the driving distance area. Using the 'Cell Statistics' tool, all 52 rasters were summed and a layer was created that showed the overlap of the mill driving distances. The range was '0' to '21'. The layer was reclassified into three different layers. The first layer reclassified values '1' through '5' to '1' and all other values to '0', the second layer reclassified '6' through '10' to '1' and all other values to '0' and the final layer reclassified all values greater than '10' to '1' and all other values to '0'.

Each subsequent layer was overlaid with the 2015 rural tree canopy. The three layers were summed with the canopy which resulted in values of '0', '1' and '2'. Each of the three layers were reclassified. The value of '2' was set at '1' and all other values were set to '0'.

Composite Map

After developing the five analysis input data layers described above a 'Weighted Sum' analysis was performed, in which each '0', '1' analysis raster is assigned a weight (Table 3.2) based on an average weight determine by 16 Kansas Forest Service staff. The resulting raster contains values ranging from 0 to 2.23 (Figure 3.12). These values were later combined with similarly produced values from the 'Sustaining Water Quality and Quantity' (Section 3.2.1), 'Protecting and Restoring Forest Biodiversity and Wildlife Habitat' (Section 3.2.2) and

'Sustaining and Protecting Forest and Agroforestry Ecosystems' (Section 3.2.3) benefits to produce a composite 'Forest Resource Benefits and Services' layer (Figure 3.11).

Summary – Forest Resource Benefits

Five-Class Composite Map

The final Forest Resource Benefits Composite data layer and map represents the results of a 'Weighted Sum' analysis combining the full suite of data layers across all four sub-issues. Table 3.2 shows the weights assigned to each data set in this Forest Threats composite. No additional weights were assigned to the three sub-issue composite maps. This weighted sum resulted in an out put raster with values between 0 and 7.3. The resulting raster was then reclassified using a five-class quantile classification scheme (Figure 3.12). Given this quantile classification is based on a uniform cell size (30 × 30 meter) across the state, the five classes also represent five equal areas. The resulting classes have been termed 'low,' 'low-moderate,' 'moderate,' 'moderate-high,' and 'high.'

Strategy for Maintaining and Promoting the Livelihoods and Economic Benefits of Woodlands

Maintaining and promoting the livelihoods and economic benefits of woodlands supports the national objective of "Maintaining and enhancing the economic benefits and values of trees and forests." The Urban and Community Forestry Program and Forest Stewardship Program are the two USDA Forest Service State and Private Forestry Programs that address this issue. Due to size, weight, and dimension of timber products, distance to markets and related transportation costs are limiting factors. Therefore, maintaining and establishing local markets for forest resources is critical to local economies. These markets and economies ultimately play a vital role in the ability to maintain sustained, healthy, and productive woodlands. The Glaciated Region and Wooded Plains are the targeted priority landscapes (Figure 3.16) for this strategy. An estimated 282,742 green tons of woody biomass is produced annually by wood manufacturing companies and urban tree care activities in Kansas with 66% available for wood energy feed stock. Therefore, the Kansas Forest Service Wood Energy Initiative will promote the use of biomass as an alternative energy source in the form of wood pellets, wood briquetting and conversion of old boiler systems to wood energy. Targeted audiences include schools, hospitals, prisons and nursing facilities.

Biochar conversion of unwanted woody plants to facilitate landscape restoration is a growing interest. The rangelands and woodlands of Kansas are susceptible to undesirable woody encroachment. Though some of these species are native to Kansas, modern land management and lack of management, has allowed them to expand beyond their pre-Columbian



Kansas black walnut gunstock blanks. Kansas forest industry has the potential to grow by increasing local use of native species.

niches.⁹ Examples of woody plants of concern are eastern red cedar, tamarisk and bush honeysuckle. Proliferation of these species can constitute a shift toward lower ecological and financial value landscapes, while the high cost of their removal can serve as a deterrent to large-scale control efforts.^{10**} Traditional market demands for the woody material harvested from invading rangelands and overstocked woodlands are low to non-existent, often being limited by raw material size, quality, and transportation costs. Biochar conversion of these materials for low agronomic uses may facilitate a financially sustainable system of removal and utilization.¹¹ The Kansas Forest Service supports the development of regional, mobile and/or on-site

9 Johnstone, I. M. (1986). *Plant Invasion windows: a time-based classification of Invasive potential*. *Biological review* 61: 369-394

10 Wilson, Kelpie. (2017). *Converting Shelterbelt Biomass to Biochar: A feasibility analysis by Wilson Biochar Associates for North Dakota Forest Service*. North Dakota State University - North Dakota Forest Service, Bismarck, North Dakota, February 10, 2017

11 John Sessions, David Smith, Kristin M Trippe, Jeremy S. Fried, John D. Bailey, Joshua H. Petitnermet, William Hollamon, Claire L Phillips, John D. Campbell. (2019). *Can biochar link forest restoration with commercial agriculture?*, *Biomass and Bioenergy* 123: 175-185

biochar systems and continues to seek opportunities for industrial and conservation interests to unite in these efforts. Therefore, Kansas has engaged in the Great Plains Biochar Initiative to promote market development of biochar of Combined Heat and Biochar or CHAB systems. Grants will be awarded to encourage the local production of biochar. Biochar will also be marketed as a soil amendment. Kansas Forest Service will continue to explore markets for lower quality, small diameter species like hackberry and eastern red cedar to address woody encroachment into grasslands.

Resources Required and Performance Measures for Maintaining and Promoting the Livelihoods and Economic Benefits of Woodlands

Performance measures Kansas Forest Service will use includes the number and acres of forest management and practices plans occurring in productive timber counties in the eastern third of the state that produce the most jobs and wages associated with forest industry. For example, based on harvest removals Douglas, Crawford, Jackson, Washington and Montgomery counties are the most productive. Currently Kansas Forest Service Utilization and Marketing Specialist is supported entirely by federal grant dollars.

Summary — Forest Resource Benefits Five-Class Composite Map

The final Forest Resource Benefits Composite data layer and map represents the results of a “Weighted Sum” analysis combining the full suite of data layers across all four sub-issues. Table 3.2 shows the weights assigned to each data set in this Forest Threats composite. No additional weights were assigned to the three sub-issue composite maps. This weighted sum resulted in an output raster with values between 0 and 2.73. The resulting raster dataset was then reclassified using a five-class quantile classification scheme (Figure 3.12). Given this quantile classification is based on a uniform cell size (30 × 30 meter) across the state, the five classes also represent five equal areas. The resulting classes have been termed ‘low,’ ‘low-moderate,’ ‘moderate,’ ‘moderate-high,’ and ‘high.’

3.3 Summary of Kansas Forest Action Plan

3.3.1 Summary of GIS Methodology

Staff Input and Weights

Kansas Forest Service staff members were involved throughout the iterative process of the statewide assessment analysis, identifying issues found in the field, as well as critiquing data and map series generated along the way. In order to target priority issues identified in the process, staff members were provided

a list of final data layers and asked to indicate the level of importance ranging from 10 (Very important) to 1 (Unimportant). Once surveys were collected from 16 staff members, the values were averaged. In order to have consistency with the 2020 Action Plan, those average values were divided by 10.

Final weights were applied through a ‘Weighted Sum’ analysis as discussed in the ‘Forest Resource Threats’ and ‘Forest Resource Benefits and Services’ section, to the individual input data layers to create the seven issue composite layers (‘Issues that Threaten a Healthy Forest,’ ‘Wildfire Risk,’ ‘Loss of Kansas Forestland,’ ‘Sustaining Water Quality and Quantity,’ ‘Protecting and restoring Forest Biodiversity and Wildlife Habitat,’ ‘Sustaining and Protecting Forest and Agroforestry Ecosystems,’ and ‘Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands’). The ‘Issues that Threaten a Healthy Forest,’ ‘Wildfire Risk,’ and ‘Loss of Kansas Forestland’ issue composite layers carried their output values – and thus the composite weights – forward into the ‘Forest Resource Threats’ composite layer. Similarly, ‘Sustaining Water Quality and Quantity,’ ‘Protecting and restoring Forest Biodiversity and Wildlife Habitat,’ ‘Sustaining and Protecting Forest and Agroforestry Ecosystems,’ and ‘Maintaining and Promoting Livelihoods and Economic Benefits of Woodlands’ issue composite layers carried their values forward into the ‘Forest Resource Benefits and Services’ composite layer.

At this point in the analysis, both the threats and benefits composite layers were classified as described in their respective sections. The classified layers were then combined as described in the ‘Statewide Composites’ section below. By using the classified results, both forest benefits and forest threats were considered of equal importance in the final analysis so that areas where the various combinations of threat values and benefit values intermingled could be identified.

Summary of Priority Areas Threats and Benefits Composite Maps

To complete the analysis portion of the Statewide Assessment and Strategy, a series of final statewide composite layers were generated, combining threats and benefits, as an apparatus for helping to identify priority resource areas – or areas where Kansas Forest Service funds and staff should be targeted. The classified ‘Forest Resource Benefits and Services’ and ‘Forest Resource Threats’ composite layers (Figures 3.12 and 3.5) were combined using a ‘Weighted Sum.’ No additional weights were assigned at this stage of analysis; rather, values 1 to 5 from each classified layer were combined to produce an assessment composite layer with values ranging from 2 to 10. Higher values in the Assessment composite layer indicate a combination of both high benefits and high threats. The layer was subsequently classified using a five-class quantile

Summary of Forest Benefits — Composite Map

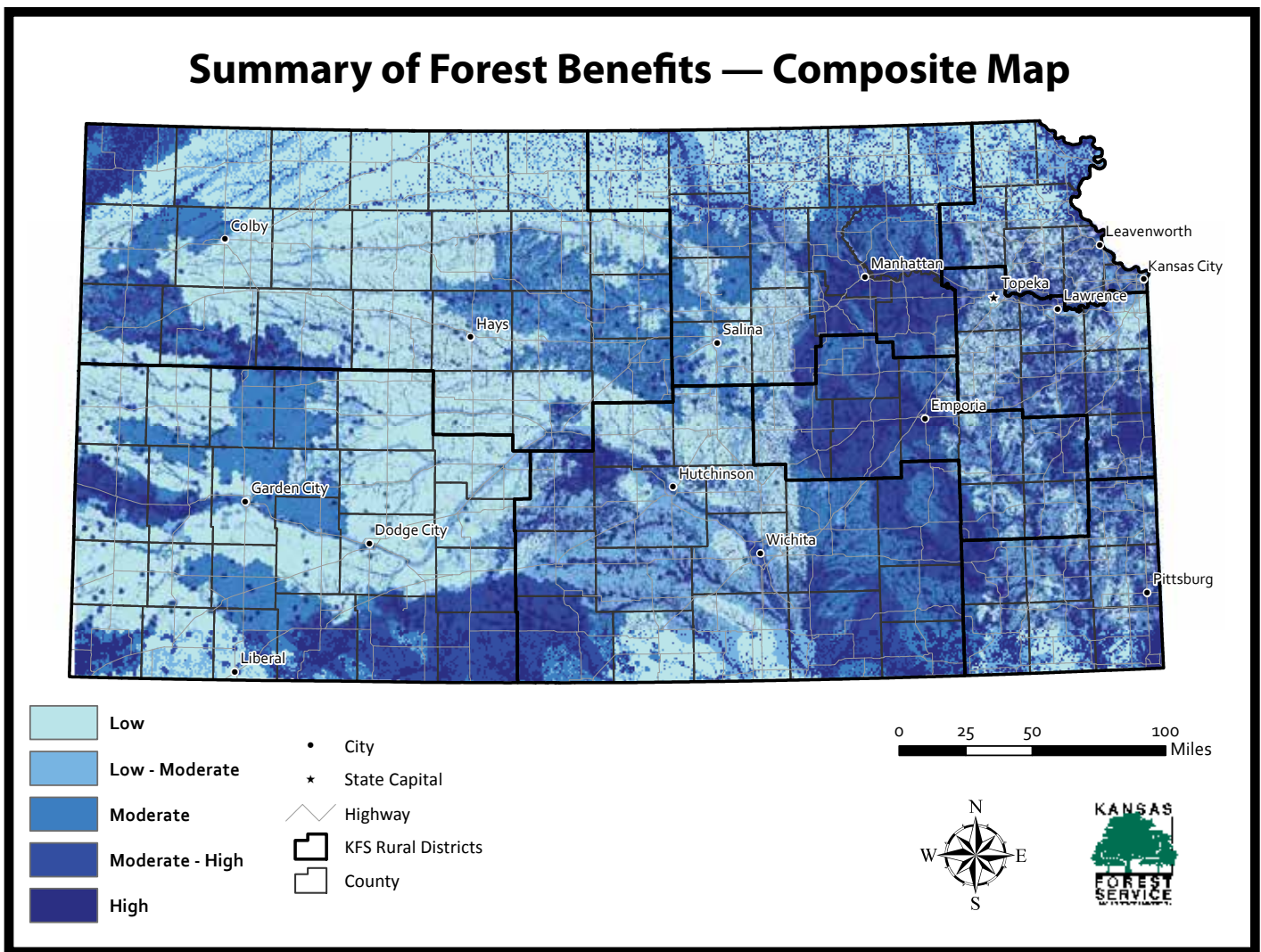


Figure 3.12. A five-class quantile reclassification of the weighted sum analysis combining the composite maps for: Sustaining Water Quality and Quantity, Protecting and Restoring Forest Biodiversity and Wildlife Habitat, Sustaining and Protecting Forest and Agroforestry Ecosystems, and Maintaining and Protecting the Economic Benefits of Woodlands.

classification scheme producing classes: ‘High,’ ‘Moderate – High,’ ‘Moderate,’ ‘Low – Moderate,’ and ‘Low’ (Figure 3.13).

In order to create the Priority Resource Areas – ‘forest landscape areas’ in Final Guidance language – the unclassified Assessment layer cell values were aggregated to HUC-14 watershed boundaries. To achieve this aggregation, the ‘Zonal Statistics’ tool was applied, with HUC-14 watersheds used as the ‘Zone’ and the unclassified Assessment composite used as the ‘Input value raster.’ Aggregation was conducted based on the mean cell value within each HUC-14 watershed. The aggregated output layer was subsequently classified, again using a five-class quantile scheme, resulting in ‘Low,’ ‘Low – Moderate,’ ‘Moderate,’ ‘Moderate – High,’ and ‘High’ classes (Figure 3.13). From this layer the ‘Moderate – High’ and ‘High’ classes were selected for a final ‘Priority Resource Areas’ map (Figure 3.15). ‘Moderate – High’ areas were selected with the idea that there may be potential for cross-boundary work from areas classified as ‘High.’ The entire GIS methodological

approach throughout the Statewide Forest Resource Assessment to this point is shown in a simplified graphical form in Figure 3.16, with marked reference to Assessment map figures contained within the text.

After the creation of the Priority Resource Areas, it was decided that to better efficiently and effectively coordinate resources and efforts across areas delineated as ‘Moderate-High’ and ‘High,’ an additional level of refinement could prove beneficial, especially in promoting work to the public and working with other agencies and stakeholders. To address this need, nine Landscape Priority Areas were created to focus future work (Figure 3.17). These areas were delineated along broad ecological and/or issue related themes. This additional level of delineation does not preclude work in other Priority Resource Areas; it simply provides a framework for broader landscape partnerships and projects with other agencies and stakeholders.

Unaggregated Summary of Priority Areas for Threats and Benefits by Five Classes — Composite Map

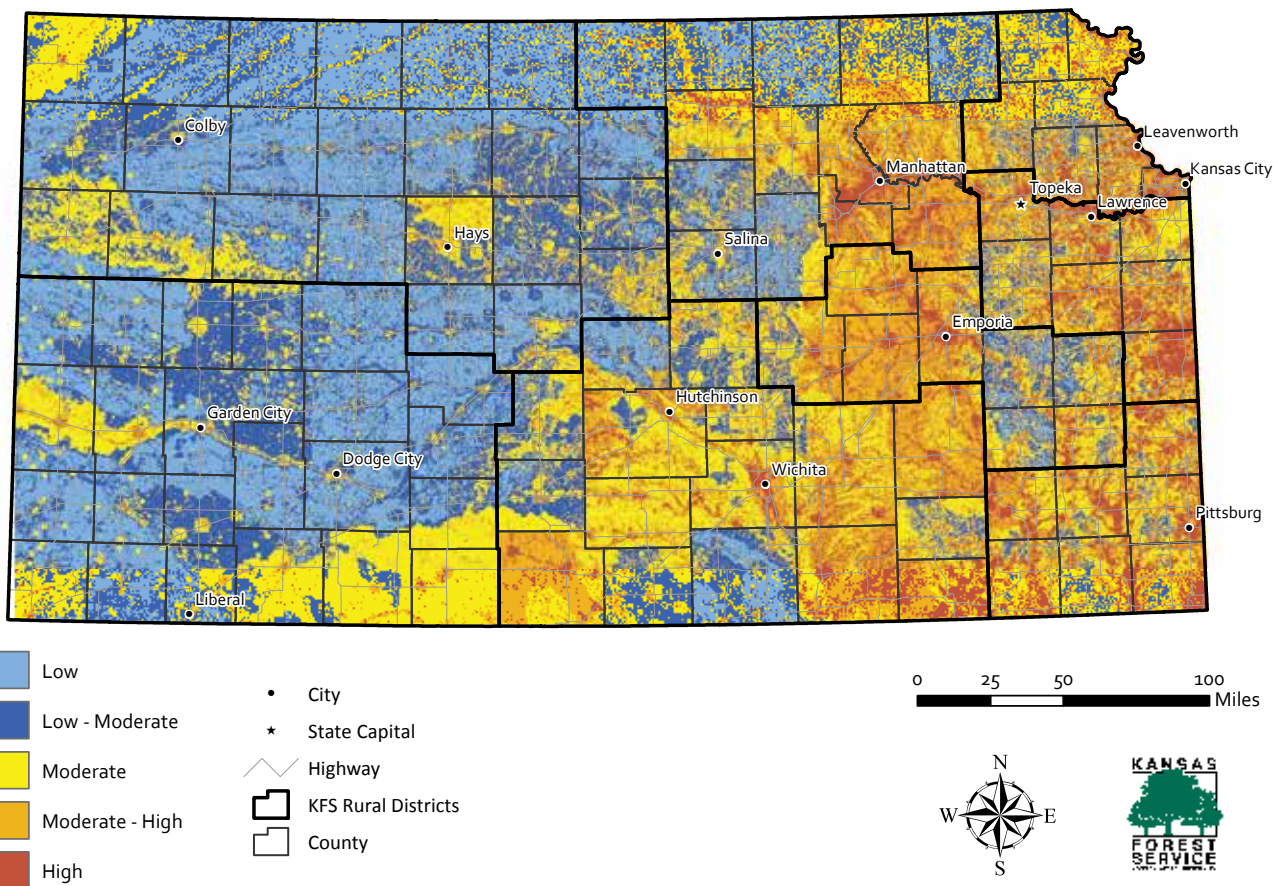


Figure 3.13. A five-class quantile reclassification of the cell values as a result of combining the composite maps for ‘Forest Resource Threats’ and ‘Forest Resource Benefits.’ No additional weights were assigned at this stage of analysis; rather, values 1 to 5 from each classified layer were combined to produce an assessment composite layer with values ranging from 2 to 10. These cell values were then reclassified into a five-class quantile classification (Low, Low-Moderate, Moderate, Moderate-High, and High).

3.3.2 Summary for Kansas Forest Resource Assessment and Strategy

The Kansas Forest Resource Assessment and Strategy will guide the development of USDA Forest Service, State and Private Forestry consolidated grant narratives, competitive redesign grants, and other grants by indicating activities in the narratives that address specific issues and strategies. Baseline forest resource conditions identified under each issue will be used to monitor successful outcomes in priority landscapes and areas. Strategies will be reviewed annually as grant narratives are developed to determine success and revised accordingly based on performance measures and indicators. The assessment and strategy will also be revised as new data becomes available with a 5-year review in 2025.

3.4 Multi-State/Regional Issues and Priority Areas

Seven multi-state or regional issues and areas have been identified (Figure 3.18) and are listed below. Some issues and areas represent ongoing projects and programs. Others will require additional planning, collaboration, and consensus.

Cross Timbers

A description of this regional area and its issues are described under section 4.2.5 as a Forest Legacy Program Area. It includes portions of Oklahoma, Texas, and Arkansas.

Flint Hills

This multi-state priority area has been described in detail in Chapter 4, Assessment of Needs under sections 4.2.1 Northern Flint Hills Forest Legacy Program Area, page 57

Aggregated Summary of Priority Areas for Threats and Benefits by Five Classes — Composite Map

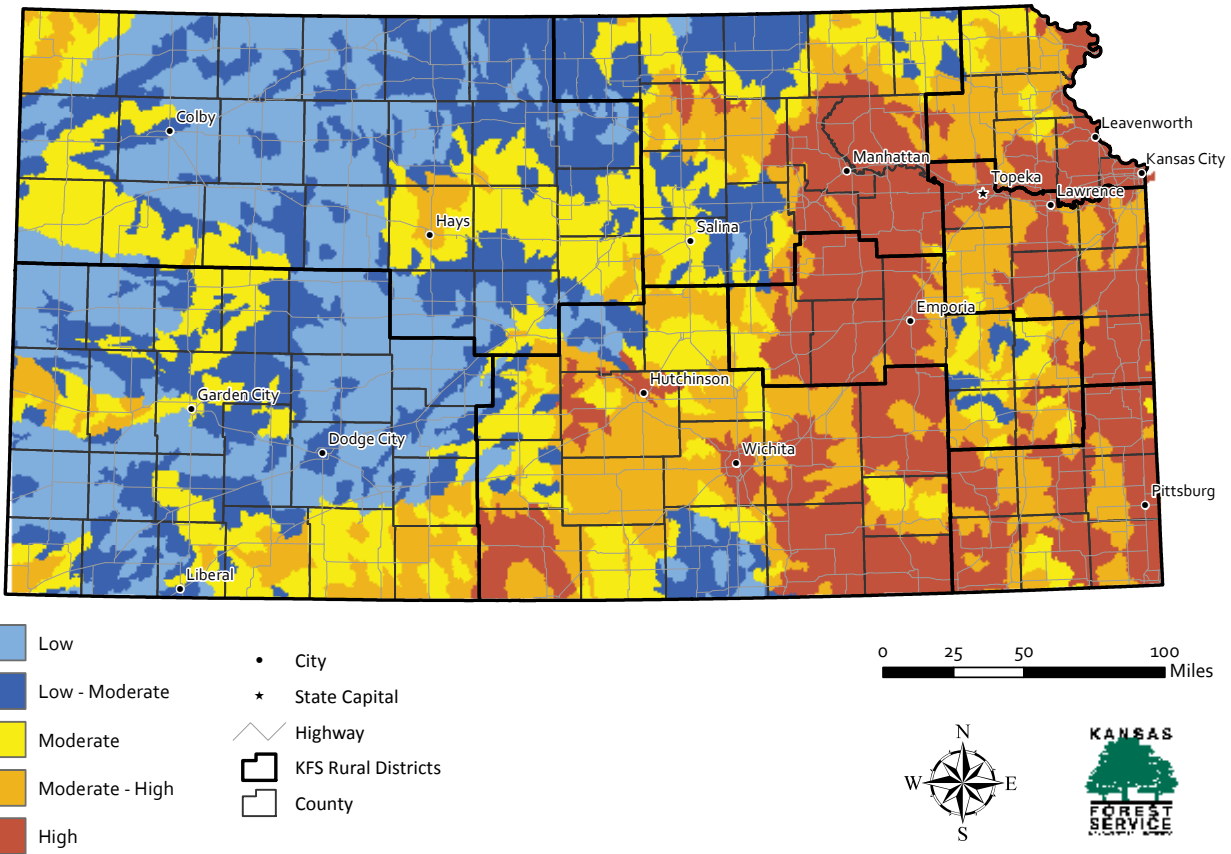


Figure 3.14. A five-class quantile classification of Hydrological Unit Code (HUC) 14 watersheds derived from the mean raster cell value from the statewide composite map (Figure 3.13) within each watershed.

and 4.2.2 Central Flint Hills Forest Legacy Program Area, page 57. Geographically, the issues in this area include Oklahoma and Kansas.

Kansas City Metro Area

A multi-state area and issue of Loss of Kansas Forestland (Section 3.1.3) that involves Missouri. Controlling invasive bush honey suckle is also a major issue for this priority area. Strong partners have included the Heartland Tree Alliance and MARC.

Republican River Watershed

A watershed shared with the states of Nebraska and Colorado. In Kansas, the Lower Republican focuses on the issues of harmful algal blooms at Milford Lake, described on page 32 in Section 3.2.1, Sustaining Water Quality and Quantity. The Upper Republican's focus is on the shared issue of controlling invasive species and water quantity. Currently partnering with Kansas Water Office on an HAB RCPP grant.

Emerald Ash Borer Quarantine

The emerald ash borer quarantine is described on p. 22 - 26, section 3.1 and shares the contiguous issue with Missouri, though Nebraska, Colorado, and Oklahoma also have confirmed emerald ash borer. Within Kansas, as of 2020, Atchison, Doniphan, Douglas, Jackson, Jefferson, Johnson, Leavenworth, Miami, Shawnee, and Wyandotte counties are quarantined. Description of the quarantine may be found at <https://agriculture.ks.gov/divisions-programs/plant-protect-weed-control/emerald-ash-borer>.

Little Big and Blue Rivers

These watersheds are shared with Nebraska. These watersheds focus on the sedimentation of Tuttle Creek Reservoir and impairments of bacteria primarily from livestock, atrazine and eutrophication. Strategies are described in in Section 3.2.1, Sustaining Water Quality and Quantity. Kansas Forest Service has had preliminary meetings with Nebraska Forest Service regarding collaboration on potential RCPP grants in these watersheds.

Summary of Priority Areas for Threats and Benefits by High and Moderate-High Priorities - Composite Map

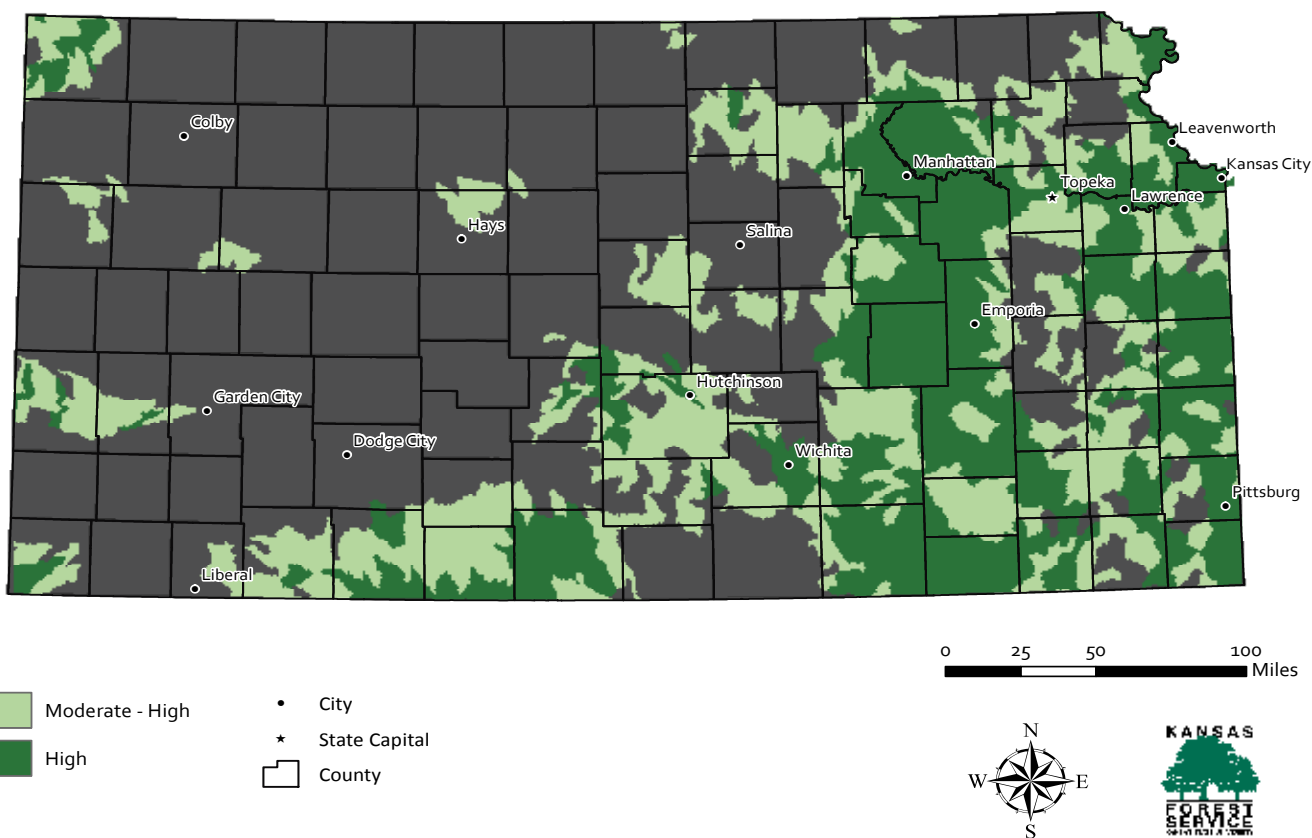


Figure 3.15. *Kansas Forest Resource Assessment identified primary resource areas.*

Tamarisk

A non-native woody phreatophyte shrub that is well-established along several watersheds in western and central Kansas, with the Arkansas, Cimarron, and Rattlesnake among the most heavily impacted. The issue is addressed in Section 3.1.1. Potential collaboration exists with Oklahoma and Colorado and to a certain extent Nebraska.

Two successful LSR projects in Kansas, in the Rattlesnake Creek watershed being particularly are restoring native habitat and streamflow.

Thousand Cankers Disease

Thousand Cankers Disease of Black Walnut has spread across much of the West, and found in parts of the black walnut's native range in the East as well. TCD has not been detected in either Kansas or Missouri, but several known infestations in eastern Colorado still persist and threaten the walnuts growing at the edge of their range in Kansas. This disease kills black walnuts through mass attack of the walnut twig beetle carrying the *Geosmithia morbida* fungus. Information is found in Section 3.1.1

Threats

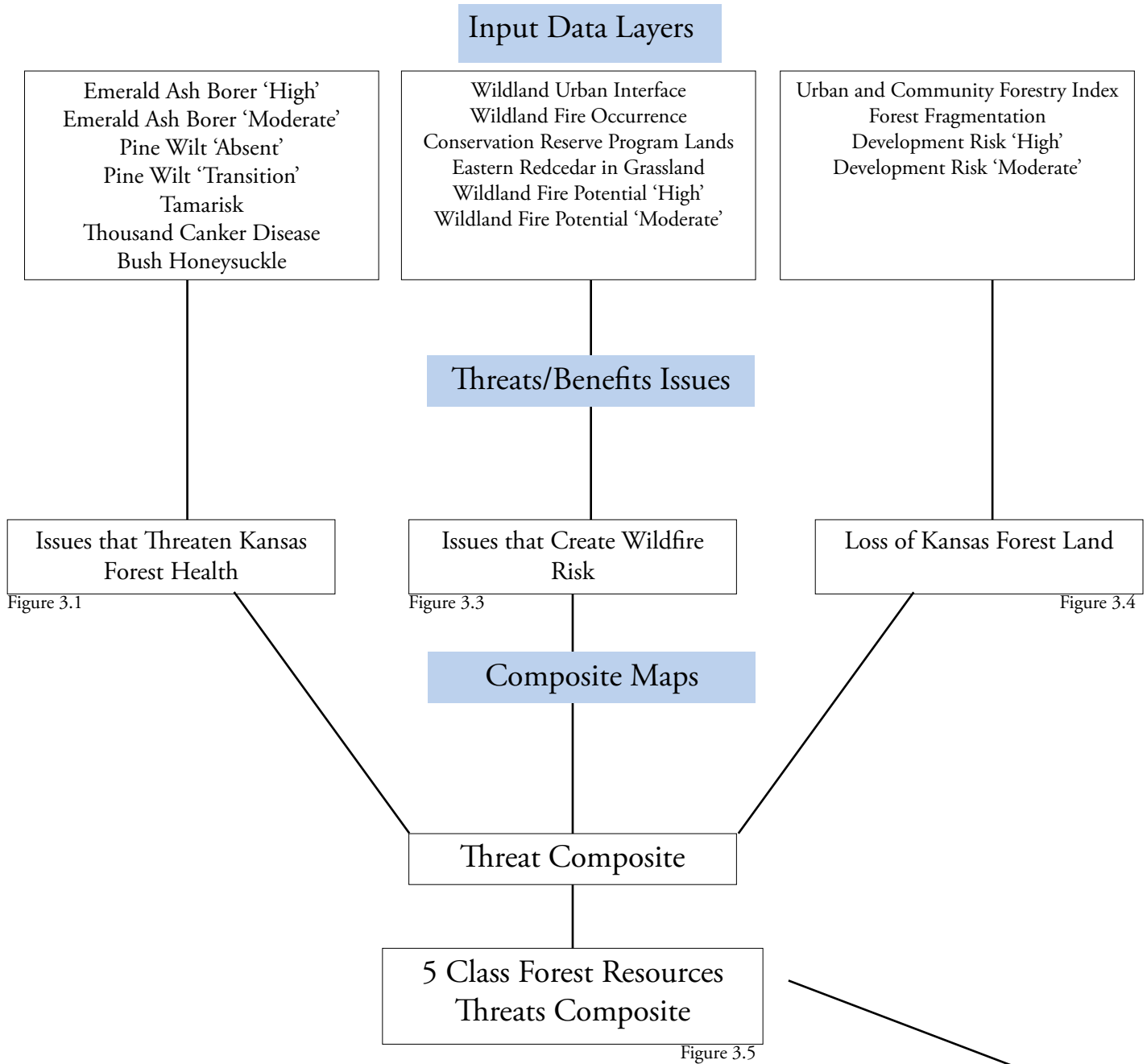
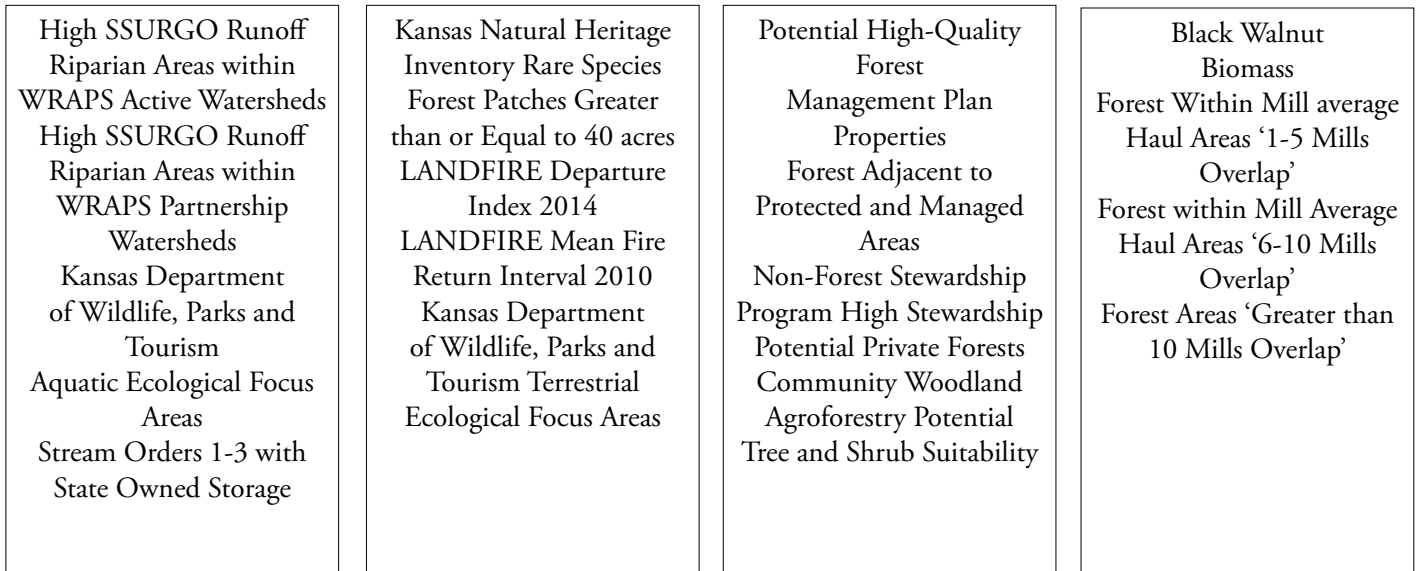


Figure 3.16. This diagram shows, in a simplified graphic manner, the GIS methodological procedure followed in the Kansas Statewide Forest Resource Assessment. Each column represents a stage in the analytical procedure that eventually resulted in a five-class Statewide HUC-14 Priority Resource Areas, Figure 3.14. The data layers column represents the 36 data inputs developed for the analysis, 16 for Forest Resource Threats, and 20 for Forest Resource Benefits. Maps detailing all 36 data input layers can be found in Appendix C. These 36 data layers produce seven sub-issue composite maps, which were created through weighted sum analysis and are represented by the second column. These seven sub-issues, three for Forest Resource Threats and four for Forest Resource Benefits, in turn created composite maps representing statewide Forest Resource Threats (Figure 3.5) and Forest Resource Benefits Services (Figure 3.12). When combined (Figure 3.13) and aggregated by HUC-14 Watersheds, these two composite maps represent the Kansas Statewide Priority Resource Areas (Figure 3.14).

Benefits

Input Data Layers



Threats/Benefits Issues

Sustaining Water Quality and Quantity

Figure 3.7

Protecting and Restoring Forest Biodiversity and Wildlife Habitat

Figure 3.8

Sustaining and Protecting Forest and Agroforestry Ecosystem

Figure 3.9

Maintaining and Promoting Livelihoods and Economic Benefits of Woodland

Figure 3.11

Composite Maps

Benefit Composite

5 Class Forest Benefits & Services Composite

Figure 3.12

Statewide Composite Map

5 Class Unaggregated Statewide Composite

Figure 3.13

5 Class Statewide HUC-14 Priority Resource Area

Figure 3.14

High Priority Landscape Areas By High Priority and Moderate-High Priority

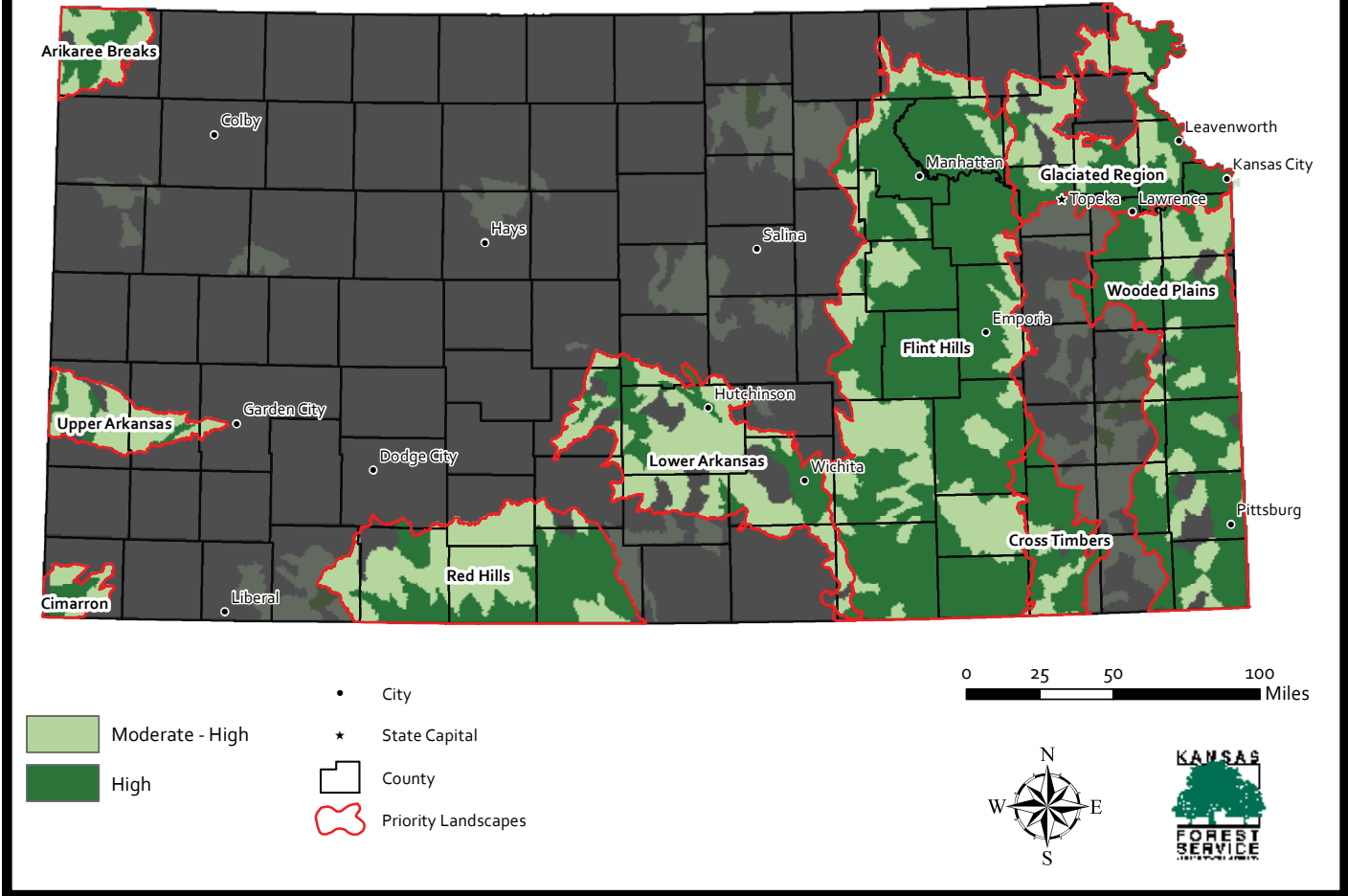


Figure 3.17. Kansas Forest Resource Assessment and Strategy priority landscapes.

Regional Issues and Priority Areas

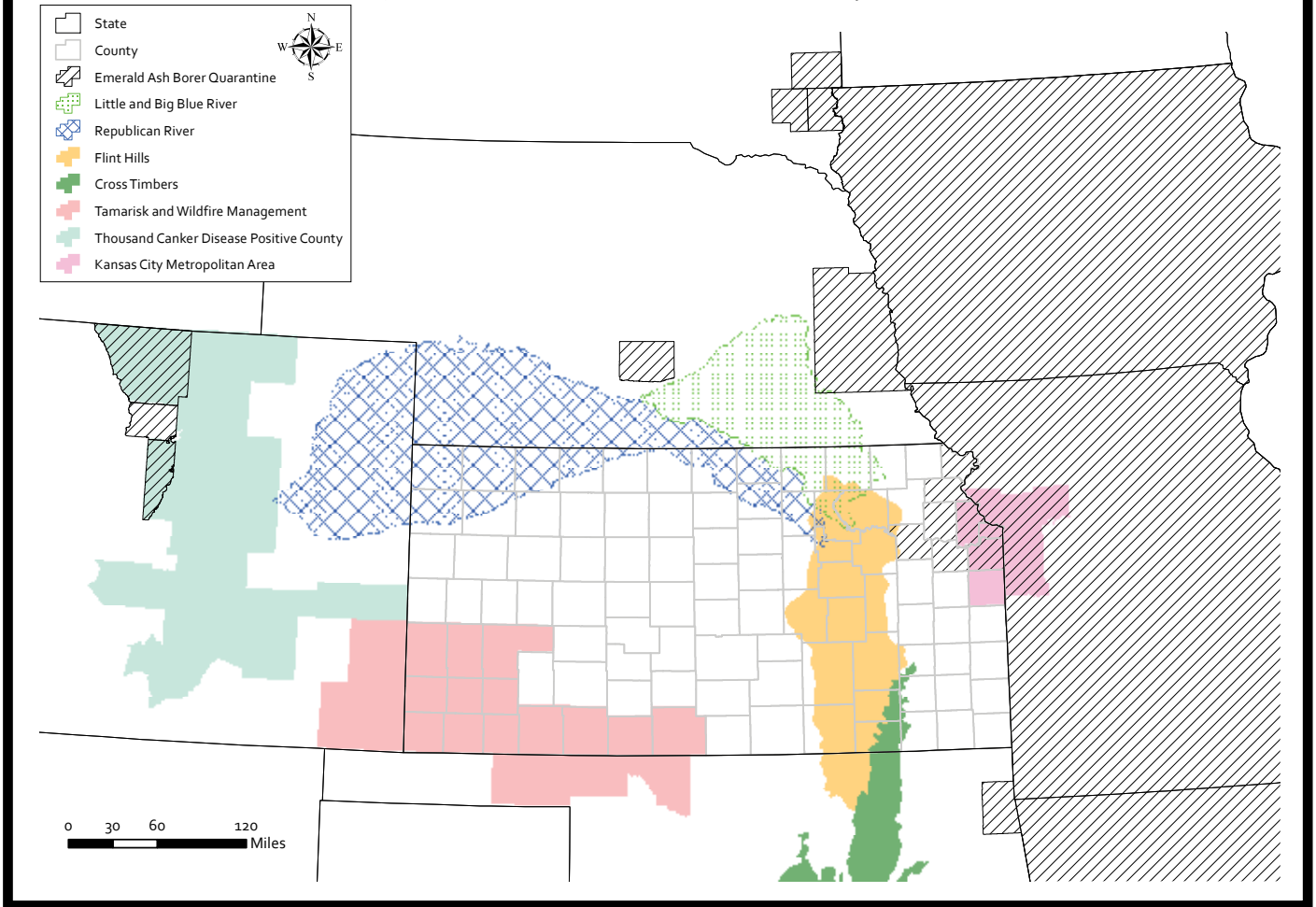


Figure 3.18. Multi-state or regional issues identified by the Kansas Forest Service.

KANSAS FOREST LEGACY PROGRAM

The Forest Legacy Program is a voluntary program that encourages the protection of environmentally important privately owned forestlands from conversion to non-forest use. The Forest Legacy Program is guided by an assessment of needs that was publicly developed and approved in 2010.

4.1 Forest Legacy Program Responsibility

In November 2008, then Governor Kathleen Sebelius designated the Kansas Forest Service as the lead agency for the Forest Legacy Program (FLP) in Kansas (Appendix F). The program was implemented through a State Grant Option, by a division of the state of Kansas, and will hold title to all deeds. The Kansas Forest Service may elect to delegate management and administration of individual tracts of land to other government entities.

4.1.1 Goals and Objectives of FLP in Kansas

- Protection of riparian forests from agricultural and urban development to sustain water quality and quantity.
- Protection of forest biodiversity and wildlife habitat for species of greatest conservation need and threatened and endangered species.



Eastern spotted skunk, Photo by Bob Gress

Protecting and restoring habitat for state and federally listed species is a goal for all Forest Legacy Program areas.

- Protection of forests and woodlands of good to high ecological value from agricultural, commercial, and residential development and fragmentation.

4.1.2 Eligibility Criteria for Establishing FLP Landscape and Priority Areas

Potential Forest Legacy Areas must be high-priority landscape areas as defined by the *Kansas Forest Action Plan* that address at least one of three issues identified in the strategy including 1) Loss of Kansas Forestland, 2) Sustaining Water Quality and Quantity and 3) Protecting and Restoring Forest Biodiversity and Wildlife Habitat. FLP Areas should offer one or more of the following public values:

- Scenic resources;
- Public recreation;
- Water quality/quantity;
- Threatened and endangered or species in greatest need of conservation;
- Archeological, cultural or geologic features;
- Contiguous or close to existing public forests or unique forest resources;
- Provides multiple uses including but not limited to forest products, watershed protection, and recreation.

FLP Areas must be threatened by current or future conversion to nonforest uses as a result of change in ownership, conversion to agricultural use, gravel pits/mining, residential/commercial development or invasive species.

4.1.3 Process for Selection and Ranking Criteria of FLP Project Proposals

Project proposals will be identified through request processes managed by the Kansas Forest Legacy Program manager. A subcommittee of the State Forest Stewardship Coordinating Committee and the Kansas Technical Committee will review submitted projects, assign values to the project attributes according to the program ranking system (below), and rank the projects according to the total value derived from the ranking system. These ranked projects will then be submitted to the Kansas State Forester for additional review and consideration. Following the State Forester's final ranking approval, the proposed projects will be submitted to USDA Forest Service. Projects compete nationally for funding.

Table 4.1. Kansas Forest Legacy Ranking System

	Max Points
Parcel located in an identified Priority Legacy Area	50
Conversion Risk (to non-forest urban or agricultural uses)	50
Economics (% contributions, 25% from non-federal or in-kind)	50
Public Resource Benefits	
Habitat for Species in Greatest Need of Conservation/Threatened and Endangered	25
Water (watershed protection/water quality/quantity)	25
Forest Products (timber/wood products/biomass)	25
Aesthetics (scenic or unique landscapes)	25
Recreation (public non-motorized opportunities)	25
Cultural Resources (historic/archeological values)	25
Unique Ecological Area	25
Size and Continuity (75% forested, 5 acre minimum, larger parcels more value)	25
Forest Stewardship Potential (occurring in high potential SAP area)	25
Mineral Rights (owned/controlled by applicant)	25
Parcel Crosses State Boundaries	25
Contiguous to Public or Protected Lands	10
Community Support	10
Contains Riparian Forestland	10
Evidence of Active and Historic Forest Management	10
Forest Type Ecologically Appropriate for Parcel	10
Total	475

The Kansas Forest Stewardship Coordinating Committee and the Kansas Forest Service created the program evaluation and ranking system shown in Table 4.1 to rank Forest Legacy Program applications.

4.1.4 Methods of Protection of Forest Legacy Program Area Tracts

Fee simple deeds are the preferred method for acquiring forestland. All management shall follow guidelines of a Forest Stewardship Management Plan prepared by the Kansas Forest Service in concurrence with the state entity holding the deed. Timber harvesting shall be in consultation with a professional forester and follow the guidelines described in the Forest Stewardship Management Plan or K-State Research and Extension publication *Marketing Kansas Timber*, C542. Departures from sustained forest management are permitted only in limited response to outbreaks of forest insects and disease and salvage in the event of fire or natural disasters. The plan shall be reviewed and updated as needed at least once every 10 years. Public access rights are not required and will be determined on



Protecting riparian forests is an important goal of the Forest Legacy Program.

a case-by-case basis by a sub-committee of the Kansas Forest Stewardship Coordinating and the deed holder.

4.1.5 Kansas Mineral Rights

According to the Kansas Geological Survey, Kansas mineral rights are defined as the right of ownership of the mineral resources that underlie a tract of land. The land surface and the resources below the surface can be owned and are considered property. The mineral rights can be owned in total or can be owned by the specific mineral commodity. One company may own mineral rights to coal, while another company owns the oil and gas rights.

In Kansas, ownership of mineral rights is not tied to ownership of the land surface. The landowner usually owns the subsurface rights, but these rights can be separated from the surface ownership. It is important to identify ownership of mineral rights extraction, excavation, and royalties early in the Forest Legacy Program process. It is also important to identify if mining is “so remote as to be negligible” (as per Treas. Reg. §1.170A-14[g][4][i]) and to conduct a geological survey of the property to determine likelihood of excavation. Severance of mineral rights occurs when the owner of both the surface and mineral rights sells or grants by deed the mineral rights underlying their property, which may need to occur for easements and fee sample transfers. Landowners also may reserve, or retain, all or a portion of the mineral rights upon sale of the property. Mineral deeds and mineral reservations are recorded with the county register of deeds and are included in any abstract of title to the land involved.

Mineral owners have the right to access and develop their minerals. Landowner rights are preserved, whether they participate in development of the mineral rights. Regulations are in place to stop operators if their activities are irresponsible or damaging to the surface. Landowners are entitled to compensation for loss of use or damage to their land. Most

operators are willing to work with the landowner to reach a fair settlement for damages, but if this fails, state and federal regulations protect the landowner.

Before any company can begin an exploration and development program in Kansas, they must obtain a lease to the mineral rights. An oil and gas lease is a legal agreement between the mineral-rights owner (the lessor) and the oil and gas operator (the lessee) that grants the operator the right to explore and develop the oil and gas resources, which may underlie the area described in the lease. Some general stipulations that are usually part of a lease agreement include:

- A legal description of the area and the number of acres.
- The primary term of the lease. This can be for any length of time but is usually 5 or 10 years.
- A provision for lease rental payments (usually annual) by the operator to the mineral-rights owner. Rental payments maintain the lease in effect throughout the primary term. If oil or gas is found, the lease will remain in effect as long as production continues, even beyond the primary term of the lease.
- A royalty clause that stipulates the mineral-rights owner's share of the oil or gas production. The royalty may be any amount mutually agreed to by the operator and the mineral rights owner but is usually one-eighth (12.5%) of the oil or gas produced from the lease. Usually the operator sells the oil or gas to a refiner and the mineral-rights owners receive payment for their share from the operator.

4.1.6 Cultural Resources

The Kansas Forest Service will work directly with State Historic Preservation Office (SHPO) of the Kansas Historical Society to protect significant historic and cultural resources within each Forest Legacy Program priority area. SHPO staff will review proposed projects under both federal and state preservation laws to determine if the proposed project will harm any historic property or archeological site. These specific laws include the Kansas State Preservation Law, Section 106 of the National Historic Preservation Act, Kansas Antiquities Act, and Unmarked Burial Sites Preservation Act.

4.1.7 Program Implementation Chronology

- November 2008 – Governor, Kathleen Sebelius designates Kansas Forest Service as lead agency for FLP.

- February 2009 – meeting with Kansas Land Trusts to discuss FLP potential and direction, Claire Harper, USDA Forest Service, presenting.
- Winter 2009, Issue #33, Kansas Canopy newsletter article on Forest Resource Assessment and Strategy.
- February 2009 – Kansas State Radio Network, Tree Tales, Forest Legacy Program.
- September 2009 – Posting of Forest Resource Assessment on the Web and “mail-out” to Kansas Technical Committee, State Forest Stewardship Coordinating Committee, and others.
- October 2009 – Kansas Technical Committee and State Forest Stewardship Coordinating Committee meeting to solicit input, (Lindon Wiebe and Dana Coelho, USDA Forest Service also attending).
- February 2010 – Kansas Natural Resource Conference, presentation of Forest Resource Assessment and Strategy.
- May 2010 – Final draft posted on Kansas Forest Service website and mailing of revised Forest Resource Assessment and Strategy to Kansas Technical Committee, State Forest Stewardship Coordinating Committee, and others. News releases, radio programs, soliciting public comment, etc.
- June 4, 2010 – Forest Resource Assessment and Strategy input deadline.
- June 2013 – Allocation of new state startup funds.
- September 2014 – Real estate appraisal completed.
- September 2015 – Warranty deed received.
- April 2016 – Dedication of Baldwin Woods. Kansas' first legacy forest.
- January 2017 – Forest Stewardship Plan.
- September 2018 – Forest Planning at Baldwin Woods Report.
- October 2018 – A tour of Baldwin Woods Forest Preserve by Kansas Biological Survey for the general public.
- February 2019 – Public Forum on Natural Areas and historic Sites of Southwest Douglas County.
- April 2019 – Native Forest Tour of the Baldwin Field Station by Kansas Biological Survey for the general public.

Forest Legacy Program Areas

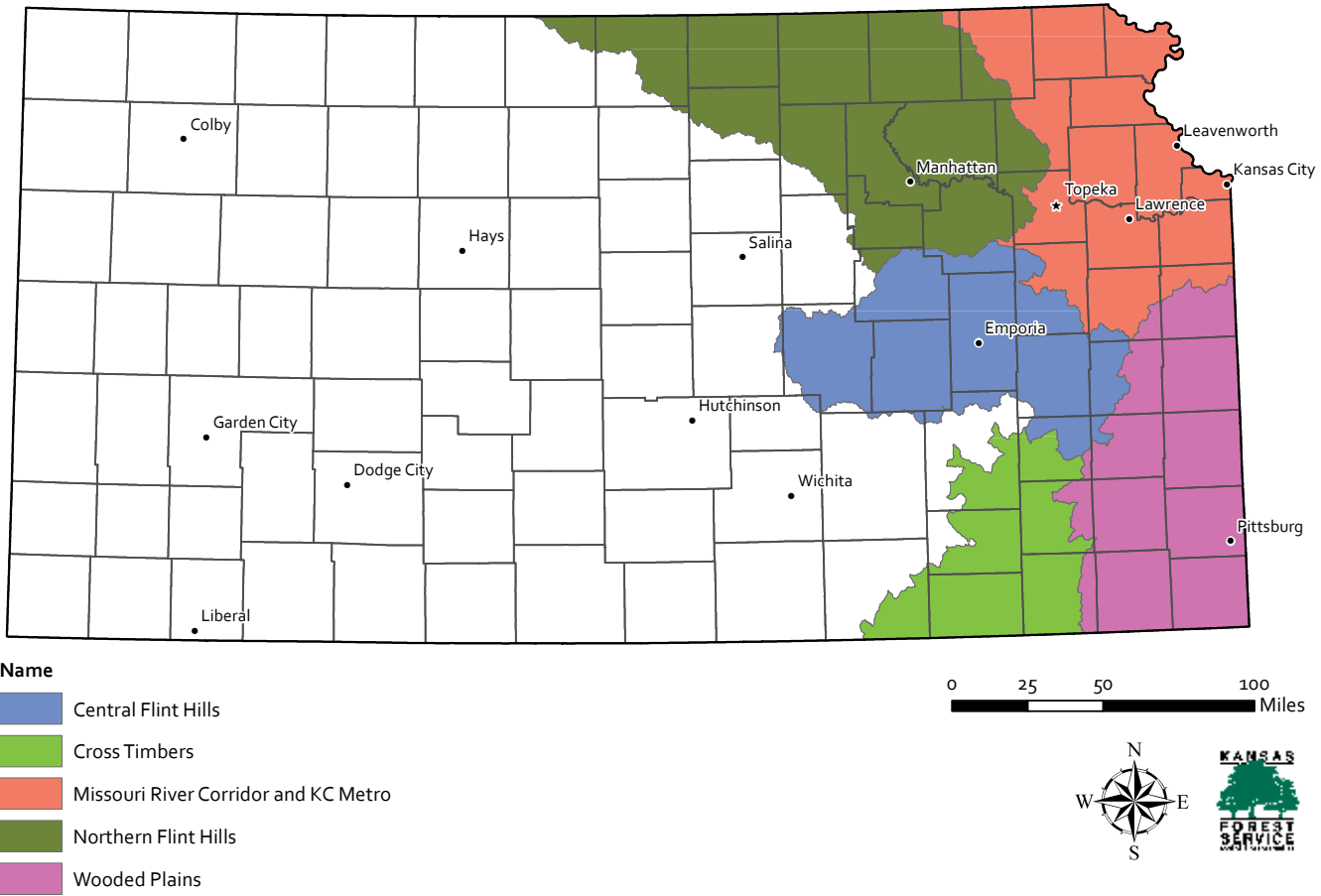


Figure 4.1. Forest Legacy Program Areas.

4.2 Kansas Forest Legacy State Priority Area Map

Eleven data layers used in the Kansas Forest Resource Assessment and Strategy (some of them multiple) were used to further refine priority areas specifically for the Forest Legacy Program. They are found under each issue's Map Data Description and Classification section and are listed below.

- Forest Fragmentation, Section 3.1.3
- Urban and Community Forest Index, Section 3.1.3
- High Development Risk, Section 3.1.3
- Moderate Development Risk, Section 3.1.3
- WRAPS Riparian Areas/High SSURGO Runoff, Section 3.2.1
- Rare Species, Section 3.2.2
- Forest Patches Greater Than or Equal to 40 Acres, Section 3.2.2

- Forest Stewardship Program Priorities, Section 3.2.3
- Non-Forest Stewardship Program Private High Priority Forestland, Section 3.2.3
- Black Walnut, Section 3.2.4
- 3 Mill Overlap, Section 3.2.4

Determining Boundaries of FLP Areas

An equal weighted raster analysis utilizing ArcMap spatial analyst tools was performed statewide with all 11 datasets at a 30-meter cell resolution. The results of this equal weight analysis were then aggregated at the HUC-14 level and classified into nine quantile classes. The top three classes (a third of all HUC-14 watersheds) were subsequently chosen to represent the basis for the selection of Forest Legacy Areas for Kansas. Forest Legacy Areas have been identified based on the threat of conversion — mostly in the east, surrounding larger cities — and environmentally important forest areas (water quality, rare species, patch size, etc.). Boundaries have generally been defined by the western edge of the Flint Hills and Loess and Glacial Drift Hills ecoregions (Figure 1.2). Forest Legacy Area boundaries represent the edge of contiguous

A partnership among organizations, entities and individuals.

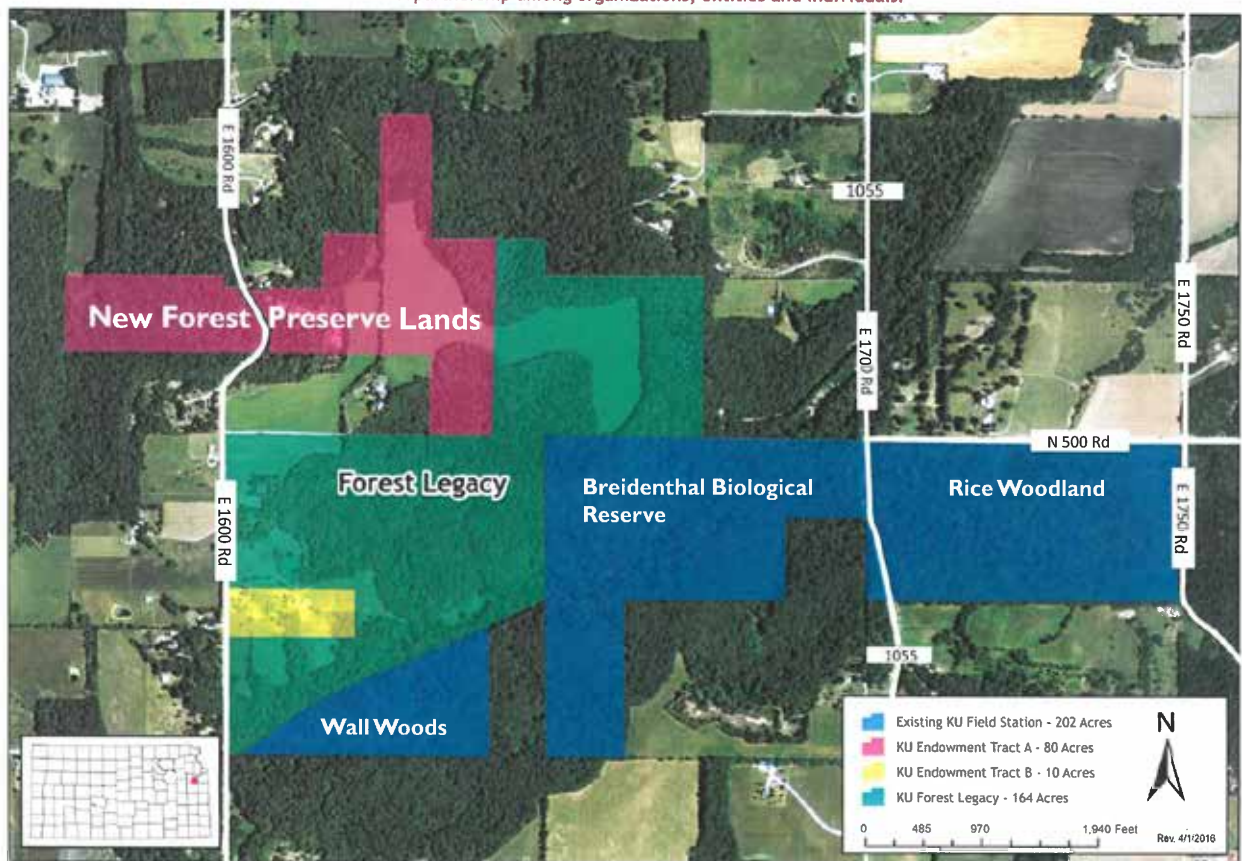


Figure 4.2. Baldwin Woods Forest Preserve.

HUC-14 watersheds classified in the top three quantile classes within eastern Kansas and are shown in Figure 4.1. Additional changes to the Forest Legacy Program boundaries were made to incorporate suggestions received from stakeholders.

4.2.1 Northern Flint Hills Forest Legacy Program Area

General Description

The Northern Flint Hills (Figure 4.3) include a majority of Riley, Pottawatomie, and Wabaunsee counties and parts of Geary, Clay, Marshall, Nemaha, Jackson, and Shawnee counties. Physiologically the area is mainly Flint Hills (Riley, Wabaunsee, Geary) with cherty, clayey soils, with some of the greatest tall grass prairie preserves remaining anywhere. Pottawatomie and Jackson represent deeper more fertile soils derived from an area once covered by glaciers. The main forest types are oak/hickory followed by elm/ash/cottonwood. Most forestland occurs as riparian forests, with eastern redcedar encroaching into grasslands. The Kansas River and Big Blue River are the major drainages. Tuttle Creek Lake and Milford Lakes are the major reservoirs.

State and Federal Lands

U.S. Department of Defense (Fort Riley), U.S. Army Corps of Engineers and Kansas Department of Wildlife and Parks (Tuttle Creek Reservoir), The Nature Conservancy, K-State University (Konza Prairie) are the main state, federal, and nongovernmental organizational entities that hold land or have interests in lands potentially associated with the Forest Legacy Program.

Environmental Values

Tuttle Creek Reservoir is a large federal reservoir that covers a surface area of 12,617 acres and has a storage capacity of 241,747 acre feet. The lake provides crucial flood control, public water supply, recreation, and fish and wildlife habitat. Forty-three percent of the storage capacity in the 47-year-old lake has been lost due to sedimentation. Riparian forests of the Big Blue River and the other streams in the 9,628-square-mile watershed provide important environmental benefits that reduce sedimentation rates and impact the longevity and function of the reservoir. Riparian forests along the Kansas River and its tributaries are also in need of protection and management. The Topeka shiner, least tern, piping plover, and the

Northern Flint Hills and Republican River Legacy Program Area



0 5 10 20 Miles

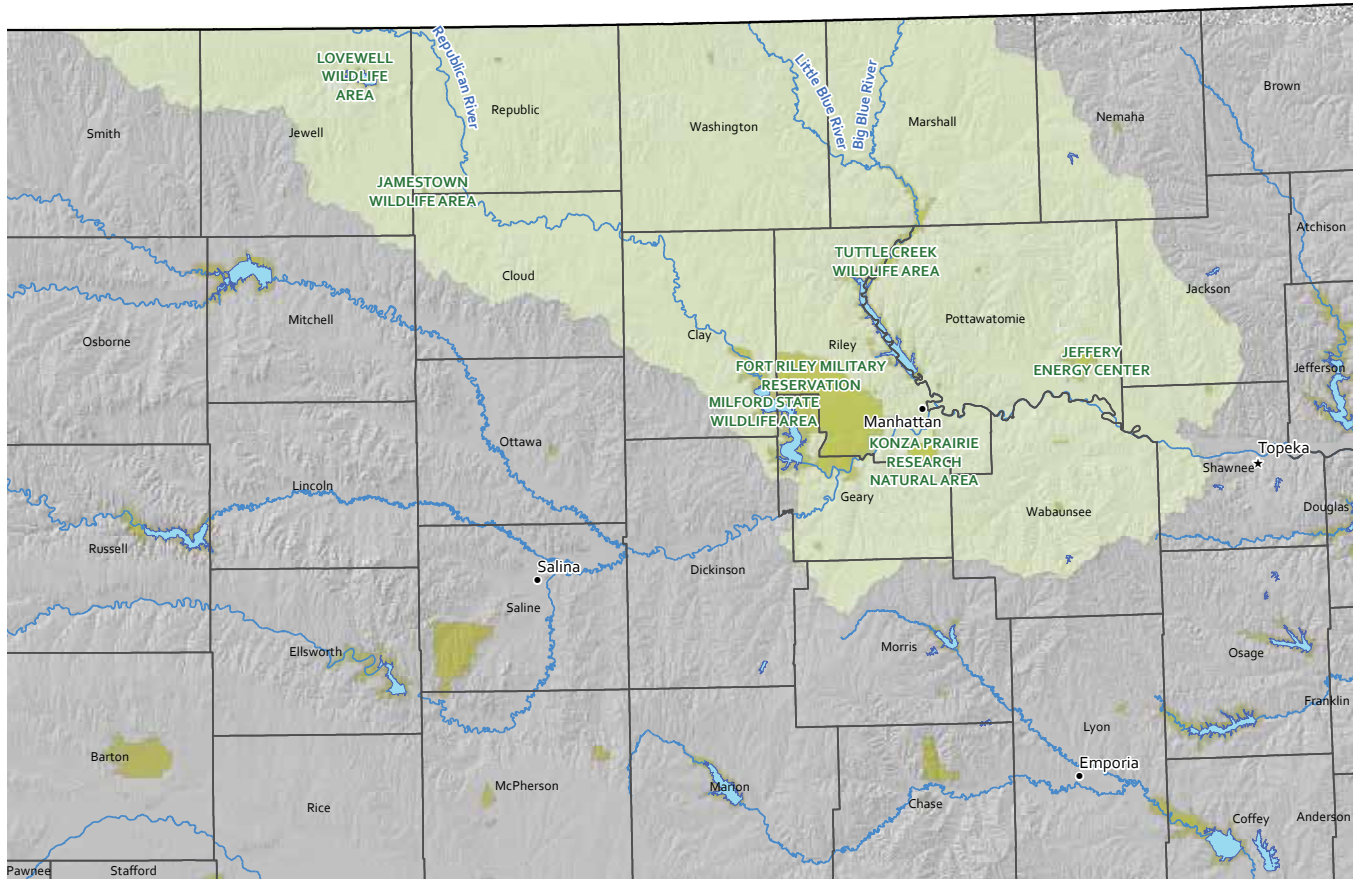


Figure 4.3. Northern Flint Hills and Republican River Legacy Program Area.

sturgeon chub are federal and state targeted species whose habitat needs development and protection. The bald eagle, which was recently removed from threatened and endangered species list benefits greatly from trees like cottonwood, the Kansas state tree.

Public Recreation and Aesthetic/Scenic Values in Forest Legacy Program Priority Areas

The public recreational and aesthetic/scenic value opportunities within the Northern Flint Hills include Lovewell Wildlife Area and Lake, Milford State Wildlife Area, Tuttle Creek Wildlife Area, Tuttle Creek and Milford Reservoirs, Pawnee Indian State Historical Site, Jamestown Wildlife Area, the Hollenberg Pony Express Station State Historic Site, Konza Prairie, and Alcove Spring Park.

Greatest Conversion Pressure

Models suggest over the next two decades that Manhattan’s population will soar from 55,000 to 80,000 people. This expansion is occurring primarily west of Junction City along US-77, east of Manhattan along US-24, with dispersed residential growth in Riley and Pottawatomie counties and along Tuttle Creek Lake Reservoir. Greatest conversion pressures will be associated with those growth projections and conversion of riparian forest to agricultural use.

Goals and Objectives

- Protect riparian forests of Tuttle Creek Lake Reservoir by classifying them for protection, establishment, and management.
- Incorporate goals, objectives, and policies from the Flint Hills Regional Growth Plan, Vision 2025 for Riley County,

Central Flint Hills and Neosho River Legacy Program Area

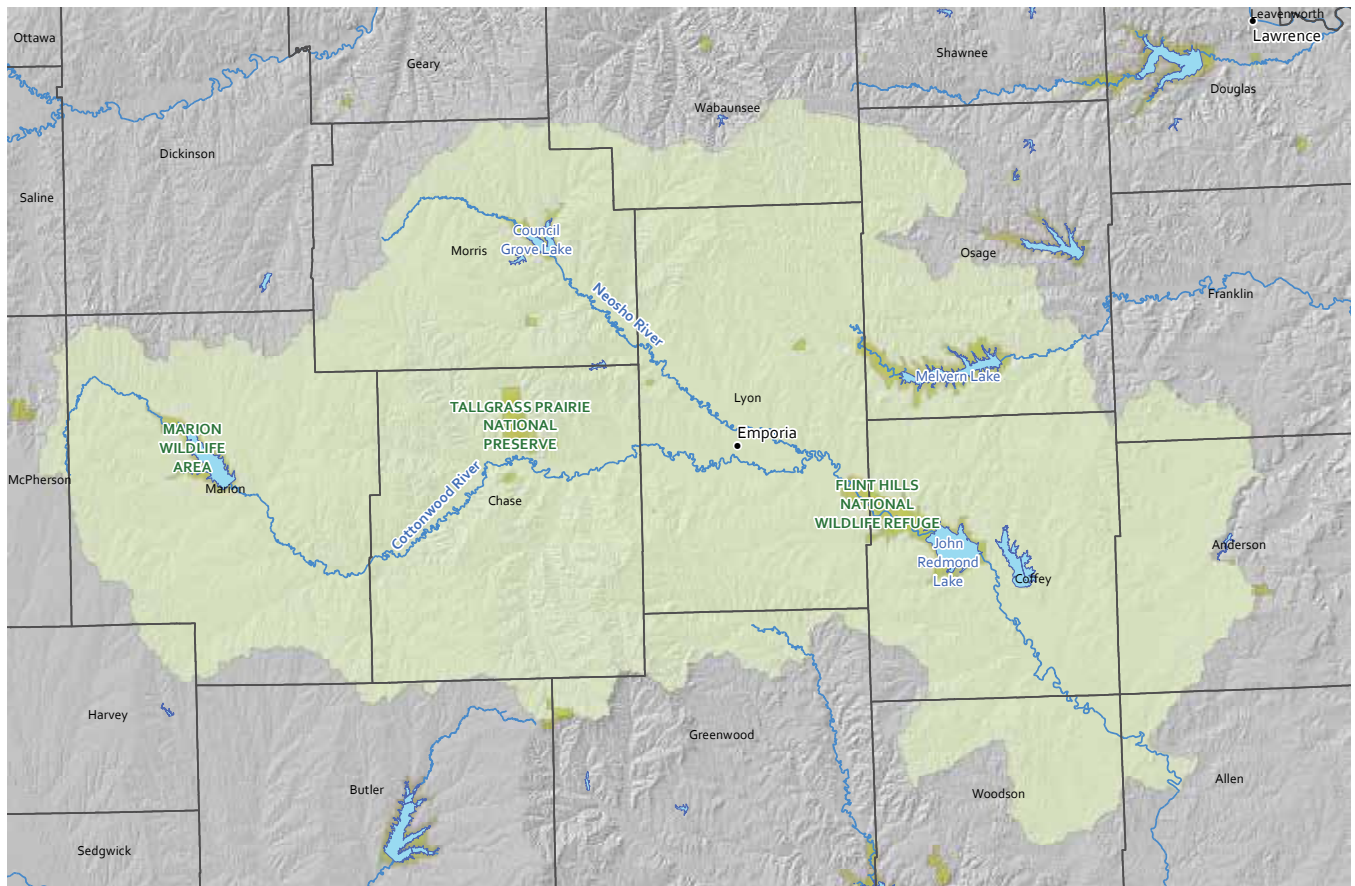
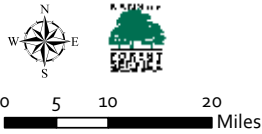


Figure 4.4. Central Flint Hills and Neosho River Legacy Program Area.

and the Tuttle Creek Lake WRAPS to target protection and management of riparian forests as Manhattan expands and rural areas become fragmented from residential development. The Kansas Forest Service will participate in the development of these goals, objectives and policies.

- Protect and restore critical habitat for state and federally listed species.

4.2.2 Central Flint Hills Forest Legacy Program Area

General Description

The Central Flint Hills (Figure 4.4) includes the majority of Coffey, Lyon, and Chase counties, with parts of Morris, Franklin, Woodson, Anderson, and Allen counties. Physiologically the majority of the area is Osage Cuestas (hills or crests) dominated by east-facing ridges with soils from limestone and shale origins. The Flint Hills, described in section 1.2.1 covers Chase and Morris counties. Riparian forests of

cottonwood, bur oak, elm, ash, black walnut and hackberry line the Cottonwood and Neosho Rivers. John Redmond and Wolf Creek are the major reservoirs.

State and Federal Lands

The U.S. Fish and Wildlife Service (Flint Hills National Wildlife Refuge); U.S. Army Corps of Engineers (John Redmond Reservoir); and Kansas Department of Wildlife and Parks, the Nature Conservancy, and National Park Service (Tall Grass Prairie Preserve) are the major entities that hold land or may have interests in lands potentially associated with Forest Legacy Program.

Environmental Values

John Redmond is a federal reservoir that covers a surface area of 8,516 acres and provides flood control, public water supply, recreation and fish and wildlife habitat has a storage capacity of 575,971 acre-feet. Forty-five percent of the storage capacity

in the 58-year-old lake has been lost due to sedimentation. Riparian forests of the Cottonwood and Neosho rivers and the other streams in the 3,015 square-mile watershed provide important environmental benefits that reduce sedimentation rates and impact the longevity and function of the reservoir. The Topeka shiner, Neosho madtom, Neosho mucket mussel, and eastern spotted skunk are federal and state-targeted species whose habitat needs development and protection. Emporia has experienced an estimated 12% increase in population growth over the last decade. Future projections suggest similar patterns with possible reductions in population in outlying areas. Wolf Creek Reservoir is owned by the major utility companies in the state with the primary purpose to cool the reactors at the nuclear power plant. Marion, Melvern and Council Grove Lakes also contribute important environmental benefits to this priority area which are described in detail in Watershed Restoration & Protection Strategy (WRAPS) EPA 9-element watershed plans for each of the lakes.

Public Recreation and Aesthetic/Scenic Values in Forest Legacy Program Priority Areas

The public recreational and aesthetic/scenic value opportunities within the Central Flint Hills priority areas include Council Grove Lake, Melvern Lake, Marion Lake and Wildlife Area, the Tallgrass Prairie National Preserve, Santa Fe Trail Landmarks, Flint Hills National Wildlife Refuge, John Redmond Reservoir, Flint Hills National Scenic Byway, Marion Wildlife Area, and Coffee County Lake.

Greatest Conversion Pressure

Continued urban expansion of Emporia and residential expansion of rural areas along major transportation corridors (primarily I-35). Greatest conversion pressures will be associated with those areas and conversion of riparian forest to agricultural use.

Goals and Objectives

- Classify the size and condition of riparian forests in the John Redmond Reservoir watershed to target areas for protection, establishment and management.
- Protect and restore critical habitat for state and federally listed species.
- Work closely with Flint Hills Wildlife Refuge and Neosho WRAPS to accomplish goals and objectives.

4.2.3 Missouri River Corridor and Kansas City Metro Forest Legacy Program Area

General Description

The Missouri River Corridor, Delaware River, and Kansas City Metro (Figure 4.5) area contains all of Leavenworth, Wyandotte, Johnson, and Douglas counties, most of Franklin, Jefferson, Doniphan, and Shawnee and parts of Miami, Osage, Jackson,



The Forest Legacy Program protects forestland, which provides many different cultural benefits, such as morel mushrooms.

and Atchison counties. A physiographic line from Wyandotte County to Topeka and north generally represents glaciated deep soils while counties south of the line have soil origins from Osage Cuestas. Oak/hickory represents the majority of forest type found in this area. Major reservoirs in this area include Perry, Clinton, Hillsdale, and Pomona. The Kansas and Missouri Rivers are the major drainages in the area. The Kansas City metro area, Leavenworth, Lawrence, and Topeka are the major cities. A scenic byway on Highway 7 from Leavenworth to Troy provides beautiful vistas of Missouri River bluffs, flood plains, and the oak-hickory forests that inhabit them.

State and Federal Lands

U.S. Army Corps of Engineers and Kansas Department Wildlife, Parks and Tourism are the major state and federal entities that hold land or may have interests in lands potentially associated with the Forest Legacy Program. These lands are associated with Perry, Clinton, Hillsdale and Pomona lakes and the Benedictine Bottoms Wildlife Area. The University of Kansas and Kansas Land Trust also hold lands associated with Baldwin Woods, a designated National Natural Landmark by the Secretary of the Interior in 1980 for providing a “unique remnant oak-hickory forest located at the western edge of the eastern deciduous forest.” In 2016, the Baldwin Woods Forest Preserve became the first Forest Legacy project in Kansas expanding protection from 202 to 456 acres.

Missouri River Corridor, Delaware River, and Kansas City Metro Legacy Program Area

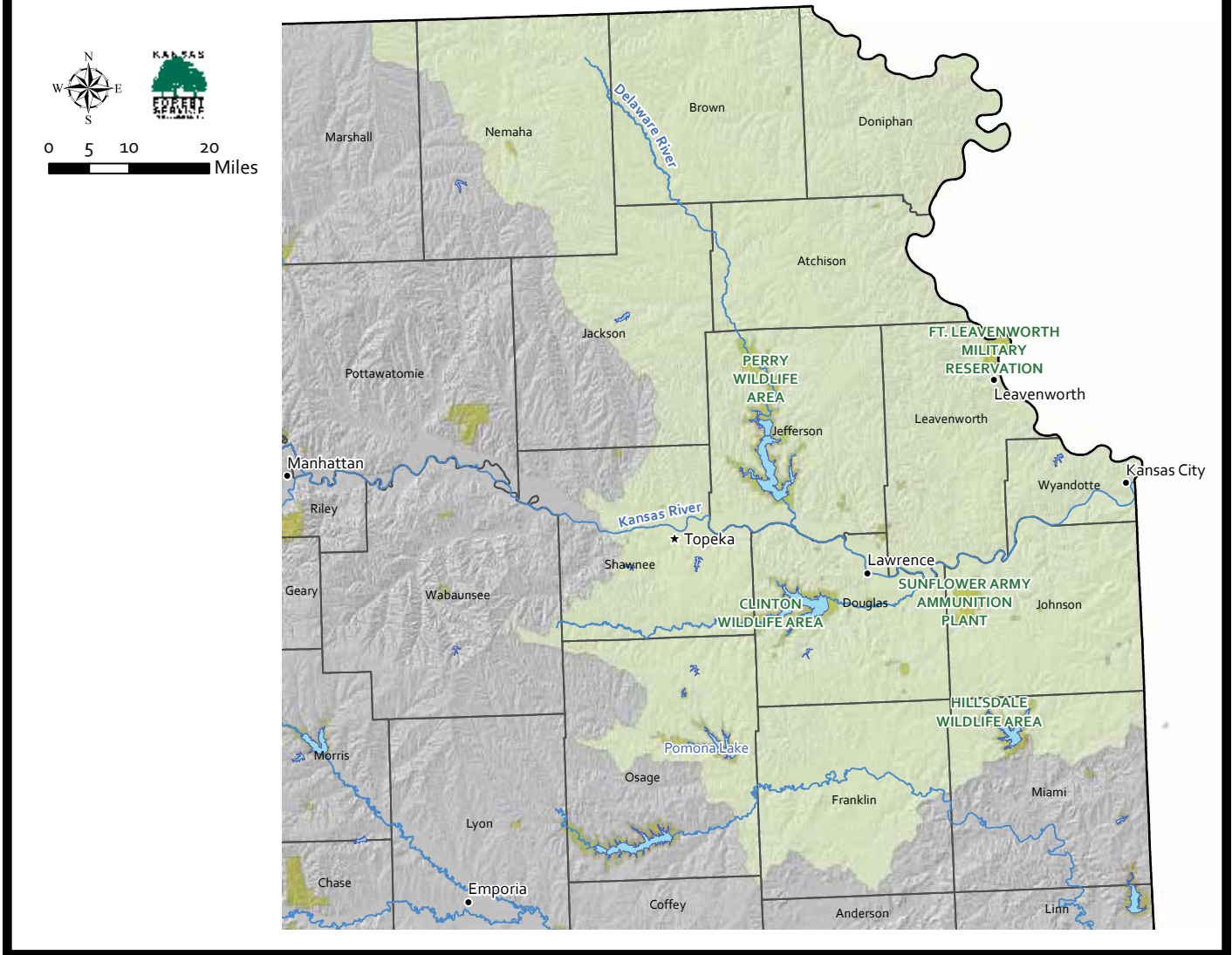


Figure 4.5. Missouri River Corridor, Delaware River, and Kansas City Metro Legacy Program Area.

Environmental Values

Through the Natural Heritage Inventory, Kansas Biological Survey has ranked 38 forested sites to determine if they are high quality natural areas that harbor rare species (half in Douglas County). Determination was based on landscape context, size and condition. Out of 38 sites, 10 received a B rating and 28 a C. The Missouri River Corridor and Kansas City Metro Forest Legacy Program Area contains some of the best quality forestland in Kansas both from an ecological and commercial perspective. All reservoirs in this area provide crucial flood control, public water supply, recreation, and fish and wildlife habitat. Sedimentation has reduced Perry Lake's storage capacity by 25%. Riparian forests have a crucial role to play in reducing sedimentation rates to the reservoirs and prolonging the public benefits they provide. According to the Natural Resource Inventory by the Mid-America Regional

Council (MARC), 18% of the 22% of land in the Kansas City Metro area is forests and woodlands with good to high ecological value.

Public Recreation and Aesthetic/Scenic Values in Forest Legacy Program Priority Areas

The public recreational and aesthetic/scenic value opportunities within the Missouri River Corridor and Kansas City Metro priority areas include Missouri River Bluffs Scenic Byway, Baker Wetlands, Benedictine Bottoms, Banner Creek Reservoir, Perry Lake and Wildlife Area, Constitution Hall State Historic Site, Clinton Lake and Wildlife Area, Hillsdale Lake and Wildlife Area, Pomona Lake, Baldwin Woods Forest Preserve, Prairie Band of the Potawatomie, Iowa Tribe, Sac and Fox, and Kickapoo Indian Reservations.

Greatest Conversion Pressure

In the Kansas City metro area, population is anticipated to increase by 350,000 by 2030 consuming an estimated 400,000 acres. Pressures are similar surrounding each major city and transportation routes including the I-70 corridor, I-35, highways 10, 24, 59, 75, 169, and 69. Urban and rural residential development offer the greatest conversion pressure and agriculture second to conversion of riparian forest to cropland.

Goals and Objectives

- Work closely with MARC programs and planning such as Natural Resource Inventory, MetroGreen, Sustainable Growth for Small Cities and Creating Quality Places. Another program to work with is Douglas County's ECO2.
- Classify the size and condition of riparian forests above reservoirs to target areas for protection, establishment, and management.
- Protect and restore critical habitat for state and federally listed threatened and endangered species.
- Work with counties and municipalities to create zoning, policy, and ordinance to facilitate the adoption of the Forest Legacy Program.

4.2.4 Wooded Plains Forest Legacy Program Area

General Description

The Wooded Plains Forest Legacy Program Area (Figure 4.6) includes all of Cherokee, Labette, Crawford, Neosho, Bourbon, and Linn counties, most of Miami, Anderson, and Allen and parts of Franklin, Montgomery, Wilson, and Woodson counties. Physiographically the area consists of the Ozark Plateau in the southeastern corner of Cherokee County characterized by thin rocky soil with chert gravel on the surface. It is the wettest area of the state with springs, seeps and caves. Oak/hickory forests dominate hillsides. The Cherokee Lowlands make up the remainder of Cherokee County and parts of Labette, Crawford, and Bourbon counties. These are gently rolling plains with deep fertile soils and oak/hickory forests. Osage Cuestas make up the remaining counties in the northern part of this area. Historically, coal, lead, and zinc mining have caused significant environmental damage in Crawford and Cherokee counties. The Neosho, Marmaton, and Marias des Cygnes rivers are the main drainages. Highway 69 is recognized as a scenic byway. The largest sawmill in the state is located at St. Paul. Pittsburg is the largest city followed by Parsons and Coffeyville.

State and Federal Lands

U.S. Fish and Wildlife Service (Marais des Cygnes National Wildlife Refuge) and Kansas Department of Wildlife, Parks and Tourism (Marais des Cygnes Wildlife Area and Neosho Wildlife Area) are the major entities that hold land or may



Photo by Mike Blair

The Missouri River corridor provides some of the most magnificent fall color in Kansas.

have interests in lands potentially associated with Forest Legacy Program.

Environmental Values

Federal and state listed species and species of greatest conservation need include the Neosho madtom, Neosho mucket mussel, eastern spotted skunk and the American bald eagle. Riparian forests along the Neosho, Marais des Cygnes and Marmaton rivers provide important water quality and stream-bank stabilization benefits especially during high-flow events.

Public Recreation and Aesthetic/Scenic Values in Forest Legacy Program Priority Areas

The public recreational and aesthetic/scenic value opportunities within the Wooded Plains priority area includes Marias des Cygnes Wildlife Area, Cedar Valley Reservoir, La Cyne Lake, Neosho Wildlife Area, Big Hill Lake and Wildlife Area, Marias des Cygnes National Wildlife Refuge, Anderson County Prairie Preserve, Hollister Wildlife Area, and Spring River Wildlife Area.

Greatest Conversion Pressure

Conversion of riparian forest to agricultural use and loss of forestland to urban development of Pittsburg and rural residential fragmentation of the landscape. Also conversion pressures along Highway 69.

Wooded Plains Legacy Program Area

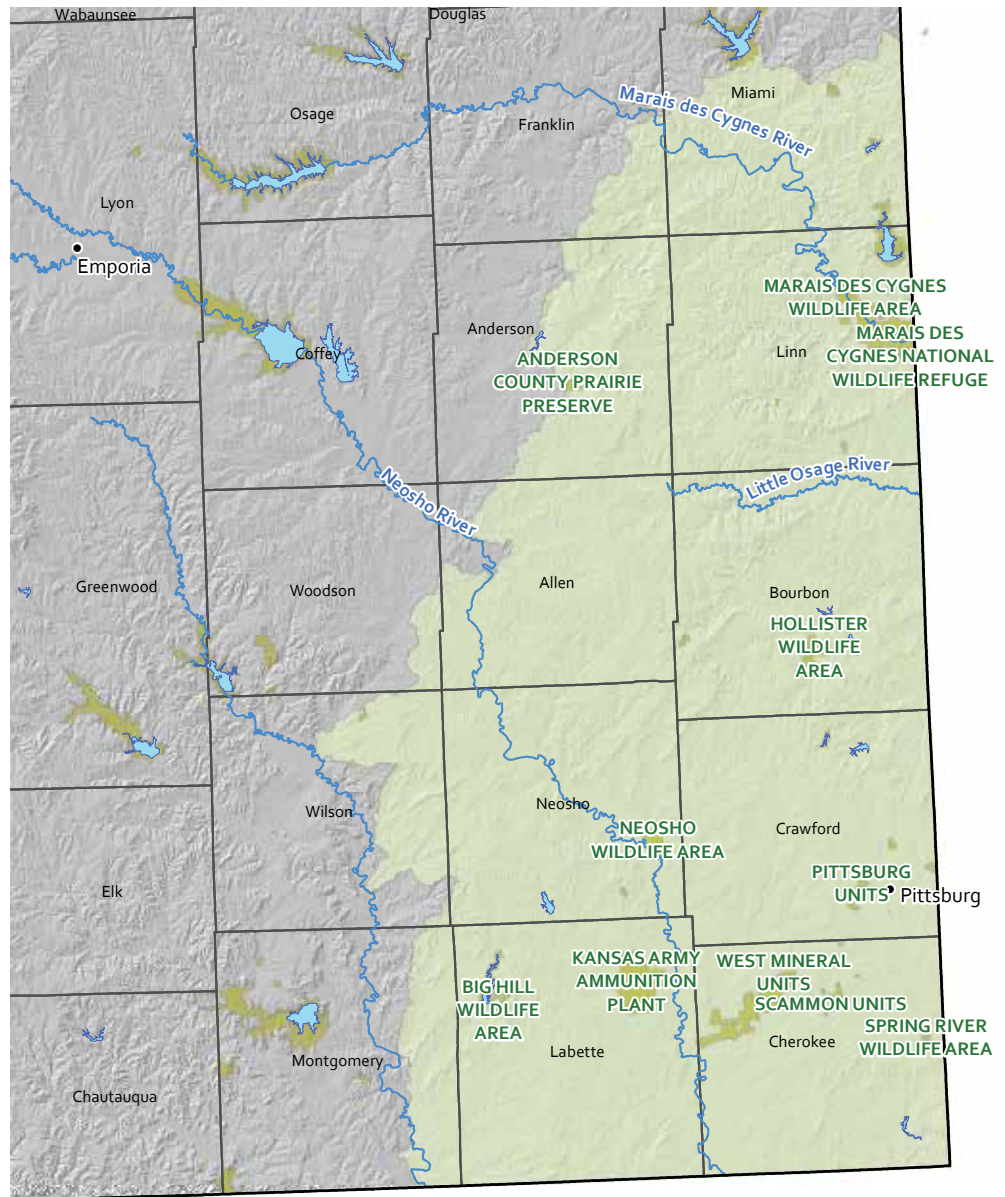
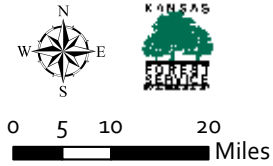


Figure 4.6. *Wooded Plains Legacy Program Area.*

Goals and Objectives

- Classify the size and condition of riparian forests in Marmaton, Neosho, and Spring River watersheds. Target riparian areas for protection, establishment, and management.
- Protect and restore critical habitat for state and federally listed species.
- Work closely with Marais des Cygnes National Wildlife Refuge and Wildlife Area to accomplish goals and objectives.
- Work closely with Neosho-Grand Lake Watershed Planning and Strategy.

4.2.5 Cross Timbers Forest Legacy Program Area

General Description

The ancient Cross Timbers is named for the numerous post oak that range from 200 to 400 years of age and eastern redcedar that exceed 500 years. Half of the 11.8 million acre ecotone occurs in Oklahoma, with the remaining area in Texas, Kansas, and a small part of Arkansas. It is a complex of upland forest, savannah and glade. In Kansas, it includes all of Chautauqua and parts of Cowley, Elk, Greenwood, Woodson, Wilson, and Montgomery counties (Figure 4.7). Physiologically the Kansas Cross Timbers are described as the Chautauqua Hills and includes rock outcroppings and narrow valleys walled by sandstone bluffs. Consequently the main agricultural use is pasture. The Verdigris, Fall, and Elk rivers are the main drainages. The majority of forest could be described as low-stature, drought-stressed, slow-growing black jack and post oak, which have little to no commercial value. Other common species include black hickory, bitternut hickory, black oak, shumard oak, and eastern redcedar.

State Lands

Kansas Department of Wildlife, Parks and Tourism is the major state entity that holds land or may have interests in lands potentially associated with the Forest Legacy Program. Specifically the Cross Timbers State Park at Toronto Lake, Fall River, Berentz-Dick, Copan, KAW, Elk City, Toronto, and Woodson wildlife areas. The Ancient Cross Timbers Consortium is another important potential partner.

Environmental Values

The lack of agricultural and timber value has made the Cross Timbers one of the least disturbed ecosystems in the United States. It is indeed the “old-growth” forests of the central United States. Toronto, Fall River, and Elk City lakes are all sources of public water supply, flood control, recreation and fish and wildlife habitat. Priority wildlife species include rusty blackbird, cerulean warbler, Lewis’s woodpecker; eastern spotted skunk (threatened), little brown myotis, gray myotis (endangered), southern flying squirrel; timber rattlesnake, redbelly snake (threatened), smooth earth snake; green frog, northern cricket frog, Oklahoma salamander; Ozark emerald (damselfly), American burying beetle (endangered), gray petaltail (damselfly). The Cross Timbers provides important research and educational opportunities for numerous scientists including those at the Ancient Cross Timbers Tree-Ring Lab, University of Arkansas, official home of the Ancient Cross Timbers Consortium. The Cross Timbers can help us understand relevant issues such as climate change and the importance of biodiversity.

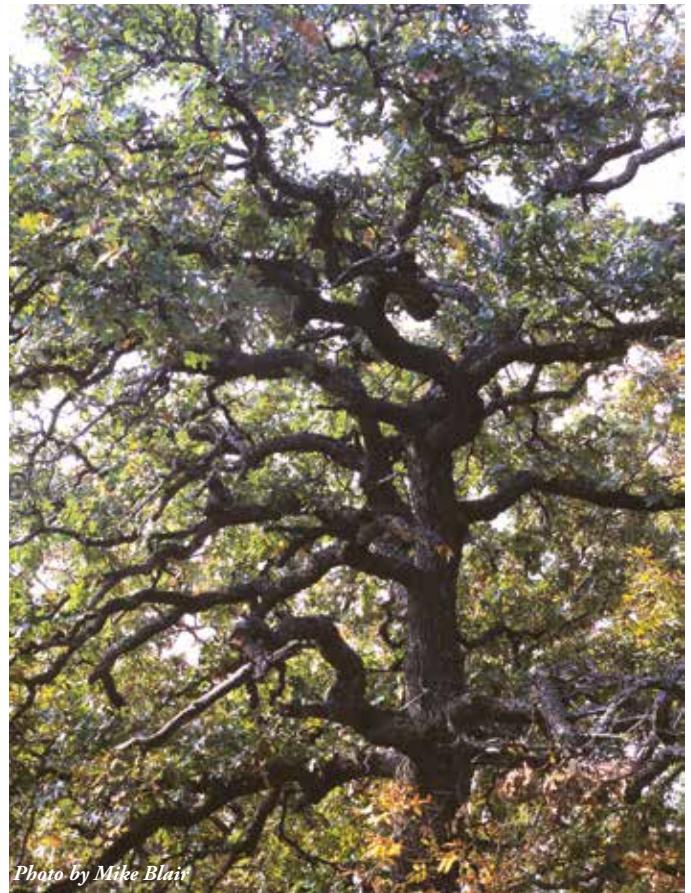


Photo by Mike Blair
The Cross Timbers region is dominated by post oak that range from 200 to 400 years in age.

Public Recreation and Aesthetic/Scenic Values in Forest Legacy Program Priority Areas

The public recreational and aesthetic/scenic value opportunities within the Cross Timbers priority areas include Toronto Lake and Wildlife Area, Elk City Lake and Wildlife Area, Fall River Lake and Wildlife Area, Cross Timbers State Park, Berentz-Dick Wildlife Area, Copin State Wildlife Area, Duck Creek Wildlife Area, Montgomery State Fishing Lake, Woodson State Fishing Lake and Wildlife Area, Cowley State Fishing Lake, and KAW Wildlife Area.

Greatest Conversion Pressures

- Aerial herbicide applications to convert forestland to pasture for grazing.
- Rural residential development (suburban, ex-urban development) for home sites.
- Oil, gas, and wind energy development.
- Logging for chip mills.
- Eastern redcedar encroachment.

Goals and Objectives

- Work closely with the Ancient Cross Timbers Consortium, Kansas Department of Wildlife and Parks, and other groups to identify priority areas for protection.

Cross Timbers Legacy Program Area

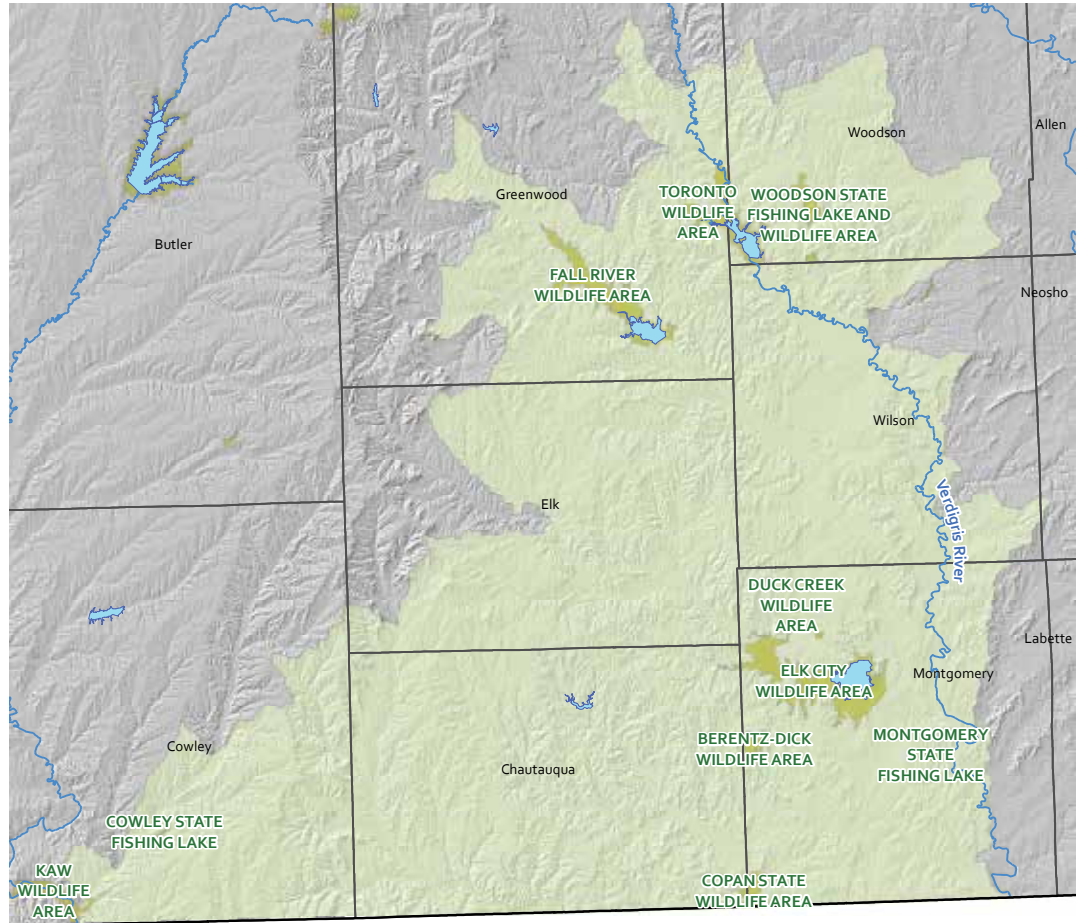


Figure 4.7. Cross Timbers Legacy Program Area.

- Work with local WRAPS groups to classify the size and condition of riparian forests above Toronto, Fall River, and Elk City lakes. Target riparian areas for protection, establishment and management to help reduce sedimentation.
- Protect and restore habitat for species of greatest conservation need.

4.2.6 Growth and Accountability

A recent audit of the Forest Legacy Program by the Office of Inspector General suggests that follow up monitoring and quality assurance inspections are areas where the program can be improved. Kansas Forest Legacy Program policy will follow all guidance offered in Forest Legacy Program Guidelines.¹

Additionally the Kansas Forest Service will follow recommendations for baseline documentation, monitoring, record keeping, and other elements of conservation easement stewardship listed in Development of Conservation Easement Stewardship Policy – A Discussion Guide, Appendix H.

Standards and guidelines created by the Land Trust Alliance² will also guide program development and success. Finally, no conservation easement will be entered into without first obtaining an adequate endowment for the maintenance of the perpetual easement. Kansas Forest Service lacks necessary funding to support a full time coordinator for the Forest Legacy Program which is necessary for its success in Kansas.

² The standards are available at: <http://www.landtrustalliance.org/>

¹ For more information on the guidelines, see: https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/15541-forest-service-legacy-program-508.pdf

REFERENCES

and ADDITIONAL INFORMATION

- Alig, R.J., Plantinga, A.J., (2004) Future Forestland Area: Impacts from Population Growth and Other Factors that Affect Land Values, *Journal of Forestry*. 102 8):19–24. <https://doi.org/10.1093/jof/102.8.19>
- Andreas, A.T. (1883) *History of the State of Kansas*. Chicago. 1616 pp.
- Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C., Crowther, T. (2019) The global tree restoration potential. *Science*. 365. 76-79. <https://doi.org/10.1126/science.aax0848>.
- Brandle J.R., Hodges L., Zhou X.H. (2004) Windbreaks in North American agricultural systems. In: Nair P.K.R., Rao M.R., Buck L.E. (eds) *New Vistas in Agroforestry. Advances in Agroforestry*, vol 1. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-2424-1_5
- Bruton, D.L. (2018) *Marketing Kansas Timber C542*, Kansas State University.
- Butler, B.J., Hewes, J.H., Dickinson, B.J., Andrejczyk, K., Butler, S.M., Markowski-Lindsay, M. (2016) *USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013*. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 pp. <https://doi.org/10.2737/NRS-RB-99>.
- Camas Creek Enterprises, Inc. (2009) *Kansas state-wide woody biomass supply & utilization assessment*. Missoula, Montana.
- Carraway, K., Meyer, A., Balthazor, T., Witt., T. (2017) *Aerial Survey & Classification of Bush Honeysuckle Project Report*. Kansas State University Polytechnic: Salina, KS. 24 pp. https://www.kansasforests.org/forest_health/health_docs/AARC%20SurveyClassification%20of%20Bush%20Honeysuckle%20FINAL.pdf
- Chapman, S.S., Omernik, J.M., Freeouf, J.A., Huggins, D.G., McCauley, J.R., Freeman, C.C., Steinauer, G., Angelo, R.T., Schlepp, R.L. (2001) *Ecoregions of Nebraska and Kansas*: Reston, Virginia, U.S. Geological Survey
- Dillon, G.K. (2018) *Wildfire Hazard Potential (WHP) for the conterminous United States (270-m GRID), version 2018 classified*. 2nd Edition. Fort Collins, CO: Forest Service Research Data Archive. <https://doi.org/10.2737/RDS-2015-0046-2>
- Dixon, M.D., Johnson, W.C., Scott, M.L., Bowen, D. (2010) *Status and trend of cottonwood forests along the Missouri River*: Final report to U.S. Army Corps of Engineers.
- Geyer, W.A., Neppel, T., Brooks, K., Carlisle, J. (2000) Woody Vegetation Protects Streambank Stability during the 1993 Flood in Central Kansas. *Journal of Soil and Water Conservation*. 55(4):483-486.
- Hutchinson, J.M.S., Atchison, R., Dulin, M., Aslin, R. (2008) *Forest stewardship spatial analysis project (sap) – methodology report for Kansas*, Kansas Forest Service: Manhattan, KS
- Institute for Policy and Social Research (2019) *Kansas statistical abstract 2018*, Institute for Policy and Social Research: Lawrence, KS.
- Johnstone, I. M. (1986). Plant Invasion windows: a time-based classification of Invasive potential. *Biological Review* 61:369-394
- Kansas Water Office. (2005) *10 year strategic plan for the comprehensive control of tamarisk and other non-native phreatophytes*, Topeka, Kansas. <https://kgi.contentdm.oclc.org/digital/collection/p16884coll78/id/162/>
- Kansas Water Office. (2014) *Kansas Water Plan*, Topeka, Kansas. <https://kwo.ks.gov/water-vision-water-plan/water-plan>
- Kennelly, M., O'Mara, J.L., Todd, T., Griffin, J., Appel, J., Strine, J., McDonnell, T. (2009) *Integrated community outreach programming to prevent spread of pine wilt into western Kansas*, Kansas State University, Manhattan

- Meneguzzo, D.M. (2018) *Forests of Kansas, 2017. Resource Update FS-172*. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-172>.
- Meneguzzo, D.M., Lister, A.J., Sullivan, C. (2018) *Summary of findings from the Great Plains Tree and Forest Invasives Initiative*. Gen. Tech. Rep. NRS-GTR-177. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 24 p. <https://doi.org/10.2737/NRS-GTR-177>.
- Meneguzzo, D.M., Haugen, D.E., Walters, B.F., Butler, B.J., Crocker, S.J., Kurtz, C.M., Morin, R.S., Nelson, M.D., Piva, R.J., Smith, J.E. (2018) *Northern Great Plains Forests 2015*. Resour. Bull. NRS-116 Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 108 p. <https://doi.org/10.2737/NRS-RB-116>.
- Moser, W.K., Hansen, M.H., Atchison, R.L., Butler, B.J.; Crocker, S.J., Domke, G., Kurtz, C.M., Lister, A., Miles, P.D., Nelson, M.D., Piva, R.J., Woodall, C.W. (2013) *Kansas' Forests 2010*. Resour. Bull. NRS-85. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 63 p.
- Nowak, D.J., Greenfield, E.J. (2010) *Urban and community forests of the North Central West region: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota*. Gen. Tech. Rep. NRS-56. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 70 p.
- Nowak, D.J., Hoehn, R.E. III, Crane, D.E., Bodine, A.R. (2012) *Assessing urban forest effects and values of the Great Plains: Kansas, Nebraska, North Dakota, South Dakota*. Resour. Bull. NRS-71. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 75 p.
- Omernik, J.M. (1987) Ecoregions of the conterminous United States (map supplement): *Annals of the Association of American Geographers*, 77(1):118-125, scale 1:7,500,000.
- Peterson, D.L., Whistler, J.L., Lomas, J.M., Dobbs, K.E., Jakubauskas, M.E., Egbert, S.E., Martinko, E.A. (2005) *2005 Kansas Land Cover Patterns Phase I: Final Report*. KBS Report 150. Kansas Biological Survey, University of Kansas, 29 pp.
- Peterson, D., Whistler, J., Egbert, S., Martinko, E.A. (2010) *2005 Kansas Land Cover Patterns: Phase II--final report*. Kansas Biological Survey, Lawrence, KS Report No. 167. 49 pp.
- Reading, W.H. IV, Bruton, D.L. (2007) *Kansas Timber Industry – An Assessment of Timber Product Output and Use*, 2003. Resour. Bull. NC-269. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station.
- Rohweder, M.R. (2015) *Kansas Wildlife Action Plan*. Ecological Services Section, Kansas Department of Wildlife, Parks and Tourism in cooperation with the Kansas Biological Survey. 176 pp.
- Sessions, J., Smith, D., Trippe, K.M., Fried, J.S., Bailey, J.D., Petitmermet, J.H., Hollamon, W., Phillips, C.L., Campbell, J.D. (2019). Can biochar link forest restoration with commercial agriculture?, *Biomass and Bioenergy* 123:175-185
- Treiman, T., Atchison, R., McDonnell, T., Barden, C., Moser, W. (2010) *Economic Loss Associated with the Introduction of Thousand Cankers Disease of Black Walnut to Kansas*. Kansas State University. https://www.kansasforests.org/forest_health/health_docs/Econ%20Loss%20KS.pdf
- USDA Forest Service. (2019) *Forests of Kansas, 2018*. Resource Update FS-217. Newtown Square, PA: U.S. Department of Agriculture Forest Service, Northern Research Station. 2 pp. <https://doi.org/10.2737/FS-RU-217>.
- U.S. Department of Agriculture. (2009) *Summary Report: 2007 National Resources Inventory*, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. 123 pp.
- Ware, E.R., Smith, L.F. (1939) *Woodlands of Kansas*. Kansas State College Agricultural Experiment Station Bull. 285. 42 pp.
- Wilson, B.T., Lister, A.J., Riemann, R.I., Griffith, D.M. (2013) *Live tree species basal area of the contiguous United States (2000-2009)*. Newtown Square, PA: USDA Forest Service, Rocky Mountain Research Station. <https://doi.org/10.2737/RDS-2013-0013>
- Wilson, K. (2017) *Converting Shelterbelt Biomass to Biochar: A feasibility analysis by Wilson Biochar Associates for North Dakota Forest Service*. North Dakota State University - North Dakota Forest Service, Bismarck, North Dakota

For Additional Information

Ancient Cross Timbers; <https://xtimbers.uark.edu/> (Section 4.2.5)

Brandle, James; Professor, School of Natural Resources, University of Nebraska; Windbreaks and their effects on crop production. <https://snr.unl.edu/aboutus/who/people/faculty-member.aspx?pid=17> (Section 2.2.2)

Community Wildfire Protection Plans; <http://www.fs.fed.us/projects/hfi/field-guide/web/page15.php>; https://www.kansasforests.org/fire_management/fireplanning.html (Section 3.1.2)

Cooperative Forestry Assistance Act - The Cooperative Forestry Assistance Act of 1978 (P.L. 95-313) revised authority (of the Clarke-McNary Act of 1924) for the Forest Service to provide financial and technical assistance to states and private landowners on a variety of forestry issues: forest management and stewardship, fire protection, insect and disease control, reforestation and stand improvement, urban forestry, etc., under State and Private Forestry. <https://www.fs.fed.us/spf/coop/library/SPF-CF%20handbook.pdf>

Economic Loss Associated with the Introduction of Thousand Cankers Disease of Black Walnut to Kansas, Treiman, 2010; https://www.kansasforests.org/forest_health/health_docs/Econ%20Loss%20KS.pdf (Section 3.1.1)

Emerald Ash Borer; <http://www.emeraldashborer.info/>. (Section 3.1)

Flint Hills Regional Growth Plan, Land Use and Planning; <http://flinthillsregion.org/resources/regional-growth-plan> (Section 4.2.1)

Great Plains Initiative - Funded by a U.S. Forest Service grant and matching state funds, state forestry agencies in Kansas, Nebraska, North Dakota and South Dakota engaged in a regional initiative in 2008-2009 to prepare for the arrival of invasive pests, such as emerald ash borer and thousand cankers disease that threaten tree resources in the northern Plains. Great Plains Initiative 2 conducted a second round of windbreak inventories in 2018 and 2019, that data has not yet been published. https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs177.pdf

Kansas Wildlife Action Plan <https://ksoutdoors.com/Services/Kansas-SWAP> (Section 2.1.2)

Forests of Kansas 2018, USDA Forest Service Northern Research Station; An overview of forest resource attributes for Kansas based on an annual inventory conducted in 2018 by the Forest Inventory and Analysis (FIA) program at the Northern Research Station of the USDA Forest Service <https://www.fs.usda.gov/treearch/pubs/58738> (Chapter 2)

Kansas State-Wide Woody Biomass Supply and Utilization Assessment; https://www.kansasforests.org/forest_products/forest_product_docs/woodybiomass.pdf (Section 3.2.4)

Kansas Water Plan and A Long-term Vision for the Future of Water Supply in Kansas. <https://kwo.ks.gov/water-vision-water-plan/water-vision> (Section 3.2.1)

Mid-America Regional Council, MARC <http://www.marc.org/Environment/> (Section 3.1.3)

National Woodland Owner Survey, Family Forest Owners of the United States 2013, USDA Forest Service, Northern Research Station; A survey of Kansas forestland owners from 2011-2013. <https://www.fs.usda.gov/treearch/pubs/50674>. (Section 2.1.1)

Natural Resource Inventory, MARC; <https://www.marc.org/Environment/Natural-Resources>. (Section 3.1.3)

Natural Resource Inventory, NRCS; <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/> (Section 2.3.1)

Pine Wilt; <https://hnr.k-state.edu/extension/info-center/common-pest-problems/common-pest-problem-new/Pine%20Wilt.pdf>. (Section 3.1.1)

Riparian Forests Protect Streambanks, K-State Research and Extension, Keeping Up with Research 122, Geyer, April 2010; https://www.kansasforests.org/resources/resources_docs/Riparian%20Forests.pdf (Section 3.2.1)

Status and Trend of Cottonwood Forests Along the Missouri River, Dixon, Johnson and Bowman, 2010; <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1077&context=usarmycomaha> (Section 2.1.2)

Thousand Cankers Disease Complex; <https://thousandcankers.com/> (Introduction)

Tamarisk - 10 Year Strategic Plan for the Comprehensive Control of Tamarisk and Other Non-Native Phreatophytes, Kansas Water Office, 2005, <https://kgi.contentdm.oclc.org/digital/collection/p16884coll78/id/162>

Urban and Community Forests of the North Central West Region, USDA Forest Service NRS-56; This report details how land cover and urbanization vary within the states of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota by community (incorporated and census designated places), county subdivision, and county. Specifically this report provides critical urban and community forestry information for each state including human population characteristics and trends, changes in urban and community lands, tree canopy and impervious surface cover characteristics, distribution of land-cover classes, a relative comparison of urban and community forests among local government types, determination of priority areas for tree planting, and a summary of urban tree benefits. <http://www.treesearch.fs.fed.us/pubs/34757>. (Section 2.3.1)

USDA Forest Service PNW Research Station, Ralph Alig, Science Findings, 2006; <http://www.fs.fed.us/pnw/science/scifi88.pdf>. (Section 3.1.3)

USDA Forest Service Forest Products Lab, Sandra Morgan, “an average wood-frame house has approx. 10,000 – 20,000 board feet (roughly). An average would be 12,000 bd. <http://www.fpl.fs.fed.us/> (Section 2.1.1)

ACRONYM GLOSSARY

AON – Assessment of Needs (Forest Legacy Program)

APHIS – Animal Plant Health Inspection Service

CFAA – Cooperative Forestry Assistance Act

CRP – Conservation Reserve Program

CWHA – Community Wildfire Hazard Assessment

CWPP – Community Wildfire Protection Plans

DASC – Data Access Support Center

EAB – Emerald Ash Borer

EQIP – Environmental Quality Incentives Program

ESRI – Environmental Systems Research Institute

FIA – Forest Inventory and Analysis

FLP – Forest Legacy Program

FRCC – Fire Regime Condition Class

FS – Forest Service (USDA)

FSP – Forest Stewardship Program

GAP – Gap Analysis Program

GI – Green Infrastructure

GIS – Geographic Information Systems

GISSAL – Geographic Information Systems Spatial Analysis Laboratory, KSU

GPI – Great Plains Initiative

HUC – Hydrologic Unit Code

ISO – Insurance Services Office

KARS – Kansas Applied Remote Sensing Program

KBS – Kansas Biological Survey

KC – Kansas City

KDHE – Kansas Department of Health and the Environment

KFS – Kansas Forest Service

KLCP – Kansas Land Cover Project

KSU – Kansas State University

KWAP – Kansas Wildlife Action Plan

NGO – Non Governmental Organization

NHD – National Hydrography Data Set

NHI – National Heritage Inventory

NIMS – National Incident Management System

NPDES – National Pollutant Discharge Elimination System

NRI – Natural Resource Inventory (NRCS)

NRCS – Natural Resource Conservation Service

NRS – Northern Research Station (USDA Forest Service)

NWOS – National Woodland Owners Survey

MARC – Mid-America Regional Council

RC&D – Resource Conservation Development Councils

SAP – Spatial Analysis Project

SFSCC – State Forest Stewardship Coordinating Committee

SINC – Species in Need of Conservation

S&PF – State and Private Forestry (USDA Forest Service)

SSURGO – Soil Survey Geographic Database

TCD – Thousand Cankers Disease

T & E – Threatened and Endangered Species

TMDL – Total Maximum Daily Load

TSI – Timber Stand Improvement

TWI – The Watershed Institute

USDA – United States Department of Agriculture

USGS – United States Geological Survey

WRAPS – Watershed Restoration and Protection Strategy

WEI – Wind Erodability Index

WUI – Wildland Urban Interface

APPENDIX A

FINAL GUIDANCE NATIONAL THEMES AND OBJECTIVES



Farm Bill Requirement & Redesign Components: STATE ASSESSMENTS & RESOURCE STRATEGIES Final Guidance



State assessments and resource strategies are integral to the State and Private Forestry (S&PF) Redesign and required as an amendment to the Cooperative Forestry Assistance Act (CFAA), as enacted in the 2008 Farm Bill. This document provides national guidance to States to develop their state assessments and resource strategies.

There are three components to the assessment and planning required by the State and Private Forestry (S&PF) Redesign approach to identify priority forest landscape areas and highlight work needed to address national, regional, and state forest management priorities:

- **State-wide Assessment of Forest Resources***—provides an analysis of forest conditions and trends in the state and delineates priority rural and urban forest landscape areas.
- **State-wide Forest Resource Strategy†**—provides long-term strategies for investing state, federal, and other resources to manage priority landscapes identified in the assessment, focusing where federal investment can most effectively stimulate or leverage desired action and engage multiple partners.
- **Annual Report on Use of Funds‡**—describes how S&PF funds were used to address the assessment and strategy, including the leveraging of funding and resources through partnerships, for any given fiscal year.

Each State is required to complete a State Assessment and Resource Strategy within two years after enactment of the 2008 Farm Bill (June 18, 2008) to receive funds under CFAA.

State-wide Assessment of Forest Resources

To ensure that federal and state resources are being focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve measurable outcomes, each state and territory will work collaboratively with key partners and stakeholders to develop a statewide forest resource assessment. The state forest resource assessment should provide a comprehensive analysis of the forest-related conditions, trends, threats, and opportunities within the state.

At a minimum, state forest resource assessments will:

- Provide an analysis of present and future forest conditions, trends, and threats on all ownerships in the state using publicly available information.

* Previously titled “State Forest Resource Assessment”. The title was changed to reflect Farm Bill terminology

† Previously titled “State Response Plan”. The title was changed to reflect Farm Bill terminology

‡ Previously titled “Annual Action Strategy”. The title was changed to reflect Farm Bill terminology

- Identify forest related threats, benefits, and services consistent with the S&PF Redesign national themes.
- Delineate priority rural and urban forest landscape areas to be addressed by the state resource strategy. States can also identify linkages between terrestrial and aquatic habitat, as appropriate.
- Work with neighboring States and governments to identify any multi-state areas that are a regional priority.
- Incorporate existing statewide plans including Wildlife Action Plans, Community Wildfire Protection Plans, and address existing S&PF program planning requirements. States can also utilize relevant national and regional assessments as appropriate.

A combination of qualitative, quantitative, and geospatial data can be used in the statewide assessment to provide information relevant to key state issues and national themes. In addition, non-geospatial information can be used in combination with geospatial data to identify priorities. States may identify separate priority areas for different programs and issues.

Appendix B contains suggested guidance for identifying state and regional priority forest landscape areas.

State-wide Forest Resource Strategy

A state's forest resource strategy will provide a long-term, comprehensive, coordinated strategy for investing state, federal, and leveraged partner resources to address the management and landscape priorities identified in its assessment. The resource strategy should incorporate existing statewide forest and resource management plans and provide the basis for future program, agency, and partner coordination.

At a minimum, state resource strategies should:

- Outline long-term strategies for addressing priority landscapes identified in the state forest resource assessment and the following national themes and associated management objectives (the intent and policy implications of each of these national objectives are described in Appendix A):
 - ***Conserve Working Forest Lands:*** conserving and managing working forest landscapes for multiple values and uses.
 - Identify and conserve high priority forest ecosystems and landscapes.
 - Actively and sustainably manage forests.
 - ***Protect Forests From Harm:*** protect forests from threats, including catastrophic storms, flooding, insect or disease outbreak, and invasive species.
 - Restore fire-adapted lands and reduce risk of wildfire impacts.
 - Identify, manage and reduce threats to forest and ecosystem health.
 - ***Enhance Public Benefits from Trees and Forests:*** including air and water quality, soil conservation, biological diversity, carbon storage, and forest products, forestry-related jobs, production of renewable energy, and wildlife.
 - Protect and enhance water quality and quantity.

- Improve air quality and conserve energy.
 - Assist communities in planning for and reducing wildfire risks.
 - 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.
- Describe how the state proposes to invest federal funding, along with other resources, to address state, regional, and national forest management priorities.
 - Include a long-term timeline for project and program implementation.
 - Identify partner and stakeholder involvement.
 - Identify strategies for monitoring outcomes within priority forest landscape areas and how action will be revised when needed.
 - Describe how the state’s proposed activities will accomplish national State and Private Forestry program objectives and respond to specified performance measures and indicators.
 - Describe how State and Private Forestry programs will be used to address priority landscape and management objectives.
 - Incorporate existing statewide plans including Wildlife Action Plans, community wildfire protection plans, and address existing S&PF program planning requirements.

Annual Report on Use of Funds

The annual report should describe how the State used all S&PF program funding, for any given fiscal year. The annual report should describe specific actions taken within the fiscal year, under each program, to address the state assessment and resource strategy. The annual report should include a comprehensive budget with known contributions from all federal, state, and nongovernmental partners.

Additional Guidance

Coordination and Stakeholder/Public Involvement—State forestry agencies shall coordinate with the State Forest Stewardship Coordinating Committee, State Technical Committee, the State wildlife agency, applicable Federal land management agencies such as the Forest Service and Bureau of Land Management, and State Urban Forestry Council to ensure that assessments and resource strategies address the rural-to-urban landscape continuum and identify opportunities for program coordination and integration. State forestry agencies should also involve other key partners, including Tribes and natural resource and related entities in their state to ensure that the state’s assessment and strategy integrate, build upon, and

complement other natural resource plans (e.g., State Wildlife Plans). This input is not necessary for the annual report.

In states where the lead agency for the Forest Legacy Program (FLP), or other CFAA program, is not the state forestry agency, state assessments should be developed in partnership with the state lead agency. In addition, the FLP section or other relevant sections, of the resource strategy should be developed by the state lead agency, even if it is not the state forestry agency and include all program-specific requirements.

Timeline and Updates—State forest resource assessments and resource strategies are to be completed no later than two years after enactment of the 2008 Farm Bill (June 18, 2008). Assessments and strategies shall be reviewed and updated at least every five years, or as determined by the Secretary of Agriculture. Annual reports for a given fiscal year must be developed and submitted by the end of the first quarter of the next federal fiscal year.

Approval Process—State resource assessments and resource strategies will be approved by the State Forester, with final approval by the Secretary of Agriculture. Once approved by the Secretary, the State-wide assessment and State-wide resource strategy shall satisfy all relevant S&PF planning and assessment requirements. The annual report should be submitted through the Forest Region or Area, to the S&PF Deputy Chief.

In states where the lead agency for the Forest Legacy Program (FLP) is not the state forestry agency, the state lead agency shall concur on all aspects of assessments and resource strategies that pertain to the Forest Legacy Program, including the identification of Forest Legacy Areas. If the state assessment incorporates a state's Forest Legacy Assessment of Need, the approval process is that which is required for the Forest Legacy Program.

Grant Narrative—States are encouraged to use a single annual grant narrative, which outlines actions to address the state assessment and resource strategy, for all S&PF programs that are authorized to receive funding under a consolidated grant option.

Forest Service Support—Each geographic region and the islands shall have an S&PF point of contact to assist states with development of assessments and resource strategies and to coordinate with Forest Service program staff.



Redesign Components: STATE ASSESSMENTS & RESOURCE STRATEGIES APPENDIX A



National Themes and Strategic Objectives

This document describes the national strategic objectives that tier to the three Redesign themes. The descriptions include suggestions on how states may address the objectives in their assessments and resource strategies. There is also a list of potential data layers that could be used in the assessments for addressing each objective. States will likely have unique state or regional issues that may also be addressed in their assessments and strategies.

National Theme: Conserve Working Forest Lands

Identify and conserve high priority forest ecosystems and landscapes.

In many parts of the United States, forests and other open space are being fragmented and converted to development. Forestry agencies can work with partners, stakeholders and communities to identify and protect priority forest landscapes through land acquisition, conservation easements, and land use policies. Forestry agencies can also provide technical assistance to communities to help them strategically plan for and conserve forests and other open space.

Factors contributing to loss include residential, commercial and industrial development; expansion of utility infrastructure and transportation networks; and planning, zoning, and policies that favor conversion. Consequences include the outright loss of public benefits associated with forests or the marginalization of those values provided by contiguous forested landscapes. Fragmentation also includes “parcelization,” or the fracturing of large singular ownerships into numerous smaller ones.

Assessments and strategies should attempt to identify, protect and connect ecologically important forest landscapes, and open space, thus maintaining a green infrastructure, particularly around and within areas of, population growth and development.

Potential data layers: Green infrastructure composite, protected areas, including Forest Legacy Areas, open space conservation plans, community forests, development risk, forest fragmentation, roads and other infrastructure.

Actively and sustainably manage forests.

Forestry agencies and partners can provide landowner assistance and incentives to help keep working forests working. Providing forestry assistance to landowners can improve the economics of, and encourage sustainable forest management. In urban and suburban areas, forest agencies can assist communities to develop sustainable forest management and green infrastructure programs.

Assessments and strategies can identify viable and high potential working forest landscape where landowner assistance programs, such as Forest Stewardship can be targeted to yield the most benefit in terms of economic opportunities and ecosystem services. Assessment and strategies can also identify opportunities for multi-landowner, landscape scale planning and landowner aggregation for access to emerging ecosystem service markets.

Potential data layers: Spatial Analysis Project (high potential for Forest Stewardship), forest cover

National Theme: Protect Forests from Harm

Restore fire-adapted lands and reduce risk of wildfire impacts.

The strategic management of wildfires is crucial to the health of our nation's forests, the safety of our citizens and the contributions of forests to our economy. Assessments should identify areas where management can significantly reduce the risk of catastrophic wildfire while enhancing multiple associated forest values and services.

Many forest ecosystems are dependent on fire for their health and sustainability. Decades of fire suppression and a changing climate have disrupted natural fire regimes, resulting in fuel buildup, loss of biological diversity, changed species composition, and loss of some fire-dependent species. Assessments should identify areas where these effects of fire exclusion can feasibly be mitigated or countered through sound management, particularly where there are opportunities for federal, state and community partnerships. Resource strategies should identify appropriate treatment strategies for priority landscapes, including the use of fire as a management tool.

Potential data layers: Wildfire risk

Identify, manage and reduce threats to forest and ecosystem health.

A healthy forest landscape has the capacity for renewal and for recovery from a wide range of disturbances, while continuing to provide public benefits and ecosystem services. Threats to forest health include insects, disease, invasive plant and animal species, air pollution, and climate change.

Assessments should identify high value forest landscape areas that are especially vulnerable to existing or potential, forest health risk factors, where forest management practices are most likely to prevent and mitigate impacts. Assessments should also identify areas where management could successfully restore impacted forests.

Resource strategies should include feasible long term strategies for addressing forest health risks and opportunities within important forest landscape areas.

Potential data layers: Forest health risk

National Theme: Enhance Public Benefits from Trees and Forests

Protect and enhance water quality and quantity.

Forests and forestry practices can help protect, restore, and sustain water quality, water flows, and watershed health. Healthy urban and rural forested watersheds absorb rainfall and snow melt, slow storm runoff, recharge aquifers, sustain stream flows, and filter pollutants.

Assessments should identify watersheds where continued forest conservation and management is important to the future supply of clean municipal drinking water, or where restoration or protection activities will improve or restore a critical water source. Resource strategies should include actions for managing and conserving these priority watersheds for water quality and supply, and other ecosystem services.

Potential data layers: Priority watersheds, water quantity and quality by source, drinking water

Improve air quality and conserve energy.

Urban and exurban forest cover, including agroforests can improve air quality, reduce energy consumption and produce biomass for energy production. Assessments should identify areas where management or restoration of the urban or exurban forest canopy will have significantly positive and measurable impact on air quality and produce substantial energy savings.

Potential data layers: Impervious surfaces, heat islands, population density, non-attainment areas, canopy cover, ozone concentration

Assist communities in planning for and reducing wildfire risks.

Communities play an essential role in reducing the risks of catastrophic wildfire. State & Private Forestry programs assist communities in identifying wildfire risks, developing Community Wildfire Protection Plans (CWPPs), and promoting FIREWISE and other risk reducing policies and actions. .

Some communities are especially prone to loss of life and property from wildfire. Local or state laws, regulations and ordinances, landowner attitudes and priorities, and public policies all play important roles in managing fire risk near communities. Assessments should identify communities where State and Private programs can substantially mitigate the risk of catastrophic wildfire occurrence and associated risks to human safety and property.

Assessments should incorporate existing CWPPs and identify communities in especially vulnerable areas that need a CWPP. Resource strategies should include a plan for effectively addressing those communities that are most at risk.

Potential data layers: Wildland-urban interface, Existing CWPPs, fire potential

Maintain and enhance the economic benefits and values of trees and forests.

Assessments should identify forest landscape areas where there is a real, near term potential to access and supply traditional, non-timber, and/or emerging markets such as those for biomass or ecosystem services. These might be areas where necessary infrastructure currently exists, is planned or developing, where group certification of landowners has created market supply aggregation potential, or where retention and management of forest cover presents a money saving alternative to an engineered fix – such as a water filtration facility. Strengthening and developing new market opportunities for forest products and benefits provide incentives for forest stewardship and conservation.

Potential data layers: Biomass potential, site productivity, existing or planned mills and other forestry infrastructure, Biomass energy facilities, CROP areas, municipal water supply intakes

Protect, conserve, and enhance wildlife and fish habitat.

Protection, conservation, and restoration of forested wildlife habitat are critical to maintaining and enhancing the rich biodiversity of our nation. Major threats to fish and wildlife habitat include the patchwork of public-private ownership, threats associated with urbanization, and uncharacteristic wildfire.

Assessments and resource strategies should identify forest landscapes that represent or contribute to viable wildlife habitats (contiguous or connected), contain high species richness, endemism, and/or that represent core habitat for focal conservation species (i.e. species of concern, threatened and endangered species or keystone species that are representative of a healthy ecosystem). Assessments and resource strategies should incorporate State Wildlife Action Plans. Resource strategies should include actions for conserving and enhancing habitat attributes in priority landscape areas.

Potential data layers: Threatened and endangered species habitat, State Wildlife Action Plan data

Connect people to trees and forests, and engage them in environmental stewardship activities.

Our nation’s federal, state, urban and private forests are the natural backyards for many communities and serve as society’s connection to nature. Assessments and resource strategies can attempt to conserve and enhance a green infrastructure that effectively connects people with their natural environment. Resource strategies can include programs that provide opportunities for children, teens and adults to recreate while gaining an appreciation for the importance of forests and open space with respect to the health, security and well-being of society.

Potential data layers: Census data, recreation and trail networks, hunting and fishing areas, cultural and heritage sites

Manage and restore trees and forests to mitigate and adapt to global climate change.

America’s forests offset a significant portion of the nation’s annual carbon emissions. Additional climate change mitigation benefits could be achieved through partnerships and management measures. These measures include supporting the development of markets for carbon offsets, utilizing woody biomass for energy, wood product substitution, and promoting tree growth in urban areas. Assessments should identify opportunities for promoting carbon emissions offsets through forestry.

The important benefits that forests provide, such as biodiversity, wildlife habitat, and water storage and flows are affected by climate change. Forest range, type and composition are projected to change significantly– with corresponding changes in wildlife habitat, biodiversity, water flows, and fire regimes.

Assessments should consider how climate change will affect important public benefits from forests. Resource strategies should attempt to maintain and enhance resilient and connected forest ecosystems that will continue to provide public benefits in a changing climate.

Potential data layers: Climate change modeling such as the Climate Change Atlas, Northern and Southern Forest Futures forecast data

APPENDIX B

COORDINATION AND STAKEHOLDER/PUBLIC INVOLVEMENT

NRCS Kansas Technical Committee
Review of the Kansas Forest Service Action Plan 2020
April 22, 2020, 9:00 a.m.
ZOOM & Teleconference

Welcome and Opening Remarks	Sharonté E. Williams, Assistant State Conservationist for Programs
Purpose and Protocol	Jason Hartman, State Forester Cassie Wandersee, Communications Coordinator
Overview of the Kansas Forest Action Plan	Bob Atchison, Rural Forestry Coordinator
Explanation of Priority Areas GIS Metadata and Analysis	Darci Paull, GIS Specialist
Programmatic Overviews:	
• Fire Management	Mark Neely, State Fire Management Officer
• Forest Health	Ryan Armbrust, Forest Health Coord.
• Rural Forestry	Bob Atchison, Rural Forestry Coord.
• Community Forestry	Tim McDonnell, Community Forestry Coord.
• Forest Products	Dave Bruton, Marketing and Utilization Coord.

Q & A



**Natural Resources Conservation Service (NRCS)
Kansas Technical Committee
Review of the Kansas Forest Service (KFS) Action Plan 2020
April 22, 2020, 9:00 a.m.
ZOOM Video Conference**

Meeting with Natural Resources Conservation Service (NRCS) and the Kansas Technical Committee (KTC); hosting the Kansas State Forest Service (KFS), beginning at 9:00 a.m. with Sharonté E. Williams, Assistant State Conservationist for Programs, Kansas NRCS, moderating. This meeting was conducted via ZOOM teleconferencing.

Opening remarks were provided by Sharonté E. Williams, Assistant State Conservationist for Programs, NRCS, Salina, Kansas.

Kansas State Forest Service proceeded with a presentation PowerPoint (PP) to open the floor for discussion on the updated Kansas Forest Action Plan.

Bob Atchison, Rural Forestry Coordinator, KFS (See PP)

Opening comments about the presentation (See PP) were provided by Bob Atchison, Rural Forestry Coordinator, KFS.

- Discussed the outline of the four chapters associated with the Kansas Forest Action Plan (FAP). For example; Geographic Information System (GIS) methods and metadata have been incorporated directly into the narrative. Seven top resource issues have been identified. These include:
 - Wildfire risk
 - Issues that threaten forest health
 - Sustaining water quality and quantity
 - Protecting and restoring forest health biodiversity and wildlife habitat
 - Sustaining and protecting forest and agroforest ecosystems
 - Maintaining the economic benefits of our woodlands
- Current and future conditions and trends of the 4.1 million acres of forest, woodlands, and trees. Invasive species have surpassed, in some cases, the native species in numbers which affect the health of urban and rural forest.
- Discussion about Chapter 3; the assessment and strategies for addressing the top seven issues. This includes the resources needed to address the issues and calculating results.
- Discussion about Chapter 4; Forest Legacy Program will cover up to 75% of a landowner's costs. Since the program's creation in 1990, the program has conserved over 2.6 million acres of forest land. The Kansas program focuses on riparian forest conserving biodiversity and forests with high ecological values.

Darci Paull, GIS Specialist, KFS (See PP)

- Used similar methodology as with the 2010 FAP. There is a lot of new data that was able to be added to the analysis. Some data in forest health and community was not improved upon. KFS felt that this data was still relevant and important, so it has been included.

- Described how they analyzed the data using 43 layers. It was analyzed by placing 20 layers into threats and 23 layers into benefits. Staff was asked to rank each layer. There were then analyzed down with various methods to bring all these layers down to 2 layers; threat and benefits. This was then combined into 1 layer and that is the final layer with the numbers. Based on the Hydrologic Unit Code (HUC)-14 watershed ranking, staff highlighted areas into landscape priorities.
- There was great diversity among the layers and rankings.
- Discussed summary of forest resource threats composite map. (See PP)
- Discussed summary of forest benefits composite map. (See PP)
- Discussed summary of priority areas for threats and benefits by five classes composite map (See PP). A map was created to focus on high and moderate-high priority areas for threats and benefits to make it less busy. It was broken down further and another to focus on regional areas in another map as well. (See PP)
- Discussed regional issues and priority areas map. (See PP)
- Discussed map associated with the Baldwin Woods Forest Preserve and the Forest Legacy Project. (See PP)

Mark Neely, State Fire Management Officer, KFS (See PP)

- Discussed issues that create wildfire risk. Discussed notable and significant threats. Since 2010, wildfire risk has become a serious risk issue, so KFS decided to address this in the Forest Action Plan. Discussed how changes in fuel have contributed to the risk, as well as lack of prescribed fire as a land management tool, and the conversion of rural lands to residential.
- Discussed strategies for wildland fire management.
 - Kansas Wildfire Risk Assessment Portal: Monies received in a grant for West Wide Risk Assessment. This helped to develop the Kansas Wildfire Risk Assessment Portal. Once rolled out, it will provide a tool to identify potential wildfire risks in their area.
 - Community Wildfire Protection Plan: KFS has the ability to provide community wildfire protection plans through a joint effort with local communities to identify risks and mitigation measures.
 - Kansas Wildfire Suppression Fund: In 2019, KFS received Kansas Wildfire Suppression Fund in the amount of \$650,000 from the State General Fund to provide wildland fire management across the State. This has allowed KFS to expand on its ability to monitor and assist throughout the State.
 - KFS needs to be named as the lead authority for wildland fire management for the State. There are currently multiple agencies monitoring and assisting. KFS was identified as having the expertise and experience for being qualified for being the lead authority.
- Resources required and performance measures needed to meet our goals:
 - Effective partnerships must be sustained and fostered;
 - Appropriate and consistent funding must be secured, and;
 - Objective, quantifiable, and impactful performance measures must be tracked.

Ryan Armbrust, Forest Health Coordinator, KFS (See PP)

- Issues that threaten Kansas forest health. The threats are diverse and interdependent. Notable and significant threats identified in the FAP are:
 - Emerald Ash Borer (EAB)
 - Pine Wilt
 - Thousand Cankers Disease (TCD) of black walnuts
 - Invasive plants
- Strategies for forest health threats include:
 - Focused, targeted efforts based on objective data;
 - State quarantines and strategic plans for TCD and EAB;
 - Community and rural tree inventories and surveys;
 - Effective outreach to the public, and;
 - Participation in regional forest health initiatives and collaborative information sharing.
- Reiterated the importance of the resources required and performance measures.

Bob Atchison, Rural Forestry Coordinator, KFS (See PP)

- Sustaining water quality and quantity is a critical issue that Kansas faces. Most notable and significant are:
 - Loss of riparian forest;
 - Sedimentation of federal reservoirs;
 - Harmful algal blooms, and;
 - Loss of biodiversity, soil health, water supply to tamarisk, Russian olive, and other phreatophytes.
- Some of the strategies in the FAP to address these issues are:
 - Focused, targeted outreach using riparian forest assessments and tools for engaging landowners effectively;
 - Interagency streambank protection teams;
 - Lowering costs on riparian buffer plantings through direct seeding;
 - Focusing on upper watershed stream orders 1-3, and;
 - Collaborating with Watershed Restoration and Protection Strategy (WRAPS), Environmental Protection Agency (EPA) 9-Element Plans, Regional Advisory Committees (RACs), NRCS, Kansas Department of Agriculture Division of Conservation (KDA-DOC) Riparian Quality Enhancement Initiative.
- Resources required and performance measures include:
 - Expand State partnerships and State funding to support water quality foresters;
 - Increase financial incentives for bank stabilization and riparian buffer establishment, and;
 - Quantify financial and environmental benefits of stabilization and riparian buffers.

Tim McDonnell, Community Forestry Coordinator, KFS (See PP)

- Issues that threaten Kansas community forestry include one of the biggest, which is canopy loss. But included are also:
 - Mature, over-mature that is in decline
 - Lack of diversity

- Repetitive storms
- Volunteerism/Labor/Budgets
- Drought
- Pests (current and impending)
- Grey/Green infrastructure
- Defective/hazard trees
- More removals than trees planted is the biggest issue Kansas has seen in the last 10-years
- Study done by the University Technical College (UTC) Study of Wichita, Kansas ICTREES. (See PP) The study shows that Wichita has about 45% possible plantable space. This type of data can give Eco benefits data when which can be analyzed to justify the benefits of increasing canopy.
- Discussed a slide on a 50-year historical inventory of 40 different communities in Kansas. (See PP) The slide example shows the community of Great Bend, Kansas in Northwest Kansas, whose canopy has seen a reduction from about 15,000 trees to under 7,000. KFS can provide assistance to rural communities to help with this canopy loss. The KFS GIS department is doing a canopy study for every single community in the State of Kansas so the reports will be available to every community across the State.
- Resources required and performance measures include:
 - Continue to increase the number of assessments, inventories, and management plans provided to communities in Kanas;
 - Increase the ordinances within communities that preserve and protect forest land, or bring in green infrastructure practices, and;
 - Increase the number of acres that are either enhanced or protected from forest fragmentation or urban land development.

Dave Bruton, Marketing and Utilization Coordinator, KFS (See PP)

- Promoting livelihoods and economic benefits of woodlands; seeing trees as a natural renewable resource. Notable and significant issues identified in the FAP include:
 - Developing, marketing, and expanding biochar;
 - Distance to markets and transportation costs, and;
 - Developing biomass as a wood energy feedstock.
- Forest industry contributes \$1.3 billion annually to Kansas economy in 2016 dollars. It supports 6,400 jobs at a payroll of \$386 million.
- In conjunction with Nebraska, the KFS established the Great Plains Biochar Initiative (GPBI).
- Strategies for promoting livelihoods and economic benefits of woodlands include:
 - Expand GPBI outreach, education, and participation;
 - Develop biomass markets for invasive species;
 - Utilize wood manufacturing residue as wood energy feedstock, and;
 - Support existing primary and secondary processors
- The downturn of the economy from 2007-2009 did cause some setbacks within the processor industries like sawmills and cabinetry manufactures. The poorer economy also effects how landowners see woodlands as a resource. If landowners don't see this as an economic benefit, then they are less likely to participate in practices and initiatives. They can generate income by bulldozing the area verses harvesting.
- Resources required and performance measures include:

- Critical Partnerships with renewable energy industry;
- Incorporation of biochar into the agricultural sector as a soil amendment, and;
- Number of wood energy biochar markets developed and sustained.
- Competition against natural gas here in Kansas is the obstacle to overcome.

Jason Hartman, State Forester, KFS (See PP)

- Once KFS has processed all input, suggestions, edits, and priority areas, the FAP will go to the U.S. Department of Agriculture (USDA) Forest Service (FS) Rocky Mountain Region 2 Regional Forester for Review. It then goes to the Deputy Chief of State and Private Forestry at the USDA-FS for final approval.

Cassie Wandersee, Communications Coordinator, KFS

- Q & A
 - Question for Dave Bruton: Who is leading the research in using biochar as cattle feed in Nebraska?
 - Reply: The Nebraska Forest Service, Heather Nobert is the person coordinating that in conjunction with the University of Nebraska in Lincoln is where they received the funding.
 - Question: Due to education and low commodity prices, is there any slowing of tree removals in Kansas, such as wind breaks, riparian buffers, and forest?
 - Robert Atchison's Reply: We do not have a baseline on this resource as in the past, it did not qualify as a resource with the USDA-FS, so it has been hard to monitor the changes you are asking for. However, as Darci indicated in her presentation, for the first time, we have a Statewide canopy GIS layer, and now we are laying other years over that to see if we can identify changes. Some of the information I have seen on windbreaks, though not published, is that we have achieved a balance. But we can't really answer that question from a scientific standpoint at this point and time.
 - Question for Dave Bruton: What is the greatest challenge for increasing commercial biochar production in Kansas?
 - Reply: The biggest challenge is to find a practical means to handle large volumes of material and produce large quantities. One promising thing is in Colwich, Kansas, here is an ethanol facility (Element) that was built after about a year and a half, and I have been told that they will have the capability to run wood waste through that. They are looking at using 400 to 450 tons of material per day through that facility. They are hoping to use wood waste from urban and manufactured wood waste. But that is the biggest challenge I see. Getting production up to a larger scale where you could say, if this feeding study comes to be and shows promise, producing enough char that could be fed to all the livestock in the State of Kansas would be an ideal situation. With fuel prices being as low as they are, it will be very hard to compete, as in making ethanol for fuel any cheaper than regular fuel is now. The ideal situation would be to have a plant like Element utilize the materials. Remove the wind break for renovation purposes, replanted, and then take that material to their facility and utilize

it that way. But producing it in a large enough scale economically to make it viable.

Closing remarks by Sharonté E. Williams, Assistant State Conservations for Programs, NRCS, Salina, Kansas.

- This information will be posted to the State Technical Committee website and the minutes will be sent out by email as well.
- Moving forward, NRCS is looking at using venues for meetings such as ZOOM and Microsoft Office Teams. It is accessible to Partners; you do not have to be an employee of NRCS, you only have to download it on your end. Set up an account, and you will find that it works similar to ZOOM, so look forward to that.
- If you have any questions moving forward, you can forward them to Jason Hartman, State Forester, Cassie Wandersee, Communications Coordinator, Sharonté E. Williams, NRCS, or Tracey L. Burgess, NRCS. We will do our best to get your questions answered.

Meeting adjourned at 10:37 a.m.

From: [Shane C Neel](#)
To: [Robert Atchison](#); [Charles Barden](#); dawn.dolezal@ks.usda.gov; mark.janzen@ks.usda.gov; [Debra McDaniels](#); [Mengarelli, Dustin \[KDWP\]](#); [Ryan Rastok](#); [Floyd Schmidt](mailto:Floyd.Schmidt@nek.forestry@hotmail.com); nek.forestry@hotmail.com; crtorney61@gmail.com; wwwawhite@gmail.com; [Sandy Chandler](#); safountain@fs.fed.us; lutter@embarqmail.com; [Tom Hogard](#); kickapoo.david@gmail.com; [Jason Hartman](#); [Darci A Paul](#)
Subject: KFA Forest Action Plan Input Meeting
Date: Wednesday, May 6, 2020 7:01:25 AM
Attachments: [KFAP KFA 5.6.20.pdf](#)
[image002.png](#)
[image004.png](#)
[image006.png](#)
[image008.png](#)
[image010.png](#)

KFA Board –

I look forward to meeting with you all here soon. Bob and Darci Paul will be presenting the attached pdf slides during the meeting. It will be beneficial to join on a computer if possible to follow the presentation. If not, then you can follow via the pdf.

Here are some Zoom Etiquette items that will help with the meeting:

1. Please mute your mics when not speaking
2. If you have bandwidth issues, share your video only when speaking
3. Utilize the “Chat” during the presentations for questions and comments
4. For newer Zoom users, I will start the meeting 15 minutes early if you want to sign on to trouble-shoot any technical issues
5. My cell is 785-617-0717 if you have troubles
6. Agenda
 - a. Welcome and Introductions – Shane
 - b. Overview – Bob
 - c. Presentation – Bob and Darci
 - d. Questions and Input

Thanks and talk to you all soon,

Shane

Shane Neel is inviting you to a scheduled Zoom meeting.

Join Zoom Meeting

<https://ksu.zoom.us/j/95802114570?pwd=eEpnV3JaRjlMU0MrTjU1QU1wcHY5QT09>

Meeting ID: 958 0211 4570

Password: KFA

One tap mobile

+12532158782,,95802114570#,,1#,444723# US (Tacoma)

+13462487799,,95802114570#,,1#,444723# US (Houston)

Dial by your location

+1 253 215 8782 US (Tacoma)

+1 346 248 7799 US (Houston)

+1 669 900 6833 US (San Jose)

+1 301 715 8592 US (Germantown)

+1 312 626 6799 US (Chicago)

+1 646 876 9923 US (New York)

Meeting ID: 958 0211 4570

Password: 444723

Find your local number: <https://ksu.zoom.us/u/amK0lPD8r>

Join by SIP

95802114570@zoomcrc.com

Join by H.323

162.255.37.11 (US West)

162.255.36.11 (US East)

115.114.131.7 (India Mumbai)

115.114.115.7 (India Hyderabad)

213.19.144.110 (EMEA)

103.122.166.55 (Australia)

209.9.211.110 (Hong Kong

China)

64.211.144.160 (Brazil)

69.174.57.160 (Canada)

207.226.132.110 (Japan)

Meeting ID: 958 0211 4570

Password: 444723

Join by Skype for Business

<https://ksu.zoom.us/skype/95802114570>

Shane Neel
Outreach Coordinator
p: 785-564-6723 c. 785-617-0717
a: 1320 Research Dr. Manhattan, KS 66502



kansasforests.org



"Care of natural resources and service to people through forestry."



Date: May 6, 2020
Time: 9:00 am – 11:00 am
Location: Zoom Meeting
ksu.zoom.us/j/95802114570?pwd=eEpnV3JaRjIMU0MrTjU1QU1wcHY5QT09
Meeting ID: 958 0211 4570
Password: KFA

Attendance: Bob Atchison – KFS; Sherry Fountain - USDA Forest Service; David Hebert – KFA Board Member, Kickapoo Tribe in Kansas; Tom Hogard – President of KFA, Forest Products; Mark Janzen - Natural Resources Conservation Service, Shane Neel – KFA Program Director, KFS; Darci Paul – KFS; Ryan Rastok – KFS; Floyd Schmidt – Vice President of KFA; Forest Landowner, Carolyn Turney – KFA Board, Forest Landowner; Roy Turney – KFA Board, Forest Landowners; Wayne White – KFA Board, Forest Landowner

Outline:

1. Welcome and Introductions – Shane
2. Overview – Bob
3. Presentation – Bob and Darci
See Attached PDF
4. Questions and Input

Questions/Comments/Input:

1. Carolyn: What is the purpose of the KFA input for the KFAP?
 - a. Bob: To take into account recommendations and input on strategies and issues identified. This isn't just stamping what has been presented. If you offer input, it will be listened to and considered.
2. Carolyn: We tried to read through documents with questions and suggested edits. Have you cleaned all that stuff up?
 - Bob: No we haven't. We are still in the process of taking comments and hope to have that done in the next couple weeks.
 - Carolyn: Good, because especially chapter 3 was extremely difficult to read. It would be nice to see that in a revised form. I also appreciate Ryan Armburst's very detailed comments. Some of the things I saw were typos. In chapter 2 there were things some formatting issues with words like biomass.
 - Bob: Right now final editing is not done and that is what Mark Stadlander and his staff will be completing in the coming days. Mark works with K-State Research and Extension and is an editor with KSU. We use them for a lot of publications.
 - Carolyn: You have been working very hard and I will look for the link once you have this cleaned up.



2. Wayne: Last time we worked on a presentation, we said there were 5 million acres of trees and 2.5 million acres of forest. The 2.483 is about the same, but this slide had 4.1 million acres of trees. Is that an actual reduction or a reassessment of the data?
 - Bob: That is a reassessment and lot of the work is done by Darci and her crew through new developed tools in GIS and Dacia Meneguzzo USDA Forest Service FIA Analysis for trees outside of forests that really has increased the accuracy of how we identify these figures. That is the reason you see such a change in those figures and how we talk about them.
 - Wayne: Yes that's a 900,000 acre change. That's significant.
 - Bob: To clarify that is not a change in the resource or acreage, but how we identify them. We've never had a good way to identify trees outside forest that weren't described as forest land. In 2015 for the first time ever we developed a statewide canopy layer for all trees in Kansas, thanks to Darci and her coworkers. We have a more accurate representation now.
3. Wayne: Related Question, you talk about foresting riparian areas and expanding community and urban forests, but not identifying appropriate areas such as degraded pasture land most appropriate for reforestation or afforestation. Is it in there or not talked about and not in the plan.
 - Bob: The focus is in the riparian areas and not necessarily in uplands. Focus on reestablishment in class 1 -3 soils, where there is productive ground. These have been discussed with a doing a better job of absorbing CO2 where we can plant and sustain trees. I will look at the details of the plan.
 - Wayne: I think a sentence or 2 would be a good addition.
4. Wayne: Emerald Ashborer Quarantine Area identified, SE Kansas is not identified. There are reports of Crawford and Lynn County.
 - Ryan: USDA would need to be apprised the situation to identify and verify presence. Work with Rastok, Armburst and KDA to verify its presence. Put us in contact with the LO to possibly identify.
5. Wayne: Could we look at an Analysis of Species that do well with climate change, especially in the community forestry.
 - Bob: Nothing that goes into detail within the plan outside narrative in the climate change section. We could consider including even though the plan normally does not go into that amount of detail.
 - Wayne: I think it's important and useful to include, especially for urban and community forestry.
6. David: Is the KFS/KFA coordinating with the BIA about prescribed burning and/or removal of eastern red cedar in grasslands? If not I would be happy to help as a liaison.
 - Bob: Yes, we have received another grant in collaboration with the Kickapoo Tribe and as part of the grant a partner is BIA. Some of the deliverables in the grant are controlling ERC. Thank you for willing to be a part of the grant and Jarran Tindle will be in contact with you for deliverables.



7. Floyd: I agree with Wayne and inclusion of an Analysis of Species for climate change. This is both for KFS and public outreach.
8. Wayne: What species are being utilized in pallets in Kansas?
 - Bob: A lot of pallet work is in the SE part of the state and a great variety of species. Oak, Hackberry and even cottonwood.
9. Wayne: Will priority areas in the Delaware watershed just be riparian areas?
 - Bob: It's both. The watershed defines the boundary, but a focus will be in riparian areas.
10. Floyd: Riparian areas as well as urban runoff remain and issue in Kansas. Forests will play a primary role in water supply and preventing some erosion.
11. Wayne: Appreciate all the work and you have done on this. It's really good and comprehensive. When will a print version be available?
 - Bob: We are hoping to finalize things by the end of June. Printing is expensive, but we will have copies available for review.
12. Floyd: Concerned about the trend data from Great Bend. He will contact people from city to reverse.
Wayne: Is that decline similar in all Western communities.
 - Bob: Yes not finalized, but contact Jami and Tim for other cities data.Tom: Has the methodologies changed from the beginning of the community data? Even with the annexed and expanded area of the community, the data is concerning.
 - Bob: It has changed some, but not enough to cause the changes we are seeing in the data.
13. Bob: Editing for proofreading is not needed as we have KSU. The input is more important for content of the document. Please have edits within the next week to move ahead ASAP. This is a living document however, so we can change it annually even within the 5 year major edits.
Floyd: Bob, Darci, and others have done an amazing job. Thank you!
Tom: We will see the final edit before publication. It is hard to read without final edits.
 - Bob: There will be a chance to edit prior to submitting to region 2 edits.Carolyn: Thank you Bob and hopefully this was much easier than the first time just doing edits. Great Job!
14. Bob will send a public input survey for more feedback:
https://kstate.qualtrics.com/jfe/form/SV_8x2JviP7gQ1FeIZ

2020 NRCS Kansas Technical Committee Meeting

On April 22, 2020, the Kansas Forest Service presented the Kansas Forest Action plan for comment and input to the NRCS Kansas Technical Committee during a 2-hour meeting via Zoom. Including the host, the meeting was attended by 119 members. These members represented 66 different state and federal natural resource agencies, companies and non-profits in Kansas such as Kansas Department of Wildlife, Parks and Tourism; K-State Research and Extension; Natural Resource Conservation Service; Farm Service Agency; and US Fish and Wildlife Service.

Meeting topics included a welcome and opening remarks provided by Sharonté E. Williams, NRCS, assistant state conservationist for programs. Jason Hartman, state forester, Kansas Forest Service, and Cassie Wandersee, communications coordinator, explained the purpose and protocol for the meeting. Bob Atchison, rural forestry coordinator, provided an overview of the Kansas Forest Action Plan followed by Darci Paull, GIS specialist, who explained the process of selecting priority areas, GIS metadata, and analysis methods.

Kansas Forest Service program coordinators provided the following overviews: Fire Management, Mark Neely, state fire management officer; Forest Health, Ryan Armbrust, forest health coordinator; Rural Forestry, Bob Atchison, rural forestry coordinator, Community Forestry, Tim McDonnell, community forestry coordinator, and Forest Products, Dave Bruton, marketing and utilization coordinator.

Action items from this meeting included: Many participants were very complimentary and supportive of the plan. There were some enquiries about the Biochar Initiative. Participants were directed to an on-line Qualitrics Survey to provide any additional comments about the plan.

Kansas Technical Committee Members 2020

Name	Title	Organization
Calvin Adams	Rancher	Smoky Hills Graziers Association
Trevor Ahring		Southwest Kansas Groundwater Mgt. District No. 3
Corey Alderson	Forester	Kansas Department of Wildlife, Parks and Tourism
Jeff Allen		Sharp Brothers Seed Company
Kent Askren	Water Resources Specialist	Kansas Farm Bureau
Robert Atchison	Rural Forestry Coordinator	Kansas Forest Service
Daniel Baffa		Smoky Hills Audubon
Debra Baker	Contractor	Kansas Alliance for Wetlands and Streams
Barry Barber	Member, Board of Directors	Kansas Rural Center
R. Scott Barrows	Liaison	Premier Tillage
Mark Bauer	Precision Ag Specialist	Great Bend Co-op
Chris Berens		Kansas Department of Wildlife, Parks and Tourism
Kolt Bevin	Wetlands Program Manager	Kickapoo Tribe
Tim Boese	Manager	Equus Beds Groundwater Mgt. District No. 2
Ronald Brown	Area V Director	Kansas Association of Conservation Districts and State Association of RC&Ds
Ken Brunson	Red Hills Project Coordinator	The Nature Conservancy
Scott Carlson	Executive Director, Acting	Kansas Department of Agriculture, Division of Conservation
Troy Coen	Board Member	Morton County Conservation District
Barth Crouch	Coordinator	Kansas Grazing Lands Coalition
Bob Culbertson	Wetland and WRAPS Coordinator	Kansas Alliance for Wetlands and Streams
Mike Disney	Private Land Supervisor	U.S. Fish and Wildlife Service
Orrin Feril	Manager	Big Bend Groundwater Management District No. 5
Dale Fjell	Director of Research	Kansas Corn Grower's Association
Ryan Flickner	Senior Director, Public Policy	Kansas Farm Bureau
Lynn Gentine	Executive Director	Ranchland Trust of Kansas
Terry Griffin	Cropping Systems Economist	Kansas State University
Jim Hays	Conservation Projects Coordinator	The Nature Conservancy
Douglas Helmke	Water Rights/Source Water Specialist	Kansas Rural Water Association
Harlan House	Producer	
Matt Hough	Manager, Conservation Programs	Ducks Unlimited
Jude Kastens	Research Associate Professor	University of Kansas, Applied Remote Sensing Program and Biological Survey
Dean Klahr	Director of Stockgrowers Division	Kansas Livestock Association
Ron Klataske	Executive Director	Audubon of Kansas
Kenneth Kopp	Source Water Protection Specialist	Kansas Rural Water Association
Abram Lollar	Biologist	Ducks Unlimited
Andrew Lyon	Watershed Management	Kansas Department of Health and Environment
Stephanie Manes	Project Coordinator	Ranchland Trust of Kansas
Jordan Martincich	Development Officer	Pheasants Forever/Quail Forever
Jesse McCurry	Executive Director	Kansas Grain Sorghum Producers Association
Chris McLeland	South Region Director	Pheasants Forever/Quail Forever

Name	Title	Organization
Terry Medley	Programs Manager	Kansas Department of Agriculture
Heidi Mehl	Healthy Streams Initiative Manager	The Nature Conservancy
Dan Meyerhoff	Executive Director	Kansas Association of Conservation Districts
Howard Miller	Outreach Coordinator	Cheney Lake Watershed
Katie Miller	Director of Technical Services	Kansas Municipal Utilities
Todd Miller	Representative	Kauffman Seed, Inc.
Jessica Mounts	Executive Director	Kansas Alliance for Wetlands and Streams
Mark Nelson	Director of Commodities	Kansas Farm Bureau
Barb Oltjen	President	State Association of Kansas Watersheds (SAKW)
Jim Pitman	District Biologist for Kansas, Nebraska, and South Dakota	National Wild Turkey Federation
Gabriel Polson	Assistant Agronomy Manager	Great Bend Co-op
Amanda Reed	WRAPS Program Manager	Kansas Department of Health and Environment
Richard Rockel	Water Planner	Kansas Water Office
Dwane Roth	Owner	Big D Farm
Mark Rude	Executive Director	Southwest Kansas Groundwater Mgt. District No. 3
Amanda Scott	President	Kansas Association of Conservation Districts Employees' Organization
Matt Smith	Conservation Delivery Specialist	Playa Lakes Joint Venture
Steven Sorensen	Conservation Vice President	Kansas Wildlife Federation
Wes Sowards	Assistant Director, Wildlife Division	Kansas Department of Wildlife, Parks and Tourism
Tracy Streeter	Global Water Practice	Burns & McDonnell Engineering Company
Tim Stroda	President/CEO	Kansas Pork Association
Steve Swaffar	Executive Director	No-Till on the Plains
Peter Tomlinson	Professor and Extension Specialist for Environmental Quality	Kansas State University
Matt Unruh	Water Resource Planner	Kansas Water Office
Cammie Vaupel	Agronomist	Great Bend Co-op
Nick Vos	Landowner	
Eric Woofter	CEO	Star Seed
Shade Wright	Board Member	Morton County Conservation District

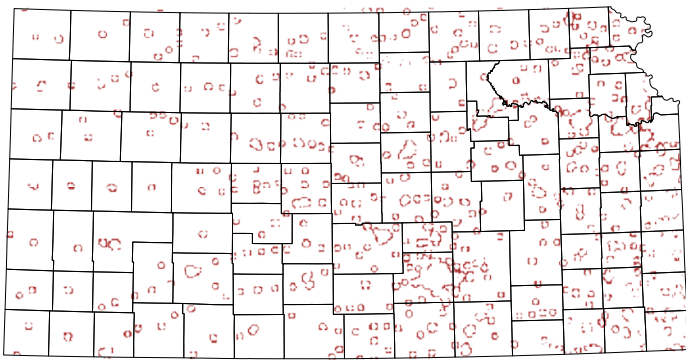
Kansas Forestry Association And State Forest Stewardship Coordinating Committee, 2020

Last	First	Title	Organization Name	City	State
Atchison	Bob	Program Admin/Rural Forestry Coord.	Kansas Tree Farm Committee/KFS	Manhattan	KS
Barden	Charles	Extension Forester/Walnut Council Pres.	Kansas State University	Manhattan	KS
Hartman	Jason	State Forester	Kansas Forest Service	Manhattan	KS
Chandler*	Sandy	Secretary/Treasurer	Kansas Forestry Association	Manhattan	KS
Dolezal	Dawn	Agricultural Program Specialist	Kansas State FSA Office	Manhattan	KS
Hebert	David	Environmental Specialist	Kickapoo Tribe	Horton	KS
Hogard	Tom	Chair/President/Sawmill Operator	Tom the Sawyer	Eudora	KS
Janzen	Mark	Natural Resource Specialist, Forestry, Plant Materials, Organics	Natural Resources Conservation Service	Salina	KS
Fountain	Sherry	Landowner Asst & FSP Prog Manager	USDA Forest Service - State & Private Forestry	Lakewood	CO
Lukert	Wayne	KACD Board Member	Kansas Association of Conservation Districts	Topeka	KS
McDaniels	Debra	Landowner	Walnut Council	Topeka	KS
Mengarelli	Dustin	Public Land Section Chief/Public Lands KDWPT R2	Kansas Department of Wildlife and Parks	Topeka	KS
Neel*	Shane	KFA Program Director, KFS Outreach Coordinator	Kansas Forestry Association	Manhattan	KS
Rastok	Ryan	District Forester	Kansas Forest Service	Oskaloosa	KS
Schmidt	Floyd	Vice Chair/Landowner	Walnut Council/Tree Farmers	Baldwin	KS
Wright	Nestoria	Enivonmental Office Director	Kickapoo Tribe	Horton	KS
Terry	Luke	Forestry Contractor	Custom Forestry Applications	Robinson	KS
Turney	Carolyn	KS Tree Farm Committee Chair	Kansas Tree Farm Committee/KFA	Emporia	KS
Turney	Roy	Landowner	Kansas Tree Farm Committee	Emporia	KS
White	Wayne	Landowner	Kansas Rural Center	Oskaloosa	KS

*Non-voting KFA Board member (or ex-board member)

APPENDIX C

INPUT DATA LAYERS

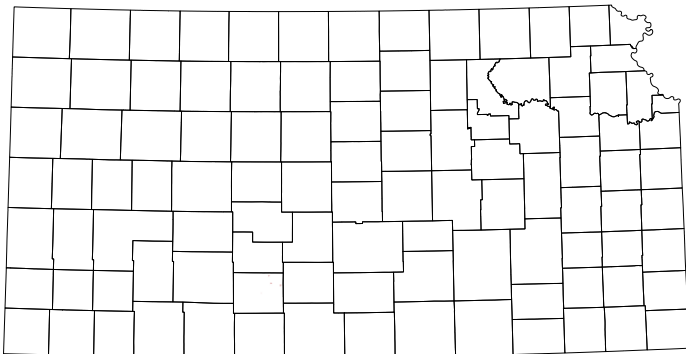
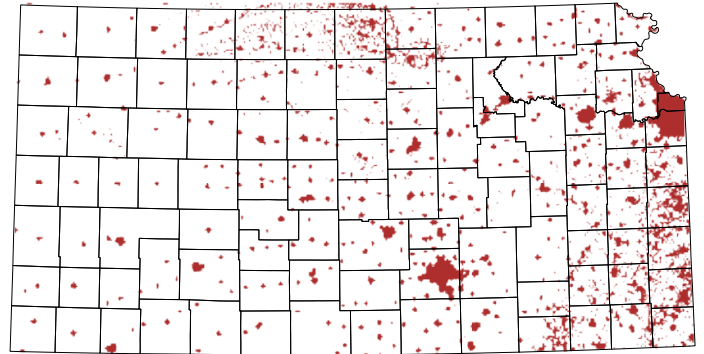


Layer | 'Moderate' Emerald Ash Borer Risk

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)

Layer | 'High' Emerald Ash Borer Risk

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)

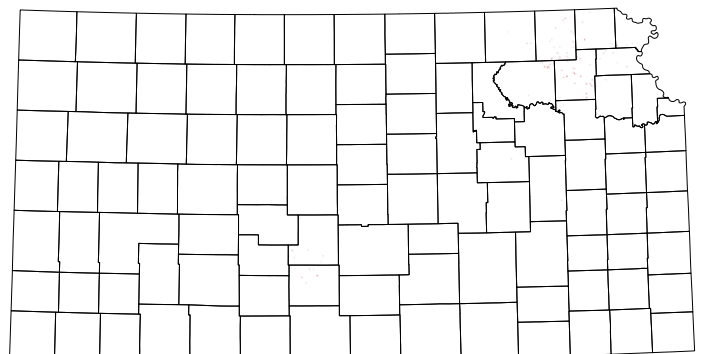


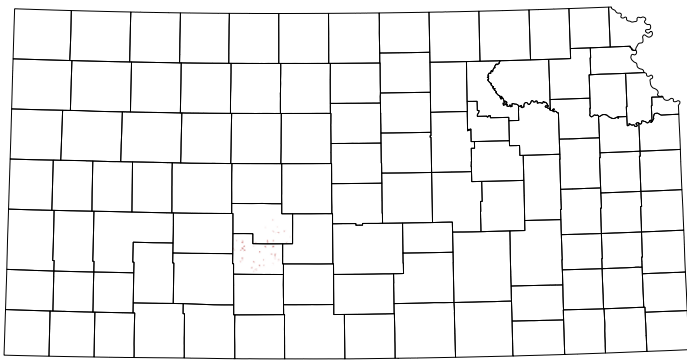
Layer | Pine Wilt 'Absent'

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)

Layer | Pine Wilt 'Present'

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)



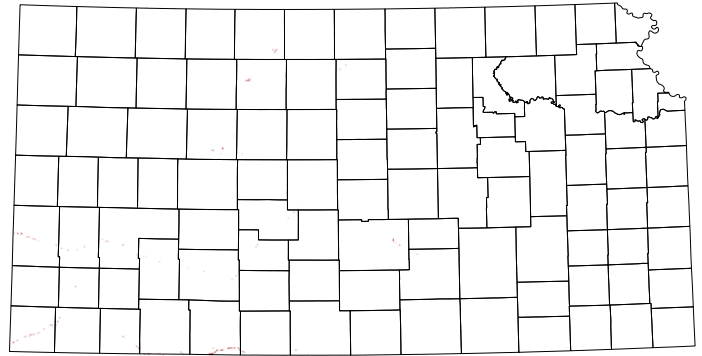


Layer | Pine Wilt 'Transition'

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)

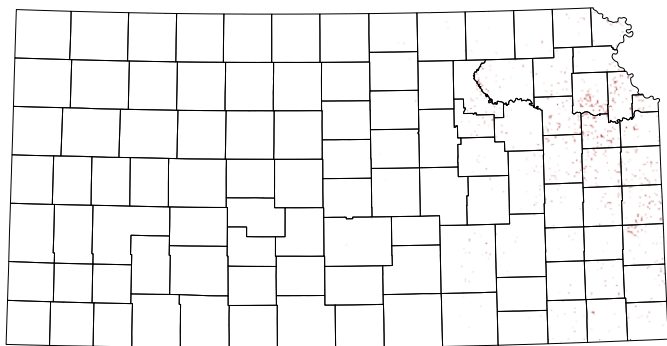
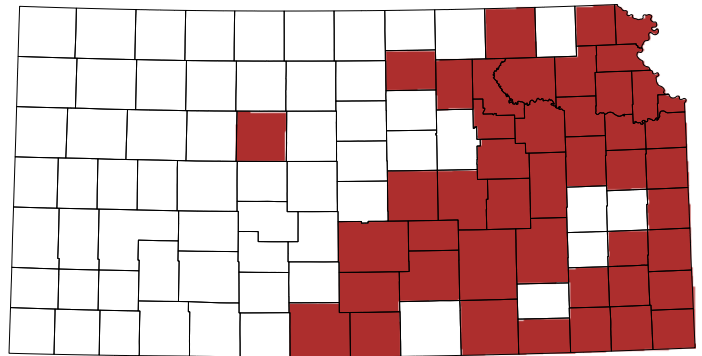
Layer | Tamarisk

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)



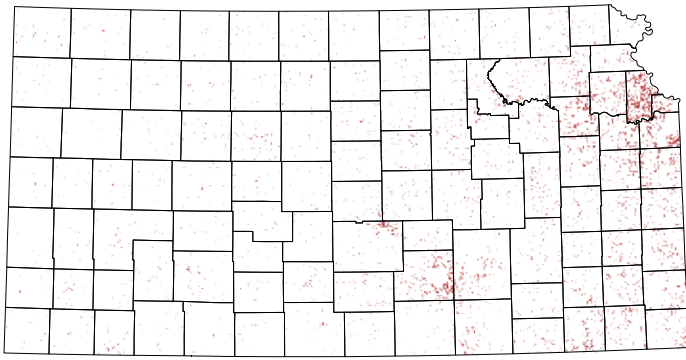
Layer | Bush Honeysuckle Present

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)



Layer | Thousand Canker Disease

Threat/Benefit Layer | Issues that threaten a healthy forest (3.1.1)

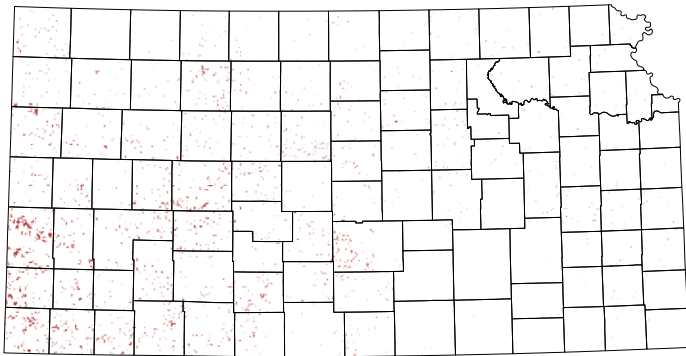
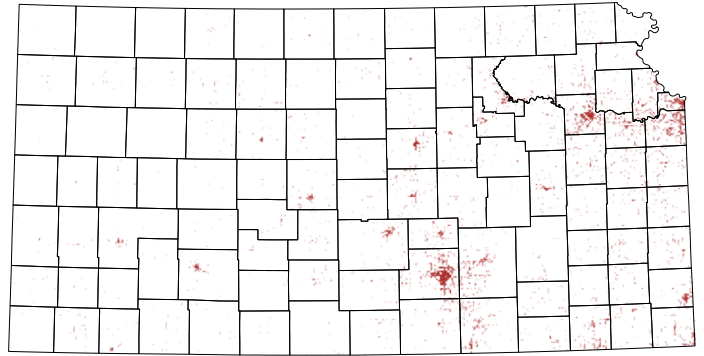


Layer | Wildland-Urban Interface (WUI)

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)

Layer | Fire Occurrences 2009-2018

Threat/Benefit Layer | issues that create a wildfire risk (3.1.2)

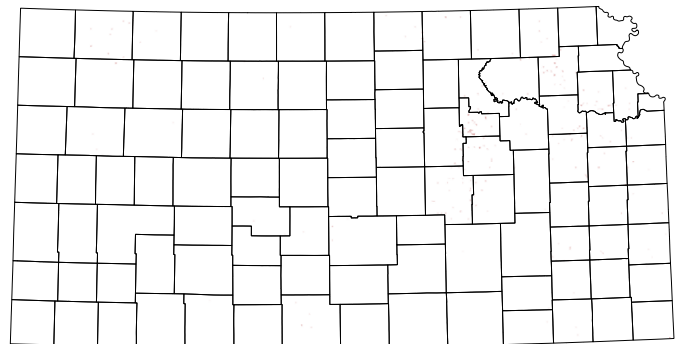


Layer | Conservation Reserve Program Land

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)

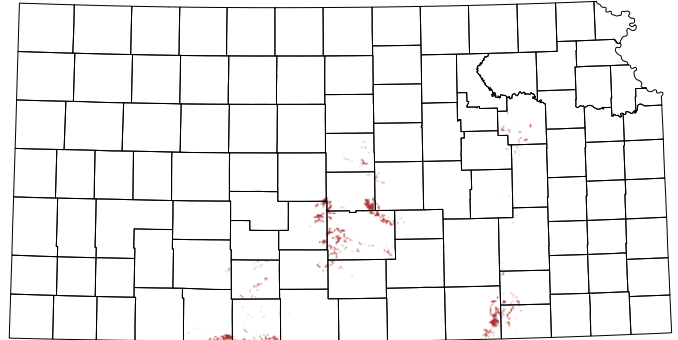
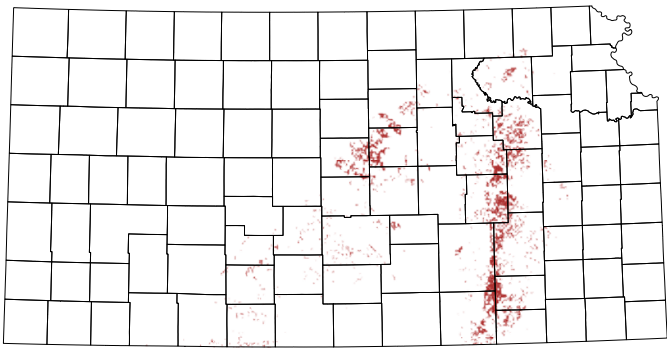
Layer | Eastern redcedar in Grassland

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)



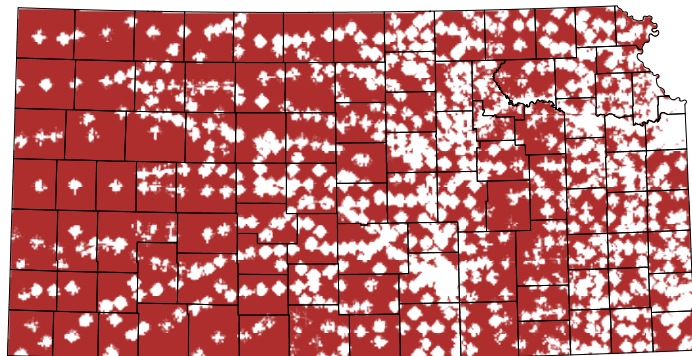
Layer | 'High' Wildland Fire Potential

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)



Layer | 'Very High' Wildland Fire Potential

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)

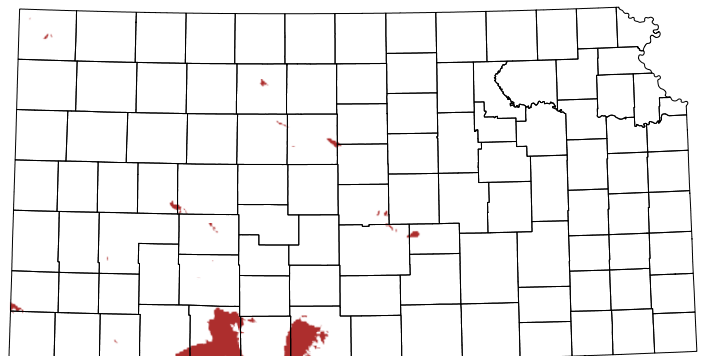


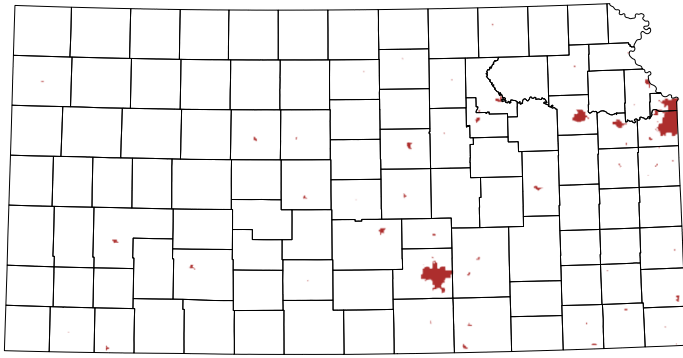
Layer | Insurance Services Office Fire Station Coverage Gaps

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)

Layer | Historic Fires

Threat/Benefit Layer | Issues that create wildfire risk (3.1.2)



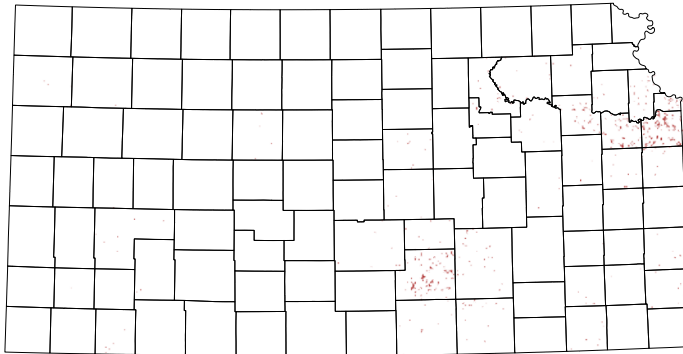
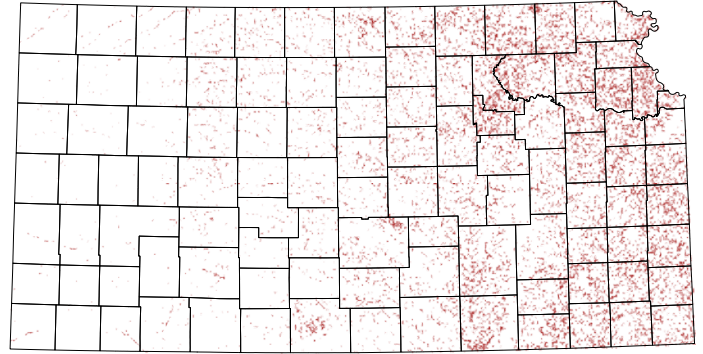


Layer | Urban and Community Forestry Index

Threat/Benefit Layer | Loss of Kansas Forestland (3.1.3)

Layer | Forest Fragmentation

Threat/Benefit Layer | Loss of Kansas Forestland (3.1.3)

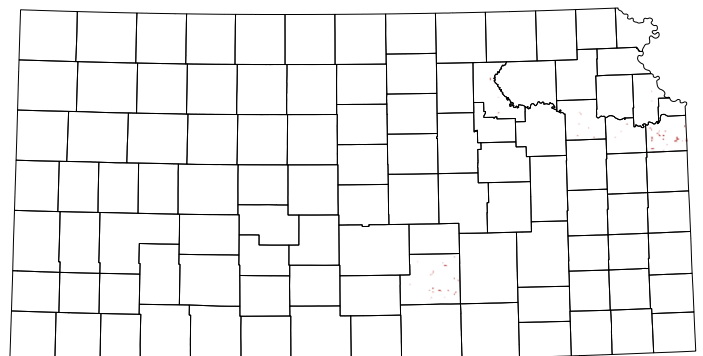


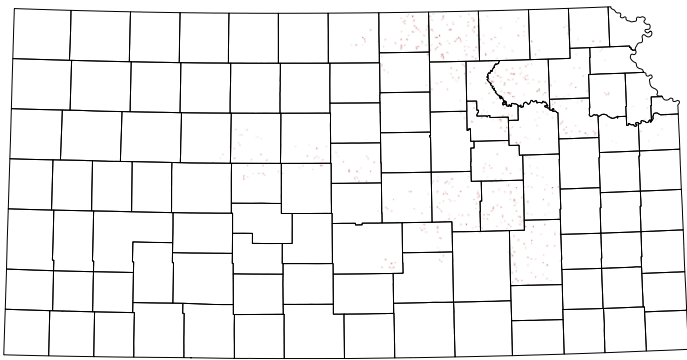
Layer | 'Moderate' Development Risk

Threat/Benefit Layer | Loss of Kansas Forestland (3.1.3)

Layer | 'High' Development Risk

Threat/Benefit Layer | Loss of Kansas Forestland (3.1.3)



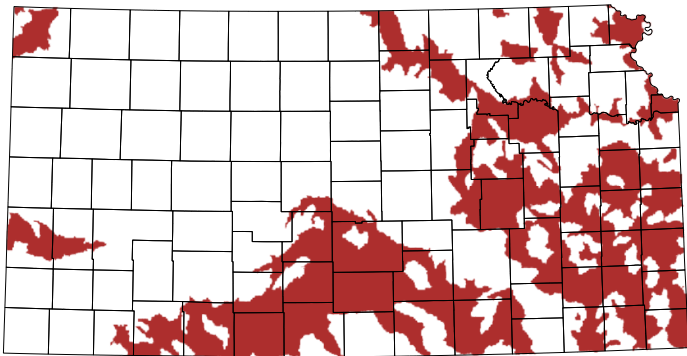
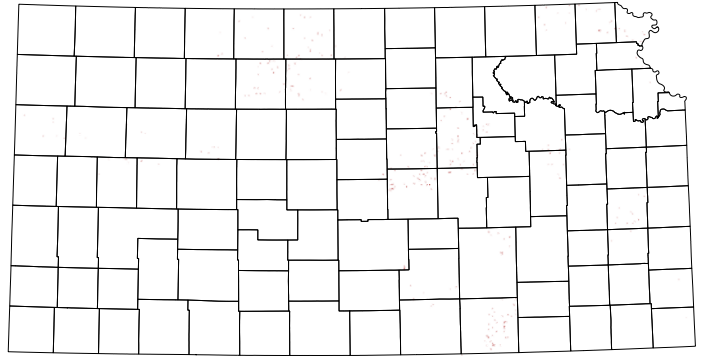


Layer | High SSURGO Runoff Riparian Areas within WRAPS Active Watersheds

Threat/Benefit Layer | Sustaining water quality and quantity (3.2.1)

Layer | High SSURGO Runoff Riparian Areas within WRAPS Partnership Watersheds

Threat/Benefit Layer | Sustaining water quality and quantity (3.2.1)

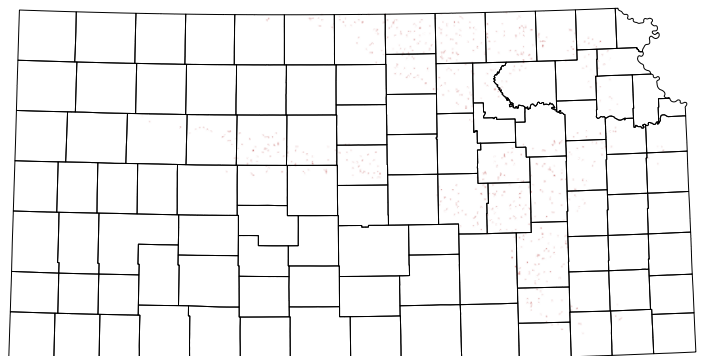


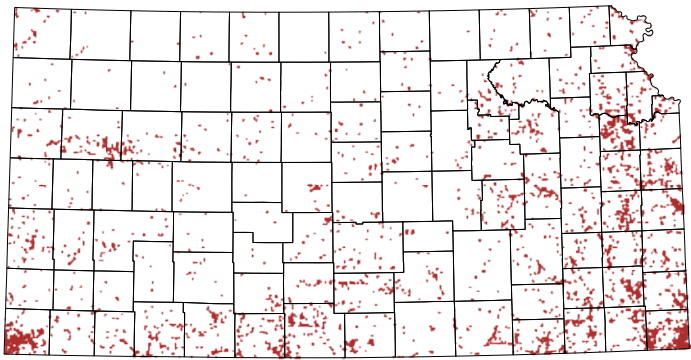
Layer | Kansas Department of Wildlife, Parks and Tourism Aquatic Ecological Focus Area

Threat/Benefit Layer | Sustaining water quality and quantity (3.2.1)

Layer | Stream Orders 1-3 with State-Owned Storage

Threat/Benefit Layer | Sustaining water quality and quantity (3.2.1)



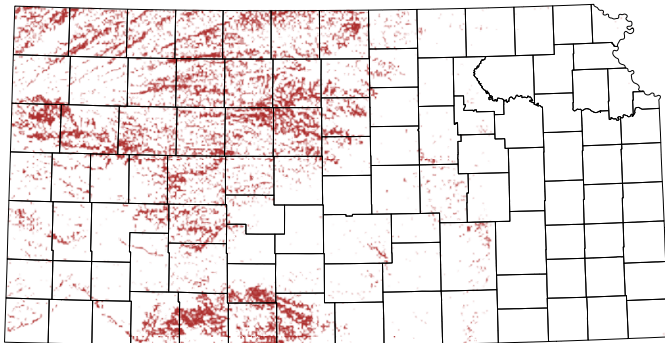
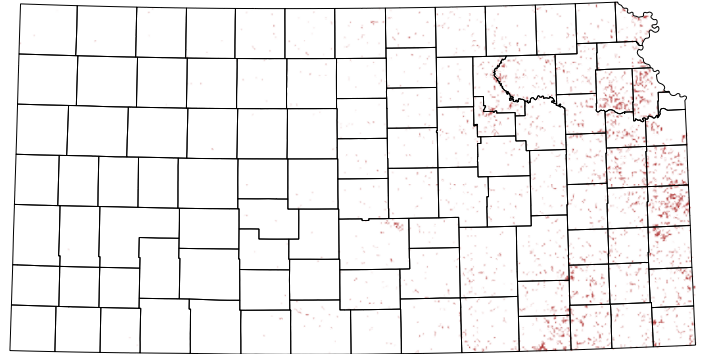


Layer | Kansas Natural Heritage Inventory Rare Species

Threat/Benefit Layer | Protecting and restoring biodiversity and wildlife habitat (3.2.2)

Layer | Forest Patches Greater than or Equal to 40 acres

Threat/Benefit Layer | Protecting and restoring biodiversity and wildlife habitat (3.2.2)

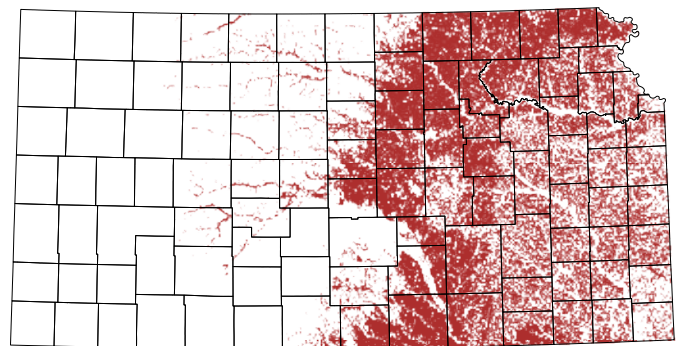


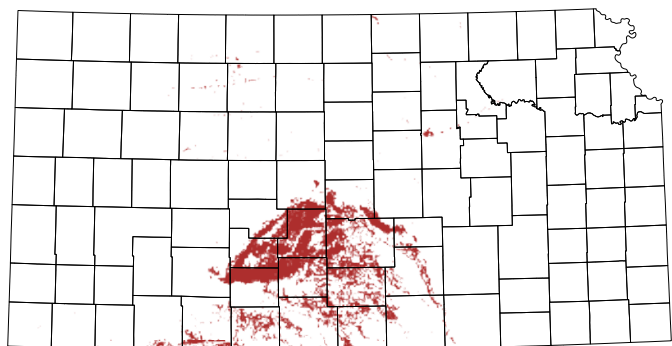
Layer | 2014 Departure Index

Threat/Benefit Layer | Protecting and restoring biodiversity and wildlife habitat (3.2.2)

Layer | Mean Fire Return Interval '0 - 5 Years

Threat/Benefit Layer | Protecting and restoring biodiversity and wildlife habitat (3.2.2)



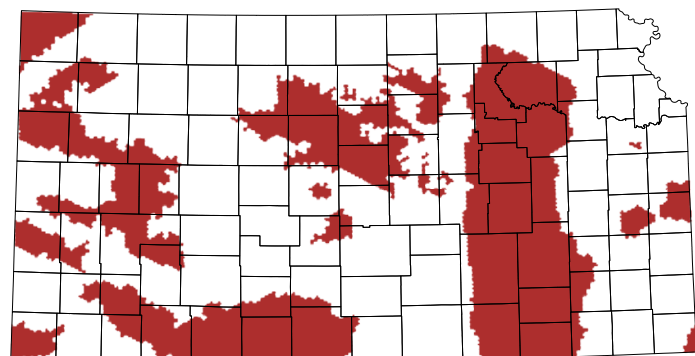
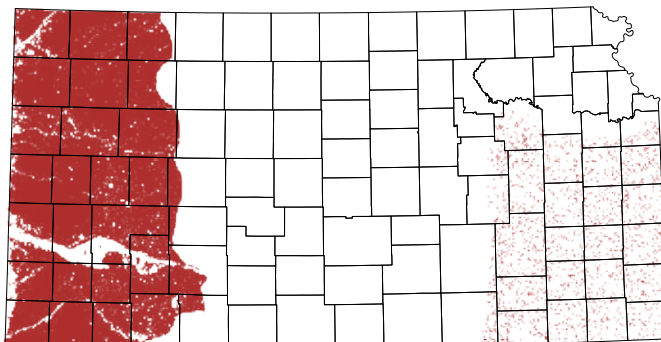


Layer | Mean Fire Return Interval '6 - 10 Years'

Threat/Benefit Layer | Protecting and restoring forest biodiversity and wildlife habitat (3.2.2)

Layer | Mean Fire Return Interval '11 - 15 Years'

Threat/Benefit Layer | Protecting and restoring forest biodiversity and wildlife habitat (3.2.2)

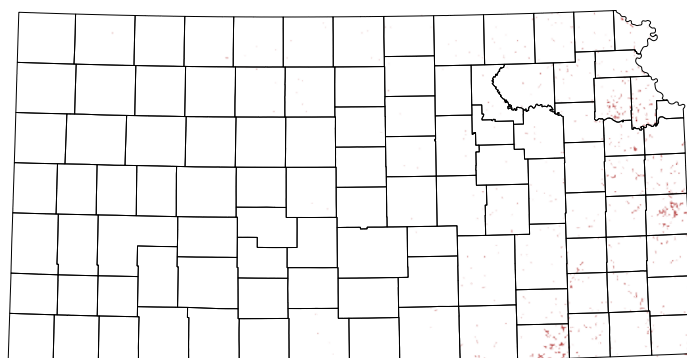


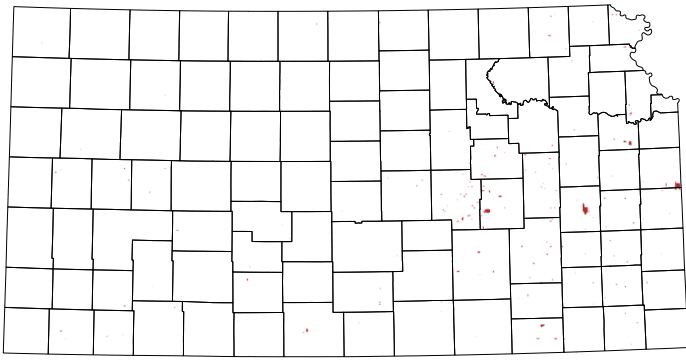
Layer | Kansas Department of Wildlife, Parks and Tourism Terrestrial Ecological Focus Areas

Threat/Benefit Layer | Protecting and restoring forest biodiversity and wildlife habitat (3.2.2)

Layer | Potential High-Quality Forest

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)



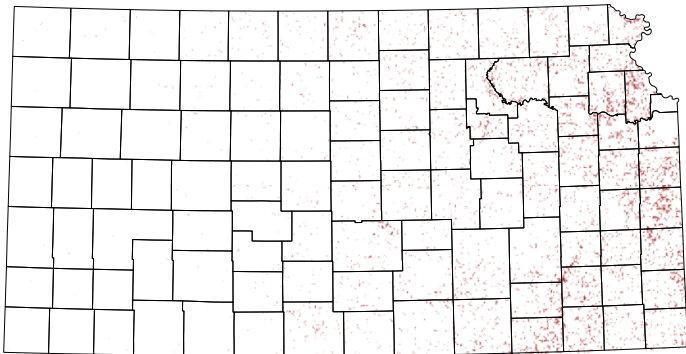
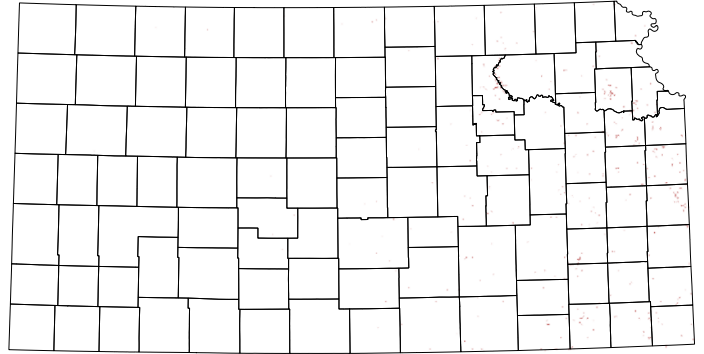


Layer | Management Plan Properties

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)

Layer | Forest Adjacent to Protected and Managed Areas

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)

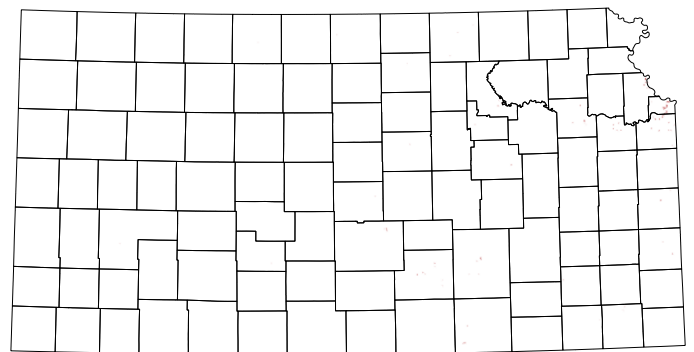


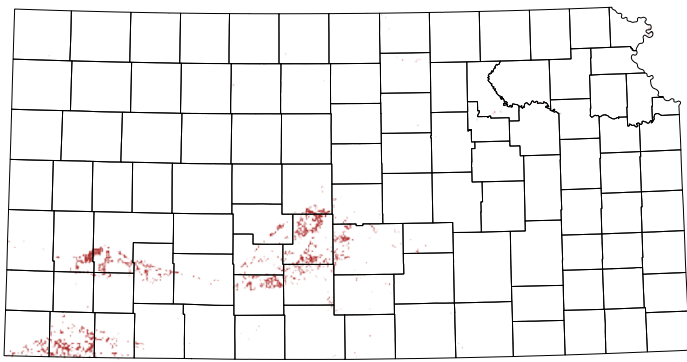
Layer | Non-Forest Stewardship Program High Stewardship Potential Private Forests

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)

Layer | Urban Woodland

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)



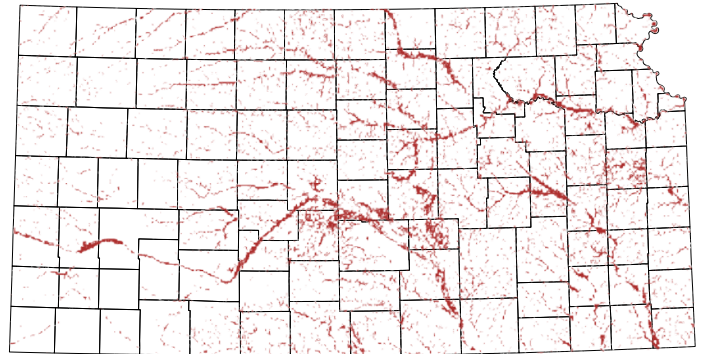


Layer | Agroforestry Potential

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)

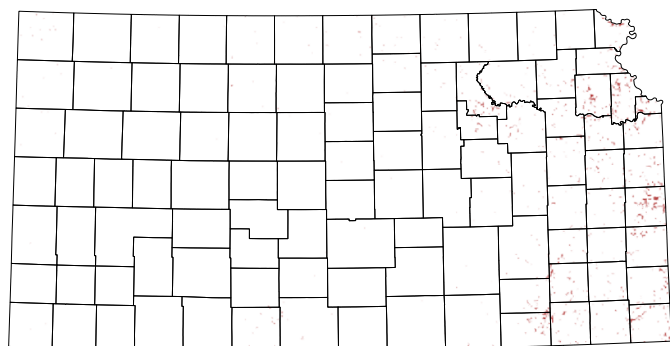
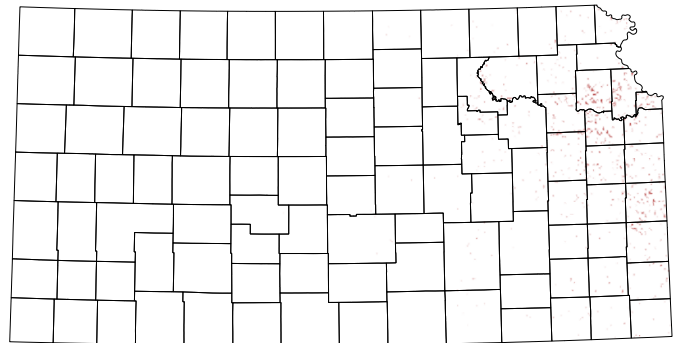
Layer | Tree and Shrub Suitability

Threat/Benefit Layer | Sustaining and protecting forest and agroforestry ecosystems (3.2.3)



Layer | Black Walnut

Threat/Benefit Layer | Maintaining and promoting livelihoods and economic benefits of woodlands (3.2.4)

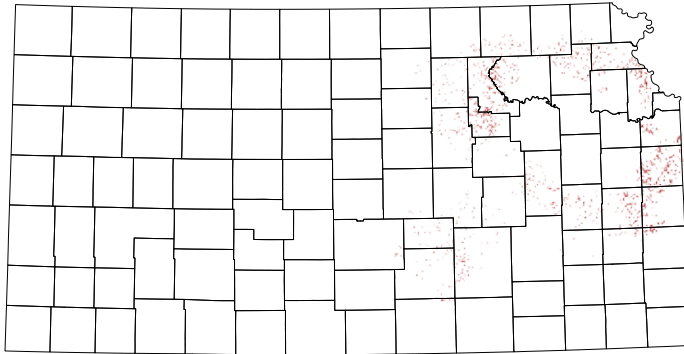
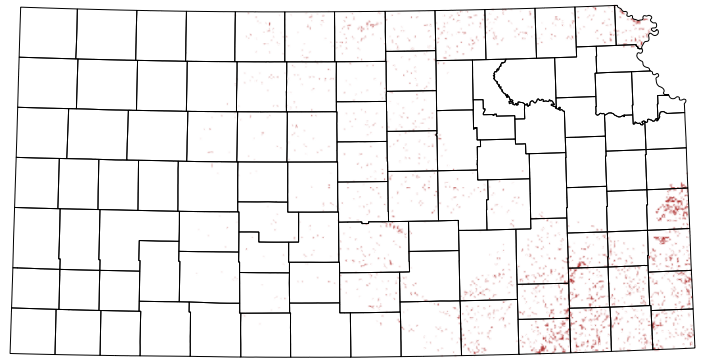


Layer | Biomass

Threat/Benefit Layer | Maintaining and promoting livelihoods and economic benefits of woodlands (3.2.4)

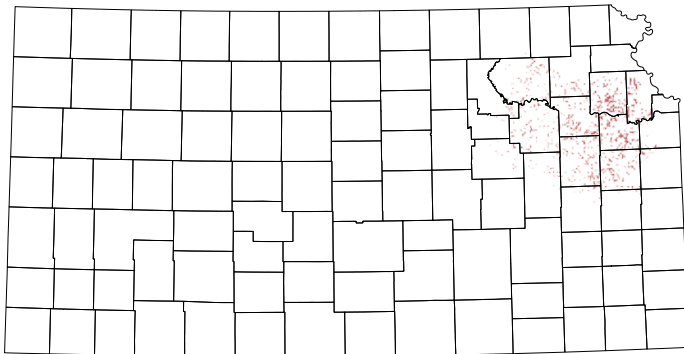
Layer | Forest within Mill Average Haul Areas '1-5 Mills Overlap

Threat/Benefit Layer | Maintaining and promoting livelihoods and economic benefits of woodlands forest within (3.2.4)



Layer | Forest within Mill Average Haul Areas '6-10 Mills Overlap'

Threat/Benefit Layer | Maintaining and promoting livelihoods and economic benefits of woodlands forest within (3.2.4)



Layer | Forest within Mill Average Haul Areas 'Greater than 10 Mills Overlap'

Threat/Benefit Layer | Maintaining and promoting livelihoods and economic benefits of woodlands forest within (3.2.4)

APPENDIX D

NATIONAL PRIORITIES, OBJECTIVES, STRATEGIES, AND PLAN IMPLEMENTATION

Enhancing Public Benefits from Trees and Forests — Water Quality and Quantity

National Objectives Addressed	Protect and enhance water quality and quantity.
General Issue	Sustaining Water Quality and Quantity
Priority Landscapes	Flint Hills, Glaciated Region, Red Hills, and Cimarron
Specific Issues in Kansas:	<ol style="list-style-type: none"> 1) Sedimentation of federal reservoirs – loss of water supply. 2) 90% of Kansas surface waters are impaired in rural and urban landscapes based on CWA Section 303(d) listing (TMDLs). 3) Compliance of municipalities with CWA stormwater NPDES permits.
Kansas Strategies	<ol style="list-style-type: none"> 1) Work through local Watershed Protection and Restoration Strategy (WRAPS) stakeholder groups in priority TMDL watersheds to protect, manage and establish riparian forests. 2) Classify functioning condition of riparian forests through local Watershed Protection and Restoration Strategy (WRAPS) stakeholder groups in priority TMDL watersheds with remote sensing and forest inventory. 3) Through local WRAPS groups landownership will be targeted based on priority areas identified in WRAPS plans. Landownership GIS data layers (create them when needed) will facilitate the process. 4) Forest Stewardship Management plans will guide implementation of BMPs on contiguous ownership within targeted watersheds. 5) Forest Legacy will be used to bring targeted riparian forests under protection. 6) KWO Kansas Water Plan, the <i>Governor's Long-term Vision for the Future of Water Supply in Kansas</i>, EPA 9-Element Watershed Management Plans, and Kansas Forest Service Watershed Assessments will guide strategy.
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> • Forest Stewardship Program • Urban and Community Forestry • Forest Legacy Program
Resources Required	Funding sources include Kansas Department of Wildlife, Parks and Tourism, CWA and KWO State Water Plan funding, KDHE's WRAPS program, EPA Region 7 Wetland Developmental Grant, NRCS TSP, NRCS RCPP, Kansas Department of Agriculture Division of Conservation, and State and Private Forestry programs. Will fund positions for watershed forester and district foresters to provide technical services
Performance Measures	Acres and percent of priority watersheds where State and Private Forestry activities are enhancing or protecting water quality or quantity. Forests in Priority Watersheds (surface and groundwater) are healthy and being sustained.



More than 12 miles of Kansas streambank tree plantings have been established since 2011.

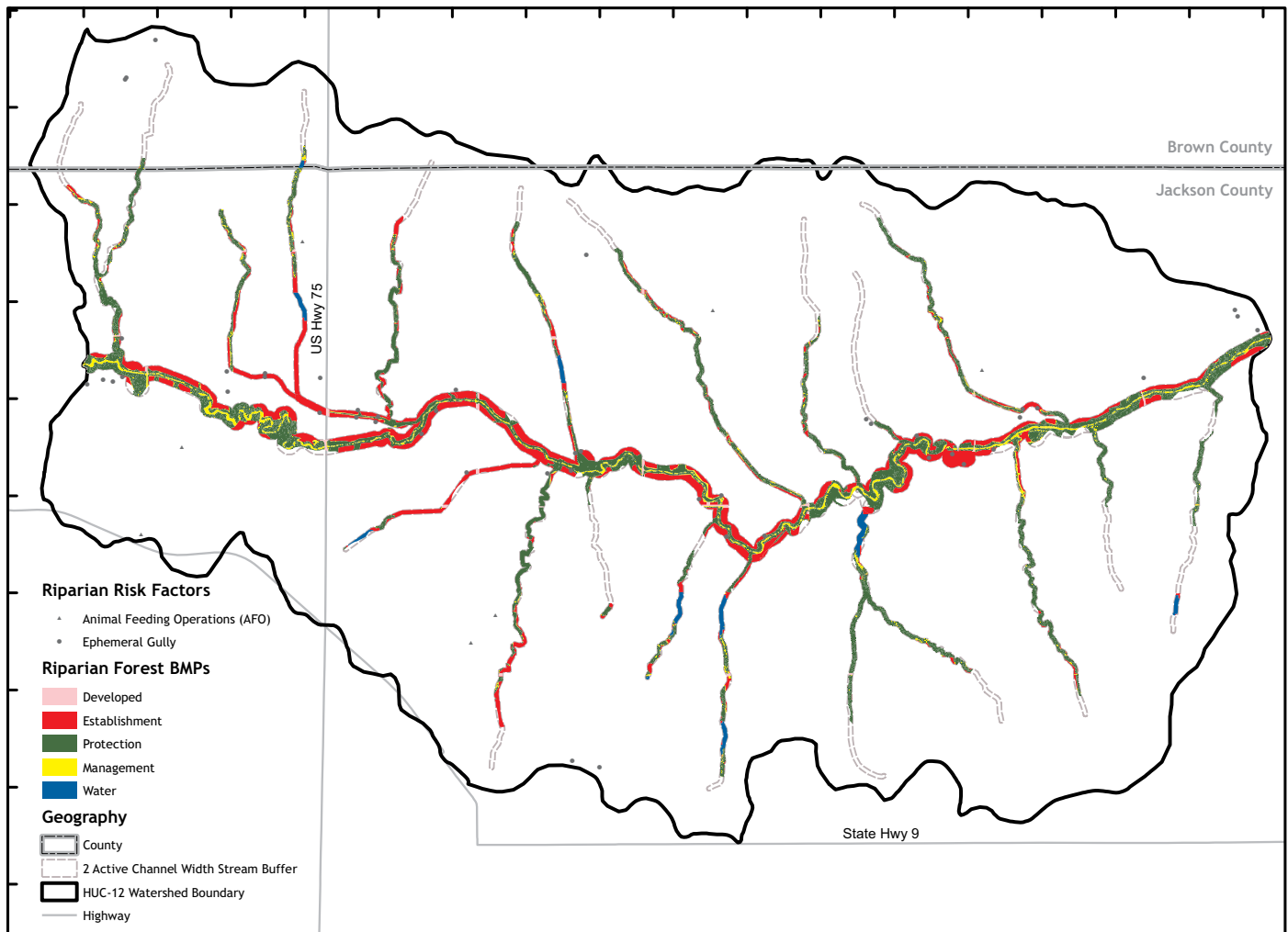
Accomplishment toward Sustaining Water Quality and Quantity

Working with an inter-agency Streambank Protection Team from 2011-2018, the Kansas Forest Service restored 12 miles of streams in high-priority watersheds by establishing 75 riparian forest buffers. This prevented 200,598 cubic yards of sediment from entering reservoirs saving \$9.3 million in dredging costs annually.

The Kansas Forest Service, Kansas Alliance of Wetlands and Streams (KAWS), and other partners worked closely with Watershed Protection and Restoration Strategy (WRAPS) stakeholder groups to complete assessments of the functioning condition of riparian forests. These assessments occurred in the Delaware, Tuttle Creek, and Spring River watersheds. Each of these watersheds has been identified as high-priority based on its history of exceeding total maximum daily loads (TMDL). Assessments of 10 priority watersheds entitled *Final Report*:

2015-2020 Kansas Forest Service Regional Conservation Partnership Program Riparian Assessment and Evaluation, is on the Kansas Forest Service website at www.kansasforests.org/resources/resources_docs/RCPP%20Final.pdf.

These geospatial assessments identify riparian forests in need of protection (properly functioning), in need of management (functioning at risk), and in need of establishment (nonfunctioning). Riparian forests in need of establishment represents 46% of the Delaware Watershed and are areas that contribute to the sedimentation of federal reservoirs and loss of water supply. The final GIS data layer added to the assessments included landowner parcel data. This landowner contact information enables a focused approach to strategically engage landowners with failing streambanks to implement forestry best management practices (BMPs).



Sources:
 Forest Classification of 2008 NAIP Imagery
 Normalized Difference Vegetation Index (NDVI)
 Active Channel Width Determination of NHDPlus Streams
 NE Kansas Regional Curves
 Bing Imagery Identification of Risk Factors

Riparian Forest Classification
Muddy Creek Watershed (102701030109)
Delaware River Basin

0 1,500 3,000 6,000 Feet



Riparian Forest Classification Muddy Creek Watershed / Delaware River Basin.

Conserve Working Forestlands — Sustaining and Protecting Forests and Agroforests

National Objectives Addressed	<ul style="list-style-type: none"> Actively and sustainably manage forests. Identify and conserve high priority forest ecosystems and landscapes.
General Issue	Sustaining and Protecting Forest and Agroforestry Ecosystems
Priority Landscapes	Flint Hills; Wooded Plains; Cimarron; Glaciated Region; Flint Hills; and Lower Arkansas
Specific Issues in Kansas:	<ol style="list-style-type: none"> 2.9 million acres of cultivated cropland (12%) of 24.6 million acres exceeds “tolerable limits” for erosion. 44% of windbreaks (127,414 acres) are in fair to poor condition and in need of renovation. 21 million acres (42%) of the Kansas landscape has the potential to benefit Kansans through forest stewardship (tree planting and management of existing rural forest and agroforestry resources). Statewide inventories indicate the urban and community forest is mature to over-mature with declining canopies. Data shows 59% of street trees are in fair to poor condition class and 41% of the overall canopy in three species: silver maple, elm, and pin oak. A decreasing canopy cover in Kansas communities. Following the droughts of 2011-12, the City of Wichita removed 55,000 dead and dying street trees. Kansas TCUSA communities for last 10 years have removed more trees than they planted. The need for current data public tree resource and canopy cover. Fluvial geomorphic dynamics (declines in sandbars and active flood plains) and landuse conversions have reduced cottonwood regeneration, which is evidenced in the decline of trees in smaller diameter classes (1 to 3 inches) and the majority of volume occurring in larger diameter classes (17 inches and larger). Though oak volume, tree numbers and density have all increased, oak forests are not replacing themselves, which is evidenced with the overwhelming proportion making up the overstory canopy.
Kansas Strategies	<ol style="list-style-type: none"> The data set for agroforestry potential has identified 916,467 acres of cultivated cropland with a wind erodability index of 87 or higher (one of the requirements for CRP participation). Working through local conservation districts, landowners will be identified in this area (GIS data layers created if needed) and contacted to promote the adoption of windbreak establishment. The Great Plains Initiative 2 (GPI 2), has completed an outreach plan for western and central Kansas Forest Service districts to promote windbreak renovation and establishment. This information will be used to identify landowners with windbreaks in fair to poor condition to promote windbreak renovation. EQIP will be the financial incentive program to promote adoption. Landowners located in areas with high forest stewardship program potential/high priority resources will be invited to participate in the forest stewardship program. The Urban and community forest will be assessed/inventoried to target: defective trees, hazard trees for removal, mitigation pruning of defects and a tree planting program to increase species diversity, decrease canopy loss and creating a sustainable and climate resilient canopy. Training and technical assistance will be focused on rural communities lacking resources to accomplish the strategy. Kansas Forest Service GIS is currently mapping Urban Tree Cover (UTC) studies for all Kansas communities. Provide technical services and education on the benefits of increased canopy cover. Areas where river dynamics support the silvicultural conditions needed for cottonwood regeneration will be identified geospatially. An initiative to promote the regeneration of cottonwood in these target areas will be developed using existing USDA conservation programs. The USDA Forest Service Northern Research Station (Daniel Dey) will assist with the refinement of silvicultural techniques to increase light through TSI and prescribed burning. KDWPT and NWTf will be close partners. Areas of the state will be identified where oak regeneration efforts will be focused.
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> Forest Stewardship Program Urban and Community Forestry Program Cooperative Fire Programs Urban Forest Inventory and Analysis Kansas Forest Service GIS
Resources Required	<ul style="list-style-type: none"> Will work closely with NRCS, National Agroforestry Center, University of Missouri Center for Agroforestry, USDA Forest Service Northern Research Station, Tree Boards, Tree City USA, Kansas Arborists Association, and Kansas Nursery and Landscape Association. Status and Trend of Cottonwood Forests Along the Missouri will be used as a reference.
Performance Measures	<ul style="list-style-type: none"> Number of forest acres being managed sustainably as defined by current Forest Stewardship Management Plans. Acres of high priority forest ecosystems and landscapes protected from conversion. Acres of windbreaks managed sustainably Community Forestry Management Plans, Assessments, Urban Tree Canopy (UTC) studies and Inventories Continued Tree Species Trials to increase resilient species palette for communities.

Accomplishments toward Sustaining and Protecting Forest and Agroforestry Ecosystems

Since 2010, more than 7 miles of shelterbelts have been renovated sustaining crop yield, wildlife and soil conservation benefits to more than 700 acres of cropland. These accomplishments occurred through the Environmental Quality Incentives Program (EQIP) and are the direct result of the implementation and expansion of a windbreak assessment strategy that began with Landscape Scale Restoration (LSR) grants in 2008 (https://www.kansasforests.org/rural_forestry/rural_docs/KS%20WB%20Assessment.pdf).

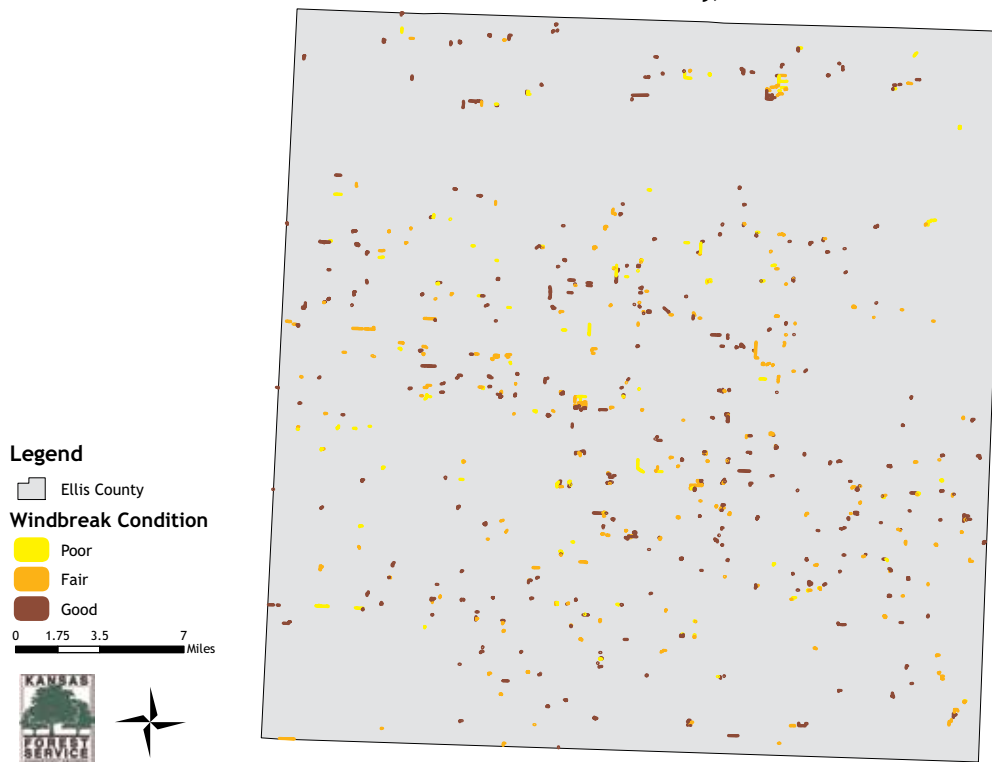
The assessment methodology has since been published as “*Identification of windbreaks in Kansas using object-based image analysis, GIS techniques and field survey.*”¹ (https://www.kansasforests.org/rural_forestry/rural_docs/ID%20of%20Windbreaks%20in%20KS%20Using%20Object%20Based%20Analysis.pdf)

Since 2010 the condition and location of windbreaks and shelterbelts in a 14-county area in Kansas and a two-county area in Colorado have been assessed and located geospatially using new GIS and remote sensing methodologies. Assessments are also underway in an additional seven-county area in south

central Kansas and a seven-county area in South Dakota. These assessments classify shelterbelts into good, fair, or poor condition classes based on criteria initially developed in the Great Plains Initiative (GPI). This same criteria was appropriated into Natural Resources Conservation Service (NRCS) Kansas Forestry Technical Note 11. In the technical note, shelterbelts classified in fair to poor condition qualify as a “Resource Concern” through the Environmental Quality Incentives Program (EQIP).

A GIS landowner parcel data layer was then used to identify farmers and ranchers with windbreaks in fair to poor condition. Direct mailings through local county conservation districts invited landowners to participate in EQIP. As a result, the number of windbreak renovation practices implemented in Kansas since 2010 has far exceeded any records of the historical implementation of the practice. The Great Plains Initiative 2, a grant from the USDA Forest Service, will provide updated inventory data on windbreak condition and location as well as a statewide GIS tree canopy layer for the first time.

Windbreak Condition in Ellis County, Kansas



Identifying windbreak condition and location has increased the adoption of windbreak renovation practices.

1 Ghimire, K., M.W.Dulin., R.L.Arbison., D.G. Goodin and J.M. S. Hutchinson. 2014. *Agroforestry Systems*. 88(5). 865-875

Enhance Public Benefits from Trees and Forests — Wildlife and Fish Habitat

National Objectives Addressed	Protect, conserve and enhance wildlife and fish habitat.
General Issue	Protecting and Restoring Forest Biodiversity and Wildlife Habitat
Priority Landscapes	Flint Hills; Wooded Plains; Cimarron; Upper Arkansas; Arikaree Breaks; Red Hills; Lower Arkansas; Glaciated Region; and Cross Timbers.
Specific Issues in Kansas:	<ol style="list-style-type: none"> 1) In the Shortgrass and Central Mixed Grass Prairie ecosystems riparian forests and shrubs are declining due to a lowering water table from surface and groundwater withdraw. 2) In the Eastern Tall Grass Prairie there is lack of active management and conservation of Deciduous Forests and Floodplain Habitats. 3) Forest fragmentation, conversion and interruption of wildlife corridors will continue in the suburban interface with forested land due to the increase of urban and community land development. <p>Note: Issues come directly from the Kansas Wildlife Action Plan.</p>
Kansas Strategies	<ol style="list-style-type: none"> 1) Riparian forest and shrub habitat will be conserved and established for priority species in priority habitats that have some dependency on forested areas or trees. In the Shortgrass Prairie Ecosystem, the focus is on the eastern spotted skunk(threatened) and barn owl while the Mixed Grass Prairie Ecosystem targets the eastern spotted skunk(threatened), red-spotted toad and pallid bat. 2) The Deciduous Forest and Floodplain is the 4th priority habitat in the Eastern Tall Grass Prairie Ecosystem. Forested habitat will be actively managed and protected in priority landscapes to sustain or increase populations of the following species. Birds: Rusty Blackbird, Cerulean Warbler, Lewis’s Woodpecker; Mammals: Spotted Skunk(threatened), Little Brown Myotis, Gray Myotis (Endangered), Southern Flying Squirrel; Reptiles: Timber Rattlesnake, Redbelly Snake(threatened), Smooth Earth Snake; Amphibians: Green Frog, Northern Cricket Frog, Oklahoma Salamander; Insect: Ozark Emerald (damselfly), American Burying Beetle (Endangered), Gray Petaltail (damselfly). 3) Communities implement tree protection/preservation ordinances for forested land or open space to limit development of these acres. Communities implement suburban interface green infrastructure practices for the protection/restoration to prevent forest conversion due to development. ie: protecting riparian areas for water quality and quantity, maintaining wildlife corridors, implementing bioswale and bio-diverse landscaping to reduce stormwater run-off and use, encourage cluster development and community open space master plans.
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> • Forest Stewardship Program • Forest Legacy Program • Urban and Community Forestry Program
Resources Required	Will seek strong partnerships with Kansas Department of Wildlife, Parks and Tourism, Kansas Biological Survey, National Wild Turkey Federation, US Fish and Wildlife Service, Quality Deer Management, and Kansas Water Office to pursue State and Private Forestry Competitive Grant opportunities and State and Private Forestry forestry programs.
Performance Measures	<ul style="list-style-type: none"> • Acres and percent of priority habitat areas where State and Private Forestry activities are protecting, conserving and enhancing wildlife and fish habitat. • Acres of connected forests resulting from State and Private Forestry investments. • Acres restored, enhanced and protected from forest fragmentation/conversion due to development. • Ordinances for preservation implemented to protect forested or open space acres from development.

Accomplishments toward Protecting and Restoring Forest Biodiversity and Wildlife Habitat

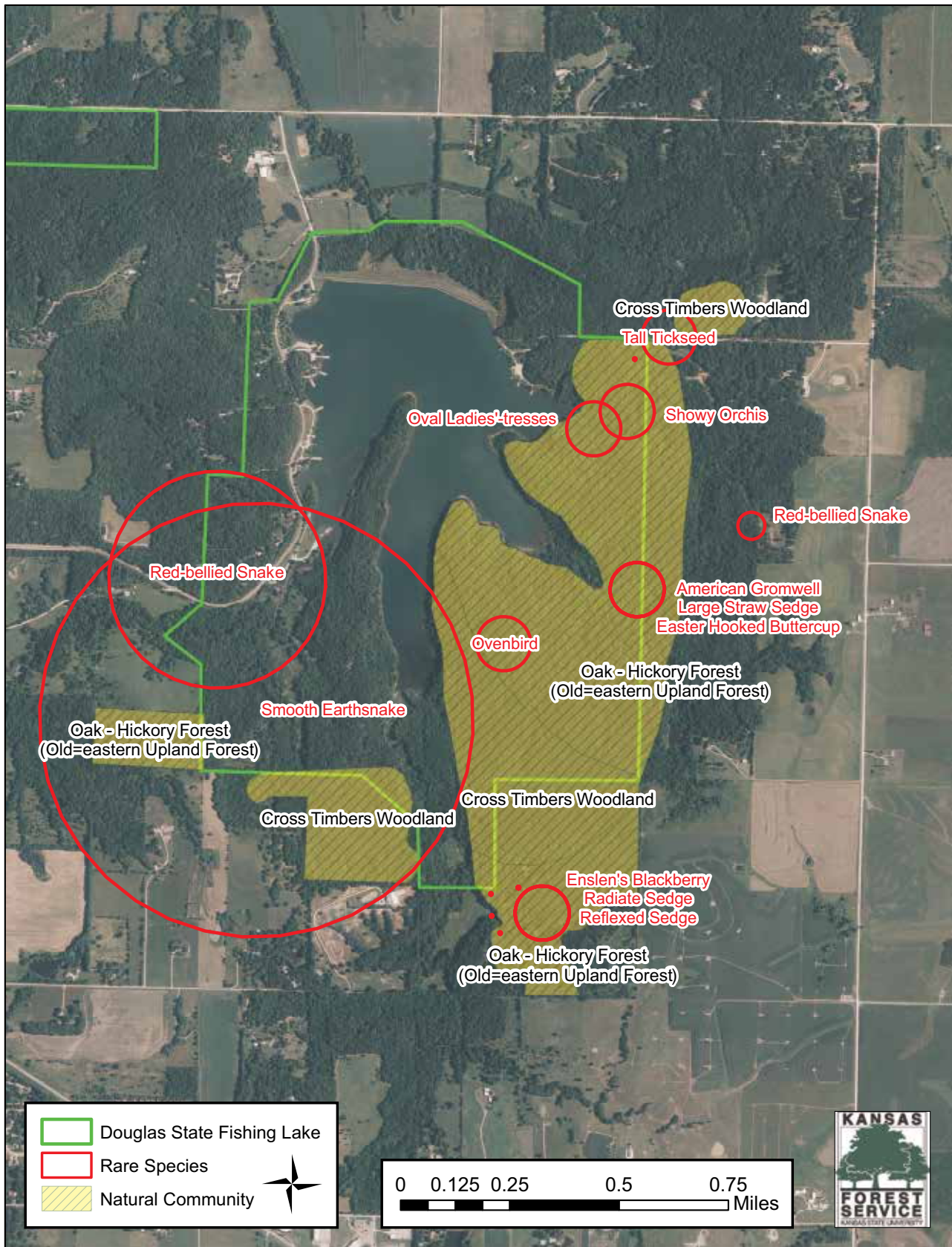
More than 1,000 acres of priority deciduous forest habitat for the redbelly and smooth earth snake and other threatened and rare species are being actively managed and protected through landscape forest stewardship planning and the Forest Legacy Program in the Glaciated Region priority landscape. The plan includes Douglas County State Fishing Lake and the Baldwin Woods Forest Legacy project.

Kansas Department of Wildlife, Parks and Tourism; U.S. Forest Service; Conservation Fund; University of Kansas; Kansas

Land Trust; and private forestland owners are protecting this important landscape through a mix of conservation easements and fee simple agreements.

Public meetings have solicited input and participation in the project and the landscape forest stewardship plan. Forest stand improvement practices have been implemented on public and private lands.

Douglas County State Fishing Lake and the Baldwin Woods Forest Legacy Project



The landscape forest stewardship plan protects a variety of rare and threatened species.

Enhance Public Benefits from Trees and Forests — Socioeconomic Benefits

National Objectives Addressed	Maintain and enhance the economic benefits and values of trees and forests.
General Issue	Promoting, Sustaining and Enhancing Socioeconomic Benefits of Forests and Agroforests
Priority Landscapes	Wooded Plains; Lower Arkansas, Flint Hills, Glaciated Region, Cross Timbers, and Red Hills.
Specific Issues in Kansas:	<ol style="list-style-type: none"> 1) Currently only one-third of green woody biomass produced annually by wood manufacturing is available for use as a wood energy feedstock or biobased product feedstock. 2) Ecosystem service values must be assigned to community and rural forests and agroforestry resources. 3) Develop a biomass market for the utilization of eastern redcedar. 4) Promote the increase of canopy cover utilizing data from tree inventories and Urban Tree Canopy studies (UTC) providing the economic, health and ecological benefits of existing canopy and potential benefits of canopy increases.
Kansas Strategies	<ol style="list-style-type: none"> 1) Conduct feasibility studies in areas surrounding Kansas City Topeka, Wichita and Pittsburg targeting public boiler systems 40 years or older for conversion to woody biomass. 2) Conduct annual or periodic forest inventory of riparian forest and windbreaks in priority landscapes and assign ecosystem service values. 3) A community of interest and support for utilization of eastern redcedar biomass will be developed with Kansas Legislature Natural Resource and Utilities Committees, State Departments of Commerce, Energy, Labor and Health and Environment – Air Quality Division, Kansas Association of Conservation Districts, Kansas Water Office, Kansas Livestock Association, State Conservation Commission, Natural Resource Conservation Service, Rural Development and Kansas State University's Center of Engagement and Community Development. Forest inventory will be intensified to improve data quality for feasibility studies. 4) Conduct and utilize tree inventories and Urban Tree Canopy (UTC) studies data to educate city staff, city officials and the general public of the benefits of trees and canopy cover. Increasing tree canopy cover and the benefits provided by using the data to increase tree planting in priority areas.
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> • Urban and Community Forestry Program • Forest Stewardship Program
Resources Required	USDA Forest Service Forest Inventory and Analysis, Great Plains Initiative, Forest Products Program, Kansas Legislature Natural Resource and Utilities Committees, State Departments of Commerce, Energy, Labor and Health and Environment – Air Quality Division, Kansas Association of Conservation Districts, Kansas Water Office, Kansas Livestock Association, Tall Grass Legacy Alliance, NRCS, Rural Development, K-State's Center for Engagement and Community Development, Urban FIA, Urban Tree Canopy studies, and i-Tree inventory systems.
Performance Measures	<ul style="list-style-type: none"> • Number of communities and percent of population served under an active community forestry management plan, inventory or Urban Tree Canopy study. • Number of total jobs (direct, indirect, and induced) sustained or maintained in the economy annually due to State and Private Forestry investments. • Total value of resources leveraged through partnerships with states and other partners.



Restoring grasslands and processing eastern redcedar into biomass.

Accomplishments toward Sustaining and Enhancing Socioeconomic Benefits of Forests and Agroforests

The Kansas Forest Service is recruiting and sustaining biomass and biochar processing facilities through the following activities:

- Measuring the movement of woody by-product by county from timber harvests and waste wood from primary and secondary wood processors, municipalities, utilities, and commercial arborists. See *Kansas State-wide Woody Biomass Supply & Utilization Assessment* (www.kansasforests.org/forest_products/forest_product_docs/woodybiomass.pdf).
- Biannual educational programs and wood harvesting equipment demonstration field days.
- Transportation cost studies based on road miles and bridge crossings from harvest to processing sites.
- The Great Plains Biochar Initiative (GPBI) will improve biochar awareness and market development in the Great Plains (<https://nfs.unl.edu/great-plains-biochar-initiative>).
- Collaborative competitive grant proposal writing activities central to joint interests in restoring grasslands by removing eastern red cedar.
- Business related confidentiality agreements and the filing of wood-based business and wood-volume data by Kansas Department of Health & Environment. These agreements are associated with the potential composting to dispose of millions of chickens and turkeys resulting from the bird flu epidemic.
- The development of the Kansas City Utilization District to network on the processing, use and sale of lumber and mulch from the 3 million ash trees located in the Kansas City Metro area as a result of potential mortality from emerald ash borer.



Expanding the Great Plains Biochar Initiative is one of the strategies to enhance economic benefits forests and windbreaks.

Protect Forests from Harm — Threats to Forest Health

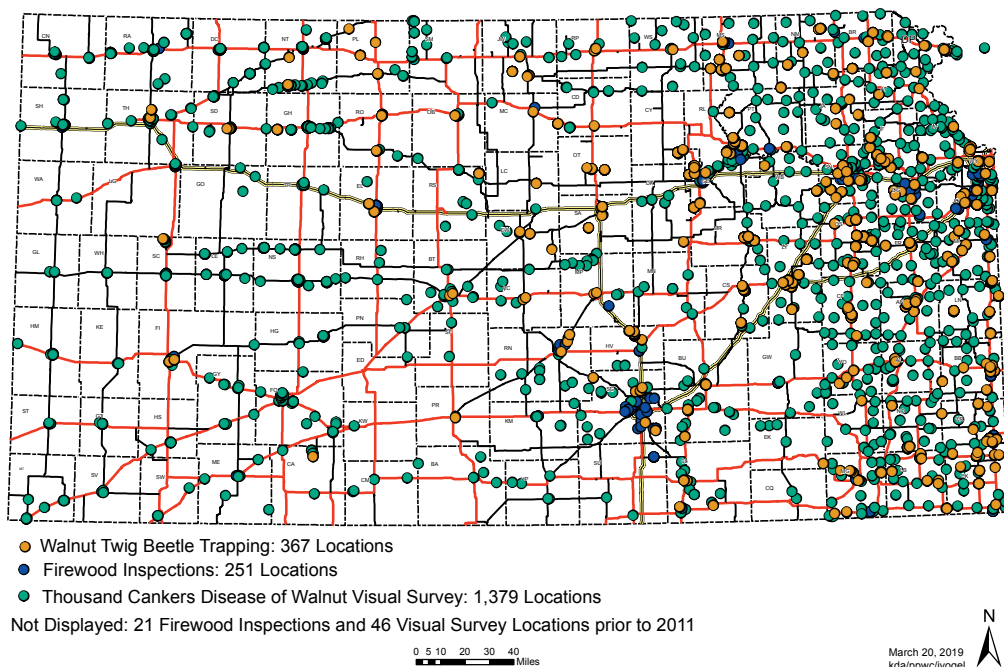
National Objectives Addressed	Identify, manage, and reduce threats to forest and ecosystem health
General Issue	Issues that Threaten Kansas Forest Health
Priority Landscapes	<ul style="list-style-type: none"> • All Priority Landscapes for emerald ash borer and thousand cankers disease. • Lower Arkansas; Red Hills; Upper Arkansas; Arikaree Breaks; and Cimarron for pine wilt, tamarisk, and Russian olive. • Flint Hills, Glaciated Region, Cross Timbers, and Wooded Plains for bush honeysuckle.
Specific Issues in Kansas:	<ol style="list-style-type: none"> 1) Thousand Cankers Disease is an imminent threat to black walnut. Found as close as Eads, Colorado, the complex has the potential to create over \$160 million loss to the Kansas economy and a loss of environmental benefits as well. 2) Emerald Ash Borer is an imminent threat to white and green ash. It was first found in Wyandotte County Kansas in 2012. Since that time, emerald ash borer has also been found in Johnson, Leavenworth, Douglas, Jefferson, Atchison, Doniphan, Shawnee, Miami, and Jackson counties. All these counties are under state quarantine. 3) Pine Wilt was first discovered in Kansas in 1979 in Cherokee County. It has since moved west at approximately 10 miles per year killing thousands of Scotch pines and to a lesser extent Austrian. It is present in the eastern half of Kansas and continues to move west. The disease has killed pines as far west as Sherman and Norton counties. 4) Exotic invasive plants have threatened the health and biodiversity of Kansas forests. The main three threats include bush honeysuckle in the eastern third and tamarisk and Russian olive in the south central and southwestern parts of the state.
Kansas Strategies	<ol style="list-style-type: none"> 1) While state quarantines are in place for thousand canker disease and emerald ash borer, these will need to be revisited and updated as new regulations and new science has changed our understanding of best management tactics for these pests. Key components of effective regulation and partnership still include a focus on limiting firewood movement, early detection and delimitation of infestations, and coordinated public outreach on detection and treatment. Partnerships with other agencies will continue in monitoring forest health conditions, including support for field survey and detection work done by Kansas Department of Agriculture specialists. This would include trapping and surveying for emerald ash borer, thousand canker disease, pine wilt, and other novel threats as they emerge. Increased and sustained engagement with local Kansas State Research and Extension county and/or district extension agents is also a priority. 2) Support for community and rural tree inventories and surveys will help reduce the risk of latent infestations and undetected spread of several pests including emerald ash borer, thousand cankers disease, pine wilt, and others. Data from previous Community Tree Assessment Protocol (CTAP) inventories of pine, walnut, and ash in Kansas communities can be used to estimate removal and replacement costs due to these insect and disease threats. Community inventories of tree species should be updated, in partnership with the Kansas Forest Service Community Forestry program, and local communities across the state. Communities with high proportions of susceptible species (ash, walnut, pine, etc.) can receive prioritized service and guidance to reduce risks to their community forest resource. 3) A focus on effective outreach to the public will continue, with outreach efforts going beyond workshops and publications. Interactive training facilitated through technology will be prioritized to reach Kansans not able to attend regional in-person events. Engaging citizen science through a pest detectors program can assist with monitoring for new pest infestations and outbreaks. Reporting infestations of invasive plants can also guide outreach and prioritize efforts to assist landowners in areas of greatest need. 4) Strategic plans developed with broad partnerships will be revisited and revised for all known forest health threats, including emerald ash borer, thousand cankers disease, and tamarisk and/or invasive plants. Southwestern Kansas will be the focus of tamarisk control along the mainstem and tributaries of the Arkansas River and Cimarron River and specifically in the Cimarron Priority Landscape. Additional and updated inventory efforts are needed to identify target areas for tamarisk and Russian-olive control. Management will include inventory/mapping, control, regeneration, monitoring, and maintenance. 5) An Exotic Invasive Species Committee for plants could be appointed by the Governor’s Natural Resource Subcabinet to coordinate and develop policy and guidelines to address invasive plant issues, including representation from natural resource agencies, university researchers, and local agencies such as county weed directors.

continued on 132

Protect Forests from Harm — Threats to Forest Health

<p>State and Private Forestry Applicable Programs</p>	<ul style="list-style-type: none"> • Forest Health Management • Forest Stewardship Program • Urban and Community Forestry Program
<p>Resources Required</p>	<p>The Kansas Forest Service has largely operated in response to forest health threats in a highly distributed manner, with leadership housed in the state office and outreach, reporting, and program delivery spread between Kansas Forest Service field foresters and partners in Kansas State Research and Extension specialists and staff with the Kansas Department of Agriculture Plant Protection and Weed Control division. These partnerships have resulted in meaningful outcomes not likely attainable through a unilateral Kansas Forest Service effort. However, limited resources have also led to only the highest-priority issues being effectively addressed, and in many cases, short-term grant funding has made sustaining these efforts impossible. Predictable and sustainable funding to address these concerns would result in better outcomes for the resources and the stakeholders in the long term.</p> <p>Support for internal Kansas Forest Service capacity and sustained partnerships will result in continued successes in such areas as invasive insect and disease survey and detection, delimitation and mapping of invasive plants, and tracking of objective forest health condition data as opposed to anecdotal condition reports.</p> <p>Important responses to forest health threats that have been only partially served include education and outreach regarding threats to the entire state, current condition reporting to the public for management decisions, and applied research and case study tracking to determine best practices for invasive plant control. In order to sufficiently respond to the prioritized threats to Kansas forests, additional resources must be identified to deliver these services.</p>
<p>Performance Measures</p>	<ul style="list-style-type: none"> • Technical assistance visits from rural foresters, community tree inventories completed, members of the public participating in trainings, acreage of invasive plant infestations controlled with assistance from Kansas Forest service personnel and equipment resources, survey summaries from partners at the Kansas Department of Agriculture, acreage of forestland treated for invasive plants through practice plans written by Kansas Forest Service foresters, and other objective measures as they become available.

Thousand Cankers Disease of Walnut Survey, 2009 - 2018



Trapping and monitoring thousand cankers disease in Kansas.

Accomplishments toward Issues that Threaten Kansas Forest Health

Working closely with the Secretary of the Kansas Department of Agriculture (KDA), the Kansas Forest Service assisted with the establishment of a statewide quarantine in 2010 to prevent and suppress the spread of Thousand Cankers Disease of Walnut. (<https://agriculture.ks.gov/divisions-programs/plant-protect-weed-control/thousand-cankers-disease>). In 2014, the Kansas Department of Agriculture and the Kansas Forest Service created and adopted the *State of Kansas Thousand Cankers Disease of Walnut Strategic Plan*.

In partnership with KDA-Plant Protection and Weed Control, a systematic trapping and monitoring program and First Detectors Program began in 2009 and has continued to date. The primary high-risk areas of concern occur in central and eastern Kansas where walnut is common and anthropogenic pathways a concern.

A secondary area of risk is western Kansas because of the presence of the disease in Eads, Colorado, 40 miles west of Tribune, Kansas. In eastern and central Kansas, five sites are monitored for a 60-day cycle at transportation hubs, parking areas, wood debris collection points, camping sites, wood utilization businesses.

Several Kansas Forest Service foresters and KDA-Plant Protection and K-State Research and Extension entomologists and pathologists have received training in identification and diagnosis of the disease. A registry for forestry industry, firewood distributors, and other appropriate groups that use black walnut is being maintained and compliance agreements developed as necessary (<https://agriculture.ks.gov/docs/default-source/pp-application-center/kansas-walnut-registry-application-4352d2002e6262e1aa5bff0000620720.pdf?sfvrsn=0>). Several publications have been developed including *Economic Loss Associated with the Introduction of Thousand Cankers Disease of Black Walnut to Kansas*, and *Thousand Cankers Disease and Walnuts*.

As part of the Pine Wilt Initiative, a collaboration between the Kansas Forest Service, Kansas Department of Agriculture, and local partners such as municipal staff and extension agents, recurring surveys of western Kansas counties were conducted each year for pine wilt symptoms. Presumptive positives were sampled, and results from this survey were used to focus local control programs that slowed the spread of pine wilt in affected counties such as Ellis, Norton, and Sherman.

In response to the ongoing infestation of emerald ash borer in Kansas, Kansas Forest Service has worked closely with Kansas Department of Agriculture, extension agents, and city/county personnel to monitor for new infestations and help prepare communities through targeted outreach regarding biology, treatment options, and adoption of strategic emerald ash borer plans. In addition, monitoring techniques for new infestations have been adapted based on best available science and past success, with a shift to trap trees due to increased effectiveness in early detection of emerald ash borer.

Based on the priority that the Kansas Forest Service and partners identified, and included in the 2010 Kansas Forest Action Plan, efforts to address tamarisk infestation along the important Rattlesnake Creek watershed in central Kansas resulted in several successful grants that funded work to remove tamarisk and restore riparian systems along this stream. This work has resulted in meaningful partnerships with a wide base of other state and federal agencies and NGOs to address this non-native invasive plant and its impact.



Professionals receiving training in TCD diagnosis from Colorado State University.

Protect Forests from Harm — Reducing Wildfire Risk

National Objectives Addressed	Restore fire- adapted lands and reduce wildfire impacts
General Issue	Wildfire Risk
Priority Landscapes	<ul style="list-style-type: none"> • Arikaree Breaks • Cimarron • Cross Timbers • Flint Hills • Glaciated Region • Lower Arkansas • Red Hills • Upper Arkansas • Wooded Plains
Specific Issues in Kansas:	<ol style="list-style-type: none"> 1) Lack of fire occurrence in Kansas grasslands is one factor that has caused eastern redcedar volume to increase by 23,000% over the last 45 years invading grasslands and adversely affecting the populations of a variety of species identified in the <i>Kansas Wildlife Action Plan</i> as the “top species of greatest conservation need.” 2) Conversion of rural land to residential, expansion of urban areas and dramatic increase in eastern redcedar forest type has created potential wildland urban interface issues where fire can move readily between structural and vegetative fuels. 3) Lack of data on fire occurrence, weather and fuels.
Kansas Strategies	<ol style="list-style-type: none"> 1) Whenever possible, identify areas fire exclusion has led to an increase in eastern redcedar and other fire-prone species. Identify areas of concern on Community Wildfire Protection Plans, the Kansas Wildfire Risk Assessment Portal, and other information being provided to counties. Include information on fighting fires in cedar and timber in training programs offered to rural firefighters around the state. Continue to support and encourage efforts to use prescribed fire safely and appropriately as a management and prevention tool in affected areas. 2) Emphasize this concern in Community Wildfire Protection Plans and identify areas of danger to local stakeholders. Provide training and information on management of cedar and other invasive species via prescribed fire and other suitable means at every opportunity. Emphasize FireWise® and similar fire prevention programs in both fire and other programs’ information (e.g. community forestry) when writing plans and sharing information with landowners, community groups, and other stakeholders 3) Continue to work with the Kansas State Fire Marshall to try to improve fire occurrence data – and its timely availability – on wildfires statewide. Continue to work with the National Weather Service to develop the weather station network that is already in progress. Ultimately, integrate fire occurrence and weather data in a manner that can provide long term historic data correlating fire and weather, which can be used in the future for identifying fire trends, danger, and forecasts. 4) Increase the capacity of the fire staff to provide service in six fire districts throughout the state. Currently, the Kansas Forest Service has dedicated staff in the Northwest, Southwest and Eastern districts, the central portions of the state are covered by staff who also have statewide duties. These district fire positions, along with the statewide fire positions, are able to assist local fire districts and communities to prepare for and manage wildfires. 5) Utilize the Kansas Wildfire Suppression fund to provide additional fire management resources, including aviation and the Great Plains Interstate Fire Compact, to assist local fire districts with suppression efforts.
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> • Cooperative Fire Programs • Urban and Community Forestry
Resources Required	<ol style="list-style-type: none"> 1) Fire departments, RC&D’s, emergency managers, landowners, conservation districts, Kansas Association of Fire Chiefs, Kansas State Firefighters’ Assoc., public land management agencies, rural/suburban development and/or residential improvement district homeowners’ associations 2) County governments, RC&D’s, local Emergency Planning Committees and Emergency Managers, and contractors developing hazard mitigation plans, rural/suburban development and/or residential improvement district homeowners’ associations 3) State Fire Marshall, National Weather Service, the Kansas Mesonet, 2016 National Fire Danger Rating System, USFWS’ remote automated weather system

Performance Measures	<ul style="list-style-type: none"> • Number of acres treated to restore fire-adapted ecosystems are moved toward and maintained in desired conditions. • Total acres treated to reduce hazardous fuels on state and private lands through the State Fire Assistance Program. • Percent of at-risk communities who increase suppression capacity by increasing the number of trained/certified fire fighters; upgrading fire suppression equipment or formation of a new department or expansion of existing ones.
-----------------------------	--

Accomplishments toward Reducing Wildfire Risk

In the preceding 5 years, Kansas Forest Service has assisted in prescribed burning of 12,912 acres of public and private land. Many of these acres lay within the urban interface and serve as an illustration of the benefits of fuel reduction to life safety and property survivable in the event of a wildfire.

The fire program continues to advocate the development of community wildfire protection plans, or similar documents to provide guidance to communities in the development of fire-resistant areas. If a community receives prescribed fire services provided by the Kansas Forest Service, it must participate in some form of guidance planning. Because the fire return interval for eastern redcedar is approximately 5 years, land

managers are encouraged to include this schedule in their fire management plans.

Through the combined efforts of the Office of the State Fire Marshal, State Weather Data Library at Kansas State University, and Kansas Forest Service, fire reporting through the National Fire Incident Reporting System has become more complete and accurate. In cooperation with the National Weather Service, Kansas Mesonet, and remote automated weather stations, we are beginning to use the 2016 National Fire Danger Rating System to align high fire occurrence and weather patterns to provide pre-burn information to land managers and properly prepare for critical fire weather.



Kansas Forest Service has offered specific prescribed fire training in the management of eastern red cedar and other invasives.

Conserve Working Forest Lands — Reducing Loss of Kansas Forestland

National Objectives Addressed	Identify and conserve high priority forest ecosystems and landscapes
General Issue	Loss of Kansas Forestland
Priority Landscapes	<ul style="list-style-type: none"> • Glaciated Region • Wooded Plains
Specific Issues in Kansas:	<p>1) The 2019 Kansas population is 2.9 million people, with 68% living in urban counties and 32% living in rural counties. USDA urban data reports 1.9 million people living in urban areas, a 12.2% increase from 1990. Land defined as urban has increased 14.1% since 1990. Developed land is currently 623,000 acres (216,181 acres of actual forested land) and urban and community land is 1,113,000 acres (337,239 of actual forested land). Tree cover (2010) for urban land was 34.7% and for urban and community land was 30.3%. Urban land growth from 2000-2010 was 0.14% and urban and community land was 0.32%. Kansas projected urban land growth from 2010 to 2060 is 1.93%; however, three of the largest Kansas counties for projected urban land growth from 2010-2060 are: Sedgwick at 33.1%, Johnson at 35.4%, and Wyandotte at 34%.</p> <p>2) Riparian forests are generally located in areas where the most valuable agricultural crops are grown. Though no good trend data exists experience suggests that significant areas of riparian forest are converted to cropland each year adversely impacting water quality, aquatic and terrestrial species and other benefits riparian forests provide.</p>
Kansas Strategies	<p>1) Forest inventories will be conducted to identify areas in need of protection and ecosystem service values will be assigned to forestland as a catalyst for protection and policy development. The i-Tree inventory systems will be utilized for ecosystem services. Continue work with Mid-America regional Council (MARC) to target forests and watersheds with high ecological values in the KC metro area for protection. Tree preservation ordinances and GI conservation strategies will be integrated into municipal land use, parks, transportation and watershed master plans. Forest Stewardship and urban forestry plans will be developed for these areas to sustain forest health by thinning and tree planting. Trees will be integrated into engineering and site design for watershed management, erosion control and energy conservation. Long-term goals are the adoption of planning guidelines, principles, specifications, and ordinances that facilitate GI conservation.</p> <p>2) The Kansas Water Plan and the Governor's Long-term Vision for the Future of Water Supply in Kansas will guide long-term strategy. Specifically, a comprehensive wetland and riparian area protection program will be developed using conservation easements, tax incentives and possible regulation. This will require increased funding and state participation.</p>
State and Private Forestry Applicable Programs	<ul style="list-style-type: none"> • Forest Legacy Program • Forest Stewardship Program • Community Forestry Program
Resources Required	The Kansas Water Office, KDHE Water Bureau and MARC are key partnerships. Legislative authority to create effective regulation and their funding to support the establishment and maintenance of easements is necessary. Forest Legacy and ACEP also have potential to support the strategy along with EQIP, WRP and CCRP.
Performance Measures	<ul style="list-style-type: none"> • Acres of high priority forest ecosystems and landscapes protected from conversion. • Forest Legacy Program success stories • Areas protected as a result of Forest Stewardship or Community Forestry Management Plans • Rates of policy adoption by municipalities.

Accomplishments toward Reducing Loss of Kansas Forestland

There are more than 249 million trees in the urban forest in the greater Kansas City metro area. These trees provide a structural value of \$93.4 billion, mitigating 37,000 tons of air pollution annually and providing \$14 million of energy savings each year. This is just a sample of the information that is guiding local leaders, planners, and residents to help reduce the conversion of forestland to development in an area projecting a conversion of 400,000 acres in the next 20 years.

Beginning in 2010 a nine-county wide forest inventory was conducted in partnership with the Kansas Forest Service,

Mid-America Regional Council, the Davey Resource Group, and the Missouri Department of Conservation. Data from 340 randomly selected plots was analyzed using the U.S. Forest Service's i-Tree modeling software and ecosystem service values assigned.

This regional initiative creates a framework to improve long-term management planning and policies that will protect and preserve the urban forest for future generations.

Greater Kansas City Regional Forest Summary

Feature	Measure
Number of trees	249,450,000
Tree and shrub cover	28.3%
Tree cover	18.6%
Most common species	American elm, northern hackberry, Osage orange, honey locust, eastern red cedar
Percentage of trees < 6-inches	71.0%
Pollution removal – trees & shrubs	37,000 tons/year (\$286 million/year)
Ozone	23,040 tons/year (\$207 million/year)
Particulate matter	8,380 tons/year (\$50 million/year)
Sulfur dioxide	3,300 tons/year (\$7.3 million/year)
Nitrogen dioxide	2,300 tons/year (\$21 million/year)
Carbon monoxide	310 tons/year (\$392,000/year)
Carbon storage	19.9 million tons (\$411 million)
Carbon sequestration	1.0 million tons/year (\$20.7 million/year)
Building energy reduction	\$14.0 million/year
Reduced carbon emissions	\$500,800/year
Structural value	\$93.4 billion

Affecting Policy Change in Urban Development in the Kansas City Metro Area

Task 1: Policy Survey	A survey of local and national ordinances will provide a basis for the development of locally tailored ordinances.
Task 2: Forestry Focus Group	A focus group of planners, public works officials and other city leaders will identify critical issues and concerns.
Task 3: Training Session	A training session with recognized topical experts will target public works, planning, parks and forestry officials.
Task 4: Stakeholder Workshop	A stakeholder workshop will build agreement on priority opportunities, barriers and next steps.
Task 5: Policy Guide	Based on stakeholder input, a policy guide will be developed to elaborate on priority strategies that local governments can embrace to enhance forest cover in commercial areas.
Task 6: Planning & Education	Demonstration tree planting and community education projects will be conducted with partners to show alternative models of community-based forestry efforts.

APPENDIX E

KANSAS LAND TRUSTS

Kansas and Other Land Trusts

The Conservation Fund

807 Rodeo Drive, SE
Pine Island, MN 55963
(507) 356-6301
Fax: (507) 356-6302
cmiller@conservationfund.org
www.conservationfund.org

Kansas Land Trust

16 East 13th Street
Lawrence, KS 66044-3502
(785) 749-3297
Fax: (785) 842-3039
info@klt.org
www.klt.org

Ranchland Trust of Kansas

6031 SW 37th Street
Topeka, KS 66614
(785) 273-5115
www.ranchlandtrustofkansas.org

The Nature Conservancy

Kansas Chapter
700 SW Jackson, Suite 804
Topeka, KS 66603
(785) 233-4400
Fax: (785) 233-2022
kansas@tnc.org
www.nature.org/en-us/about-us/where-we-work/united-states/kansas/

Sunflower Land Trust

Jim Michael, CEO
(316) 744-3550
ljmichael@cox.net
www.sunflowerlandtrust.com

The Watershed Institute

7211 W. 98th Terr. Ste. 140
Overland Park, KS 66212
(913) 685-4600 ext 15
frank@watershedinstitute.biz
www.watershedinstitute.biz

APPENDIX F
FOREST LEGACY LEAD
AGENCY DESIGNATION LETTER AND FOREST
PLANNING AT BALDWIN WOODS

November 3, 2008

Ms. Abigail Kimbell, Chief
U.S. Forest Service
14th and Independence Avenue, SW
Washington, DC 20090-6090

Dear Chief Kimbell:

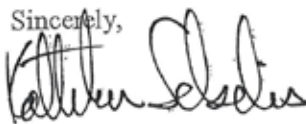
I hereby designate the Kansas Forest Service as the lead agency for the USDA Forest Service's Forest Legacy Program in Kansas as authorized under Section 1217 of Title XII of the Food, Agriculture, Conservation, and Trade Act of 1990.

Please forward information and other materials concerning the Forest Legacy Program to:

Larry E. Biles, State Forester
Kansas Forest Service
2610 Claflin Road
Manhattan, KS 66502

The Kansas Forest Service is the appropriate agency to lead Kansas's Forest Legacy Program as the agency is charged with providing forest management advice and assistance to state, local and private forest landowners. We look forward to working with the Forest Service in implementing the Forest Legacy Program in Kansas.

Sincerely,



Kathleen Sebelius
Governor

Forest Planning at Baldwin Woods
Final Report to the Kansas Forest Service
(Draft Sept 18, 2018)

Jennifer M. Delisle and William H. Busby
Kansas Biological Survey, Kansas Natural Heritage Inventory
2101 Constant Avenue, Lawrence, KS 66047

This work involves conservation planning at Baldwin Woods on behalf of the U.S. Forest Service's Forest Legacy program. The area of interest includes most of the greater Baldwin Woods site which is delimited by the extent of forest mapped by the Government Land Office in 1856 (Figure 1). The area of interest does not include the westernmost portion of this forested feature or the northward-extending finger of the greater Baldwin Woods site.

Summary of Accomplishments:

1. Created database to hold ecological and personal information about 152 landowner tracts in the greater Baldwin Woods site.
2. Held three events to raise awareness about forest values and identify landowners with conservation interests.
3. Assigned a conservation priority rating to each landowner tract in the area of interest. Identified nine landowner tracts (220 acres) with high conservation interest for potential addition to the Baldwin Woods Forest Preserve (BWFP); seven of these contain significant forest resources (128 acres).
4. Engaged directly with landowners in an effort to secure protection of tracts adjacent to the BWFP. Actively pursuing protection of four tracts (101 total acres which includes 67 forested acres).

Details of Accomplishments:

1. Created database to hold ecological and personal information about 152 landowner tracts in the greater Baldwin Woods site.

Staff at the KBS have a long history of personal interaction with landowners in the Baldwin Woods area. Recognizing that staff from the KBS and its partners will change over time it is important for individuals continuing conservation work in the Baldwin Woods area to be aware of these relationships. We have created an Access database that contains information about each landowner tract in the area of interest including: owner/address of each tract; ecological information gathered by field survey or review of current and historic aerial photography; and notes on personal interactions. This database contains confidential information and will be maintained by the KBS.

2. Held three events to raise awareness about forest values and to identify landowners with conservation interests:
 - Field tour for local residents with forest property (by invitation). Approx. 50 invitations were distributed by mail or e-mail; 20 landowners and resource professionals attended.
 - Public tour of the Baldwin Woods Forest Preserve (advertised widely via e-mail, distribution of flyers, and Facebook). Approx. 50 attendees participated.
 - Public forum in Baldwin City that addressed protection of natural areas including forest lands. Approx. 50 attendees participated.
3. Assigned a conservation priority rating to each landowner tract in the area of interest.

Conservation priority ratings are an integration of ecological condition, adjacency to protected areas, anticipated threats, restoration potential, and contribution to connectivity. Ecological condition was determined by field survey or by review of aerial photography from 1937 to 2017. Field surveys were conducted some time between 1988 and 2015; ranks for ecological condition were assigned at that time. If no survey had been conducted, a conservation priority ranking of “potential” was assigned to tracts that appear to have been forested continuously since settlement. Anticipated threats were estimated based on suitability of the terrain to development. Restoration potential was based on the existence of a remnant of the historic forest community, and adjacency to an intact community of the same type. Using these criteria fifteen landowner tracts were assigned a conservation priority rating of “high”; of these, nine (220 acres) are adjacent to the BWFP. Seven of these nine tracts contain significant forest resources which total approximately 128 acres. Forty eight landowner tracts were assigned a conservation priority rating of “potential”; most of these are located east of the BWFP and could provide connectivity between the Preserve and Douglas County State Lake or could be added to the State Lake property.

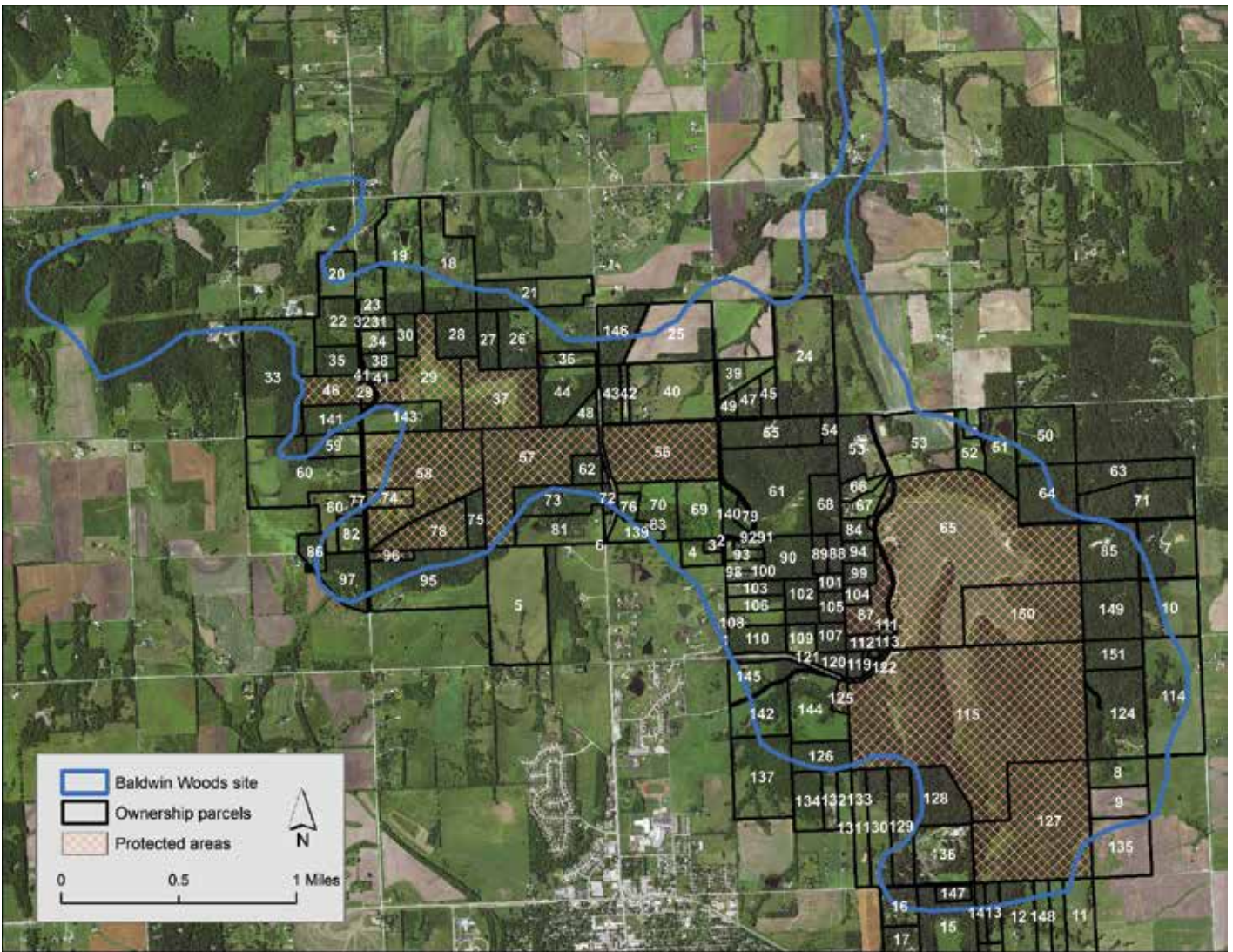
4. Engaged directly with landowners in an effort to secure protection of tracts adjacent to the BWFP.

We are actively pursuing protection of four of the seven tracts (101 total acres which includes 67 forested acres). Two other tracts are owned by a family who has attended our public events and said they are not interested in pursuing formal protection measures at this time. We have not interacted with the owner of the seventh tract. Forest quantity and quality on two additional tracts are lower but offer the opportunity for restoration. These tracts are important to the integrity of the BWFP due to their position higher in the watershed, with the land sloping toward the Preserve. We intend to contact these landowners in the near future.

While the focus of this work has been on the lands adjacent to the BWFP we recognize the conservation value of a larger protected area that connects with Douglas County State Lake and the adjoining conservation easement. In this region we have identified three landowner tracts of high conservation value with a combined forested area of approximately 126 acres. We also have identified up to 500 acres of forested area that has not been surveyed but appears to be of good quality based on a review of aerial photography that spans 80 years. These properties offer a wealth of opportunity for conservation work by our partners.

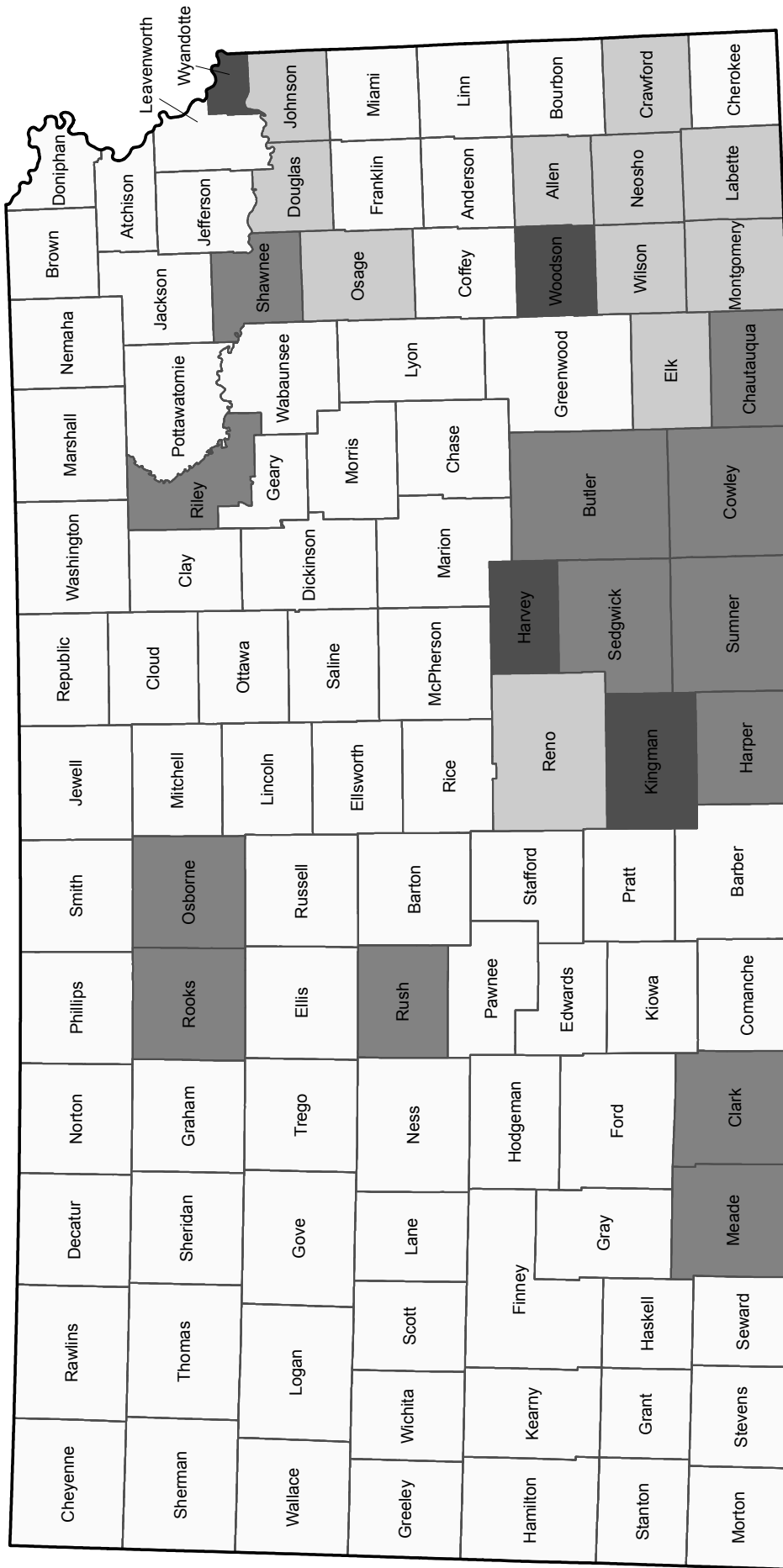
Future needs and events:

1. Conduct ecological surveys in the far western portion of the greater Baldwin Woods site. Several landowner tracts west of E. 1550th Rd. may contain good quality forest acres but have not been surveyed.
2. Continue conversations with partners including the KU Endowment Association and the Kansas Dept. of Wildlife, Parks and Tourism to discuss mechanisms for making future purchases. We will continue ongoing conversations with the Kansas Land Trust and the Conservation Fund about additional conservation opportunities in the region.
3. A public tour of the Baldwin Woods Forest Preserve is scheduled for October 27, 2018.



The greater Baldwin Woods site showing landowner tracts within the project area of interest (numbered tracts). Note the western portion and the northward-extending finger are not included in the area of interest.

APPENDIX G
COMMUNITY WILDFIRE PROTECTION PLANS-
COUNTY MAP



Kansas Community Wildfire Protection Plan Status

- Pending
- In Progress
- Approved

APPENDIX H
CONSERVATION EASEMENT STEWARDSHIP POLICY
DISCUSSION GUIDE

Kansas Forest Legacy Assessment of Needs

https://www.kansasforests.org/kansas_forest_services/kfs_docs/Kansas_FRAS_1.pdf

Forest Legacy Program Implementation Guidelines

https://www.fs.fed.us/sites/default/files/fs_medialfs_document/15541-forest-service-legacy-program-508.pdf

Table of Contents

Part I – Forest Legacy Program Overview	9
1. Background and History	9
2. Purpose and Authority	10
3. Other Related Laws	11
Part II – Forest Legacy Program Structure and Funding	15
4. Options for State Participation	15
5. Roles and Responsibilities	15
6. State Forest Action Plans	18
7. Forest Legacy Program and Project Funds	22
Part III – Forest Legacy Program: Project Eligibility and Selection	25
8. Project Eligibility and Development	25
9. Project Selection Process	32
Part IV – Forest Legacy Program Procedures and Grant Requirements	35
10. Grant Requirements for States	35
11. Federal Acquisition Procedures	40
12. Cost-Share and Donated Tracts	42
Part V – Land Acquisition Process and Requirements	45
13. Due Diligence for Acquisition	45
14. Conservation Easement Language	48
15. Fee Simple Purchase Deed Language	56
16. Appraisal and Appraisal Review	61
17. Multi-Resource Management Plans	63
Part VI – Post-Acquisition Requirements	67
18. Forest Legacy Information System	67
19. Recordkeeping Policy	69
20. Stewardship of Forest Legacy Program Tracts	73
21. Other Post-Acquisition Considerations	76
22. Amendments to Conservation Easements	77
23. Extinguishment of a Conservation Easement; Disposal of Fee Land; Reimbursement	81

Part VII – Program Oversight	87
24. Forest Legacy Program Reviews	87
25. Quality Assurance Inspections	87
Part VIII –Forest Legacy Program Glossary of Terms and Acronyms	91
26. Glossary of Terms	91
27. Forest Legacy Program Acronyms	99
Part IX – Appendixes	103
Appendix A – Authorizing Legislation for the Forest Legacy Program	103
Appendix B – National Environmental Policy Act (NEPA) Categorical Exclusion Letter	107
Appendix C – USDA Forest Service Map	109
Appendix D – Landowner Application	110
Appendix E – Examples of Forest and Nonforest Uses	116
Appendix F – Compatibility Analysis Tool	119
Appendix G – Forest Legacy Program Project Selection Cycle	122
Appendix H – Grant and Cost-Share Requirements	123
Appendix I – Forest Legacy Program Award Provisions	125
Appendix J – Examples of Cost-Share Calculations	131
Appendix K – Baseline Documentation Report Sample	133
Appendix L – Amicable Agreement Acknowledgment Letter	136
Appendix M – Conservation Easement Language Examples	137
Appendix N – Guide to Evaluating Appraisal Risk Factors	145
Appendix O – Sample Content of a Multi-Resource Management Plan	147
Appendix P – Tract Boundary Submission Standards for Forest Legacy Information System	149
Appendix Q – Forest Legacy Program Recordkeeping	150
Appendix R – Supplemental Amendment Information	156
Appendix S – State Forest Legacy Program Reviews	158
Appendix T – Forest Service Regions/Northeastern Area/International Institute of Tropical Forestry Forest Legacy Program Reviews	161
Appendix U – Process for Conducting Quality Assurance Inspections	164
Appendix V – Sample Graphics and Signs	167



Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Robert Atchison et al., *Kansas Forest Action Plan*, Kansas State University, August 2020.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

K-State Research and Extension is an equal opportunity provider and employer. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of K-State Research and Extension, Kansas State University, County Extension Councils, Extension Districts.