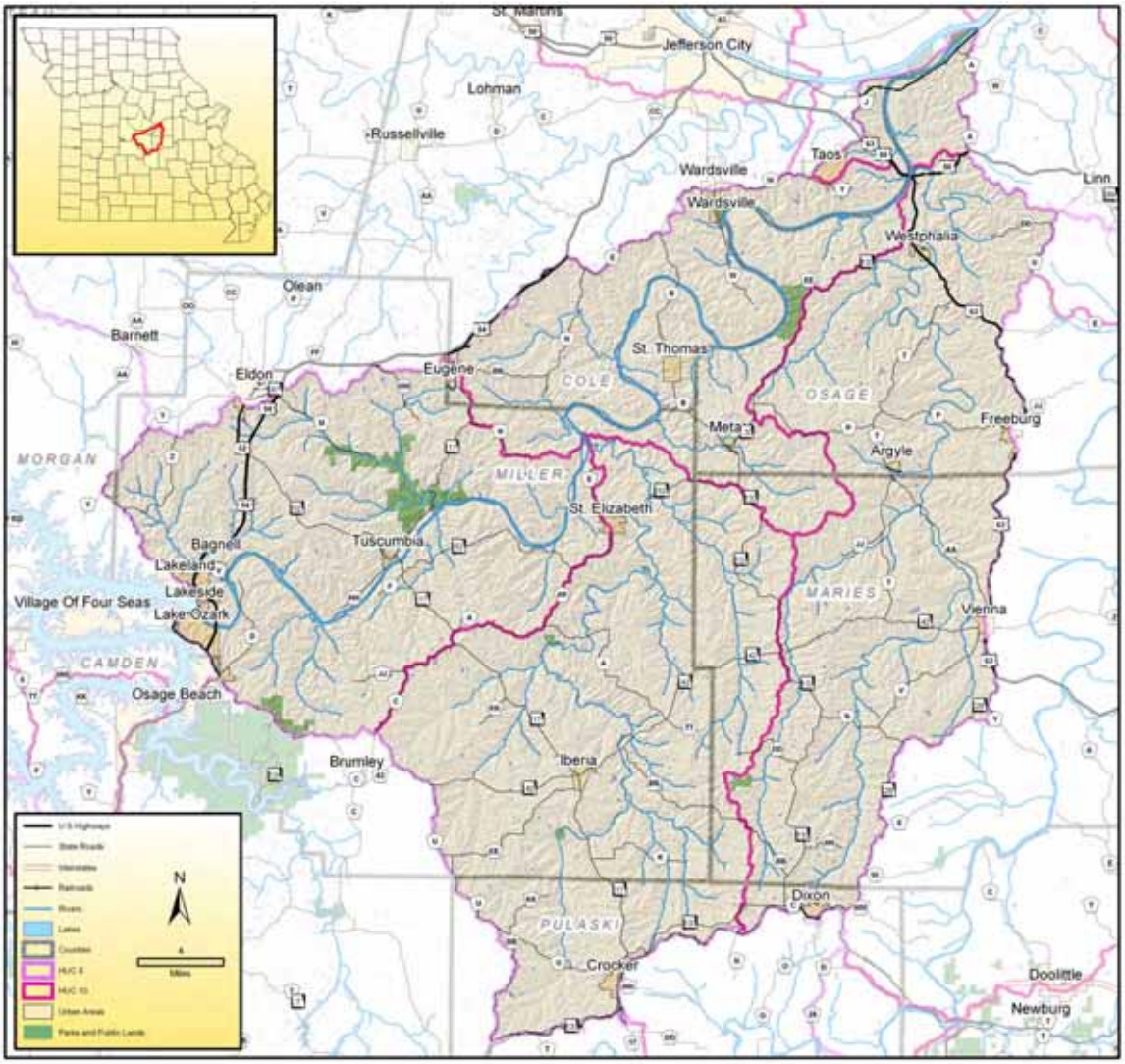
Lower Osage River - 10290111

8 – Digit Hydrologic Unit Profile and Resource Assessment Matrix



UNIVERSITY OF MISSOURI Extension

NRCS Natural Resources Conservation Service

CARES Center for Applied Research and Environmental Systems

Profile Contents

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Produced by the Center for Applied Research and Environmental Systems - University of Missouri-Columbia

Summary

The Lower Osage Watershed (Hydrologic Unit 10290111) is a 1,085 square mile watershed in central Missouri. Agricultural activity is typically on smaller, general farming operations, concentrated in narrow valleys and on ridge tops. The watershed is characterized by dissected areas on steep slopes with narrow to moderate width ridges and with significant forestation. Agricultural operations are primarily livestock-based, consisting primarily of hay and pasture. The watershed is predominately private land, with only 1.3 percent in public holding.

The watershed is situated on Karst topography with a number of springs located throughout the center of the watershed. The watershed contains six Common Resource Areas (CRAs) – Central Plateau, Gasconade River Hills, Missouri River Alluvial Plain, Northern Inner Ozark Border, Osage River Hills and the Prairie Ozark Border. The Central Plateau and the Osage River Hills are the major CRAs in the watershed. Cropland comprises only 3.9 percent of the land cover, while grassland is 40.6 percent, and deciduous forest is 44.7 percent. Highly erodible land is some 59.7 percent of the watershed, followed by 23.8 percent of potentially highly erodible land; only 6.6 percent is identified as prime farmland. Only 20 Confined Animal Feeding Operations are permitted in the watershed, and all are swine operations; these are located primarily in the western portion of the watershed. The only 303(d) listed stream in the watershed is the Osage River from Bagnell Dam to the Missouri River.

Local stakeholder meetings held at Westphalia and Tuscumbia in March and May of 2007, respectively, identified corn, soybeans and milo as the primary crops. These crops are grown mainly in bottoms. Fescue, orchard grass, and some warm season grasses are grown for pastures. Cow-calf management is the primary livestock operation. Most grazing is rotational between hill ground and bottom ground. Various conservation practices were mentioned, with most relating to livestock management. A number of natural resource issues were identified; the majority of the specific issues were related to river management and urban encroachment, to some extent.

The Resource Assessment is summarized in the following table, by Conservation System - Treatment Level for cropland, forest land, grassland and urban uses.

Summary - Continued

Summary of Resource Assessment – acreages and costs, by Conservation System – Treatment Level, for Cropland, Forestland, Grassland and Urban uses.

Conservation System – Treatment Level	Current Conditions (acres)	Future Conditions (acres)	USDA Investment ($ - PV)	Private Investment ($ - PV)
Cropland				
Baseline	21,678	18,426		
Progressive	4,065	5,826	3,492,891	3,616,960
Resource Mgmt.	1,355	2,845	2,173,667	2,305,695
Total		3,658	5,666,558	5,922,655
Forestland				
Baseline	279,824	251,842		
Progressive	34,978	42,723	1,646,381	1,493,942
Resource Mgmt.	34,978	54,216	3,855,682	3,088,719
Total		33,229	5,502,064	4,582,662
Grassland				
Baseline	195,954	146,965		
Progressive	41,990	67,184	14,111,577	13,629,563
Resource Mgmt.	41,990	65,784	71,349,779	72,197,679
Total		53,187	85,461,356	85,827,243
Urban				
Baseline	3,058	2.293		
Progressive	382	784	724,434	784,952
Resource Mgmt.	382	745	505,186	537,831
Total		822	1,247,620	1,322,783

PV – Present Value of costs.

Introduction

Watershed management planning is a process which, if successfully applied, will result in a sustainable supply of water of adequate quantity and quality to support residential, agricultural, commercial and industrial needs. The process consists of several phases:

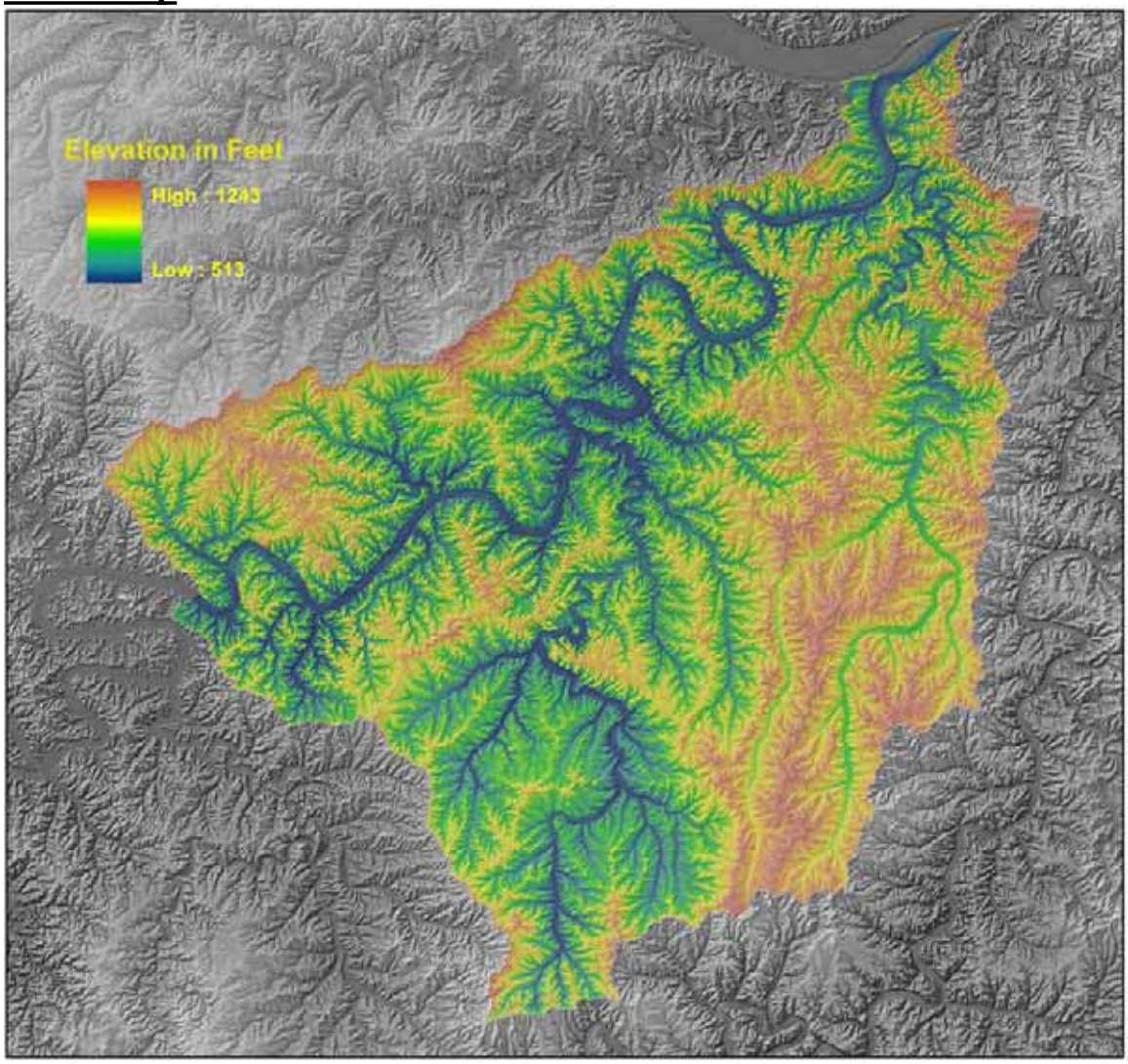
- Identifying the various factors which impede the watershed from providing a safe and reliable supply of water and related products to the users.
- Stating a set of measurable objectives for removing or resolving the impediments to water quality.
- Identifying a set of strategies and practices and strategies that will enable attainment of the objectives.
- Acquiring needed resources – technology, personnel, funding – to implement the strategies and practices.

The initial phase is the one which sets the stage for the following phases of plan development, so it must be conducted to yield the needed information in a most efficient and timely way. The initial information needed consists of an accurate and comprehensive description of the social, physical and biological characteristics of the watershed, (watershed profile), an enumeration of the natural resource concerns and issues impacting water quality and quantity in the watershed, and an assessment of the possible conservation practices that might be applied in the watershed along with their respective costs and benefits from implementation.

USDA Natural Resource Conservation Service has sponsored development of a process for generating this initial information called “Rapid Watershed Assessment.” Assessments will provide a “… rough picture of resource conditions and conservation efforts” for Missouri’s large watersheds and can be used as a focal point for locally led identification of resource concerns and priorities.”

The Lower Osage Watershed is 1 of 19 rapid watershed assessments completed on 8-digit hydrologic units in Missouri which were selected for inclusion in a pilot project to further develop and refine this process. Watersheds were selected based on information contained in the Missouri Unified Watershed Assessment and the Missouri Department of Natural Resources 303(d) list.

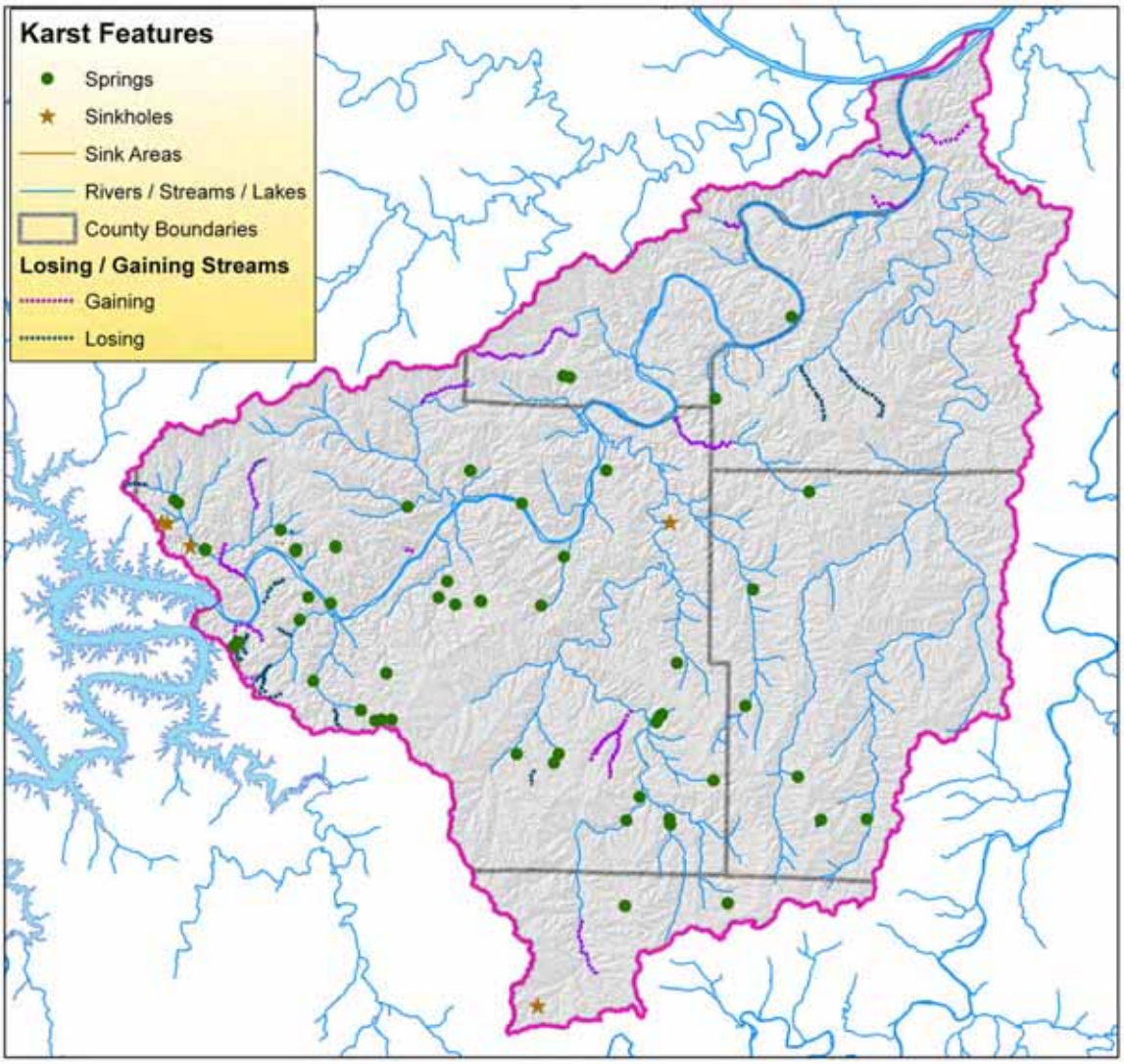
Relief Map



The Lower Osage Watershed (Hydrologic Unit – 10290111), a 1,085 square mile watershed in central Missouri, was selected for its topography and mix of agricultural activities. Agricultural activity is typically on smaller, general farming operations, concentrated in narrow valleys and on ridge tops. The watershed is characterized by dissected areas on steep slopes with narrow to moderate width ridges and with significant forestation. The steep slopes are primarily forested with mixed oak species. Agriculture operations are predominately livestock-based, consisting primarily of hay and pasture. Concerns within the watershed include the karst topography with a high potential for groundwater quality problems, and a significant number of animal feeding operations.

Drainage within the basin flows northeast from Bagnell Dam at the Lake of the Ozarks to the mouth of the Osage River at the Missouri River. The watershed is traversed by Interstate 44 and US Highway 63, with Rolla serving as the main population center. The Lower Osage Watershed is located along the northern boundary of the Ozark Plateau region of the state. The topography is quite hilly, with substantial relief.

Karst Features

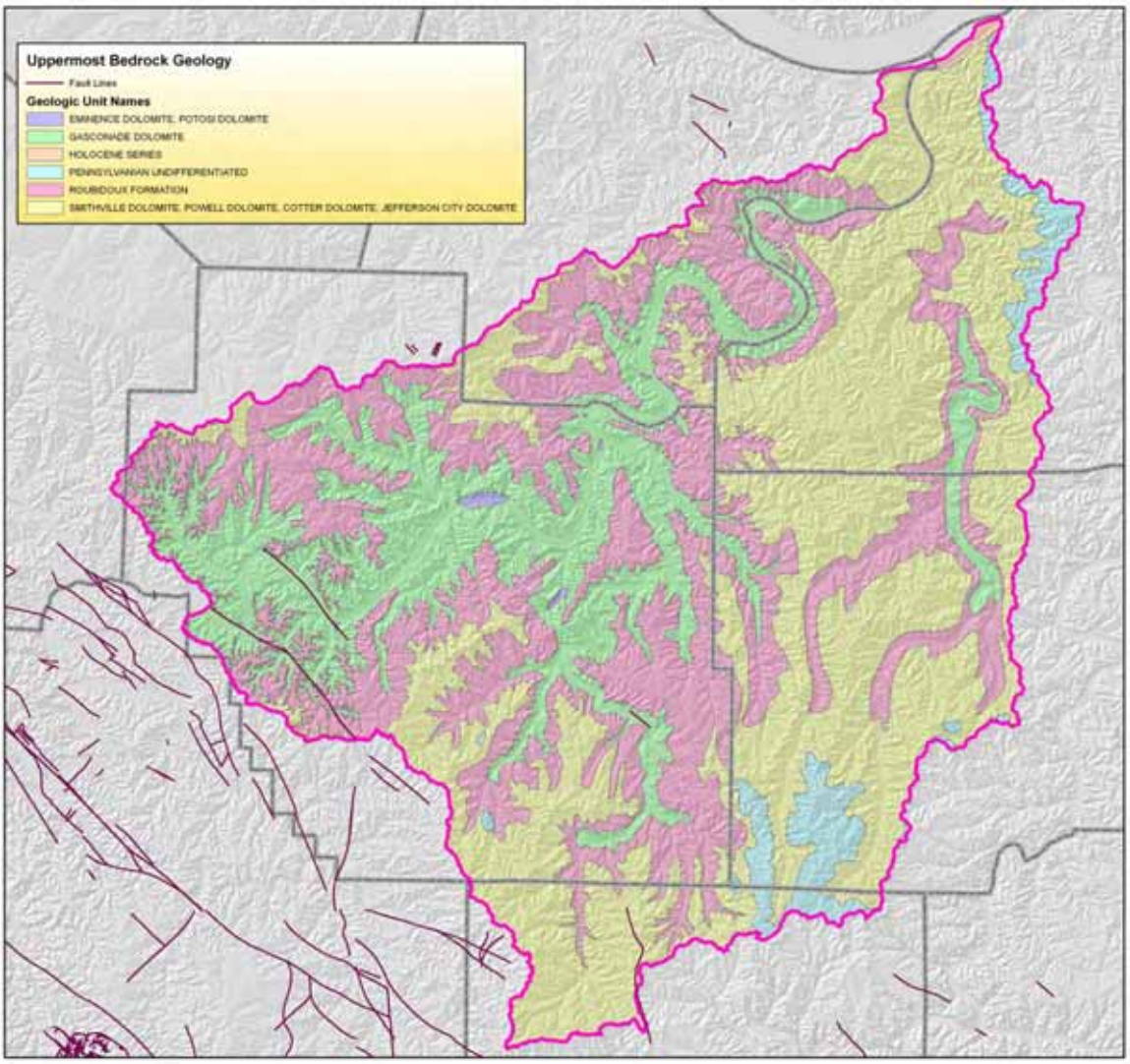


A gaining stream is one in which the channel bottom is lower than the level of the surrounding groundwater table. Water moves from the ground into the channel, gaining water flow from the subsurface. **A losing stream** is one which is above the groundwater table. Water moves from the channel into the surrounding ground, losing water flow to the subsurface.

Karst topography is a landscape shaped by the dissolution of a soluble layer or layers of bedrock. These landscapes display distinctive surface features and underground drainages.

For the Lower Osage River sub-basin, there are a total of 22 gaining streams and 18 losing streams. These springs are located predominately in the north and west part of the watershed. There are also 5 sinkholes and 11 sink areas. There are 54 total springs, with 10 being named. Of the named springs, only 4 have been measured with Abbot, Blue, and Elm Springs producing between 10 - 100 gal/minute. Spring Valley Spring produces 1 - 10 gal/minute.

Geologic Features



The geology of a watershed shows bedrock formations (or parent materials) which will produce soils that will in turn influence water quality, biological activity, and aquatic life in a stream. Different types of bedrock also control how channels develop.

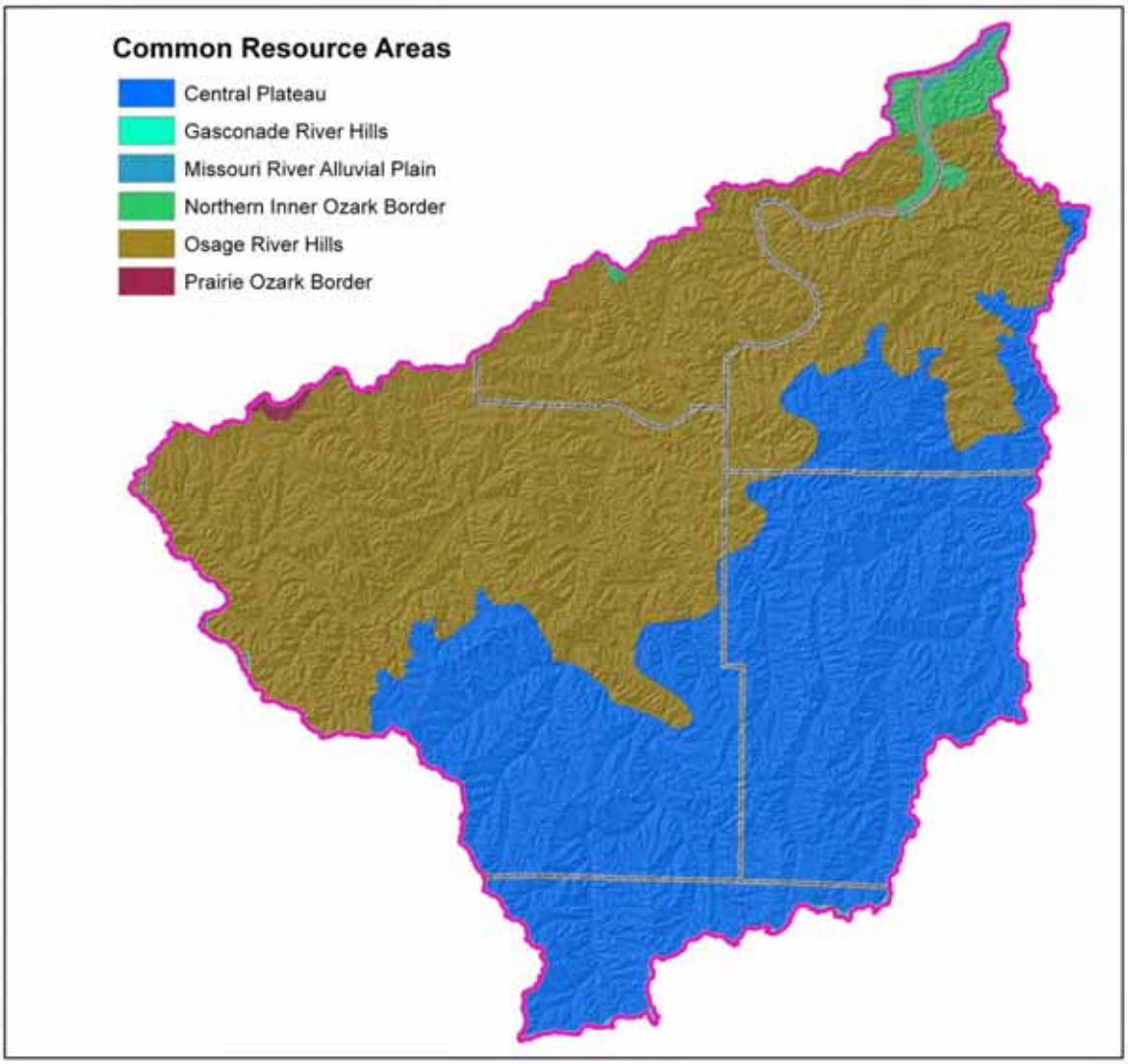
For this sub-basin, the majority of the bedrock in the large river and stream bottoms is made up of Gasconade Dolomite surrounded by a Roubidoux Formation. Smithville Dolomite, Powell Dolomite, Cotter Dolomite, and Jefferson City Dolomite are found in upland areas. There is little impact from surface fault lines on this watershed.

Geologic Features - Continued

Bedrock Descriptions

Unit Name	Unit Description
	rock type 1; rock type 2; rock type 3
Smithville Dolomite, Powell Dolomite, Cotter Dolomite, Jefferson City Dolomite	dolostone (dolomite); sandstone; shale, conglomerate, chert
Roubidoux Formation	sandstone; chert; dolostone (dolomite)
Gasconade Dolomite	dolostone (dolomite); sandstone
Pennsylvanian Undifferentiated	shale; limestone; sandstone, coal
Eminence Dolomite	dolostone (dolomite); chert
Holocene Series	clay; silt; sand, gravel

Common Resource Areas



Common Resource Area (CRA) map delineation is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) map delineation or polygon. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area

Common Resource Areas - Continued

General Descriptions of Common Resource Areas

The Lower Osage River Watershed is comprised of six Common Resource Areas (CRAs), described as:

Central Plateau – Consists of some of the least dissected portions of the Ozark Highlands. Dominated by carbonate lithology, it is strongly karstic in many portions and is mantled by a very thick solution residuum. Lack of surface water and droughty soils are characteristics. Much of the land has been cleared for pasture although oak forests and brush dominate locally.

Gasconade River Hills – Consists of the deeply dissected landscapes. Steep slopes, narrow ridges, and narrow valley bottoms occur virtually everywhere. Soils are rocky and frequently thin over carbonate and sandstone bedrock principally of the Roubidoux and Gasconade Formations. Local karst and large springs are characteristic. Oak forests and oak-pine cover most of the region.

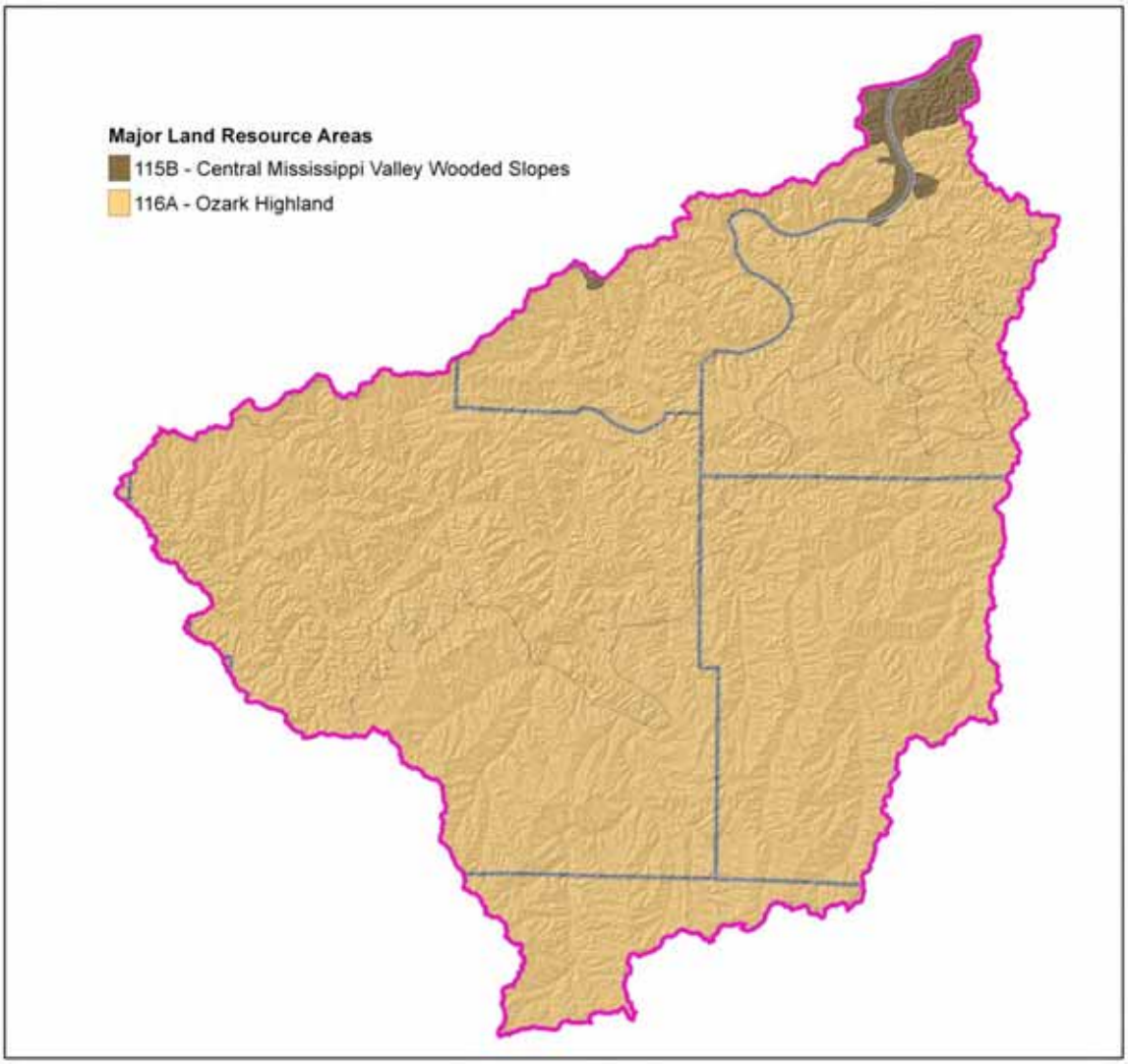
Missouri River Alluvial Plain – Consists of the Missouri River channel and its adjoining alluvial plain across the northern Ozarks. Formerly the channel contained numerous islands and bars, but in the last half century it has been narrowed, its islands virtually eliminated, and its banks stabilized. Soils are deep and loamy. The alluvial plain is subject to flooding. Land use is chiefly row crops.

Northern Inner Ozark Border – Consists of dissected plains and hills with various expressions of local relief with a range of 150-300 feet. The CRA is defined largely by its association with the dolomites and loess-mantled ridges. Land use is extremely varied, from row crops and improved pasture to overgrown glades and dense second-growth oak forests.

Osage River Hills – Composed of the hilly to rugged lands. Lithology varies from Jefferson City-Cotter-dominated areas in the west to areas underlain by Roubidoux, Gasconade, and Eminence-Potosi Formations in the east. Small areas of Mississippian and Pennsylvanian parent materials occur on the western fringe. Rural lands are a nearly even mix of pasture and oak forests.

Prairie Ozark Border – Is a high, smooth plain of less than 100 feet of local relief. It has a thin layer of loess over dolomite in the south and limestones on the north. In many respects this subsection is transitional between the wooded hills of the Ozarks and the open Osage Plains to the west. Farms of cropland and pasture dominate the subsection, with woodlands on steeper or wetter soils.

Major Land Resource Areas (MLRA)



Major land resource areas (MLRAs) are geographically associated land resource units (LRUs). Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning.

Dominant physical characteristics, such as physiography, geology, climate, water, soils, biological resources, and land use are used to describe MLRAs.

Major Land Resource Area - Continued

Major Land Resource Area (MLRA) Descriptions

The Lower Osage Watershed is located in two MLRAs as described below:

115B – Central Mississippi Valley Wooded Slopes

Land use: Nearly all this area is in farms, and approximately 40 percent is cropland. Feed grains and hay for livestock are the principal crops, but grape vineyards and peach and apple orchards are important in some places. Some 35 percent of the area is forested, including some national forests. Most of the remainder of the farmland is in permanent pasture and native grasses. The hazards of erosion and sedimentation are severe in urban areas near St. Louis and other cities and on the farmland.

Elevation and topography: Elevation ranges from 100m on the main valley floors to 300m on the ridge tops. This dissected glacial till plain has rolling narrow ridge tops and hilly to steep ridge slopes and valley sides. The small streams have narrow valleys and steep gradients; the major rivers have nearly level broad flood plains. Valley floors are tens of meters below the adjoining hilltops.

Climate: Average annual precipitation range from 900 to 1,150 mm; approximately two-thirds of the precipitation falls during the freeze-free period. The maximum is in spring and early in summer and the minimum from mid-summer through autumn. Average annual temperatures range from 12° to 14°C with an average freeze-free period of 180 to 200 days, increasing from north to south.

Water: In most years precipitation is adequate for the crops commonly grown, but in some years yields are reduced by drought. Ground water is the source of water for domestic and livestock needs on farms. The Mississippi, Missouri, and Ohio Rivers are major transportation arteries and are also used for recreation.

Soils: Most of the soils are Udalfs. They are deep and medium textured to moderately fine textured and have a mesic temperature regime, an udic moisture regime, and mixed mineralogy. Well drained and moderately well drained Hapludalfs (Alford, Fayette, Menfro, Muren, Weller, and Winfleld series) are in silty loess; other Hapludalfs (Gara, Hickory, Keswick, and Lindley series) are in glacial till; and still others (Bloomfield and Princeton series) are in sandy aeolian material. Well drained and moderately well drained Fragiudalfs (Grenada, Hatton, and Hosmer series) are on ridgetops in silty material. Well drained, cherty Paleudalfs (Goss series) weathered from cherty limestone. Somewhat excessively drained shallow Hapludolls (Gasconade series) are on steep slopes. Udifluvents (Eel, Genesee, Haymond, Nodaway, and Sharon series), Fluvaquents (Piopolis, Shoals, and Wakeland series), Haplaquolls (Beaucoup, Darwin, and Wabash series), and Hapludolls (Leta series) are on flood plains.

Potential natural vegetation: This area supports a forest flora consisting mainly of oak and hickory species.

Major Land Resource Area – Continued

116A – Ozark Highland

Land use: Approximately 70 percent of this area is forests or woodland, most of which is in large holdings, national forests, or farm woodlots. Some 20 percent is pasture, mainly of introduced grasses and legumes. Approximately 10 percent is cropland. Corn, feed grains, and hay for dairy cattle and other livestock are the principal crops. Orchards, vineyards, and truck crops are important on some of the more friable deep soils. Summer droughts and steep slopes are major land use problems.

Elevation and topography: Elevation ranges from 200 to 500m. The sharply dissected limestone plateaus have narrow rolling ridge tops that break sharply to steep side slopes. Valleys are narrow and have steep gradients, especially in the upper reaches. Local relief is in meters to tens of meters.

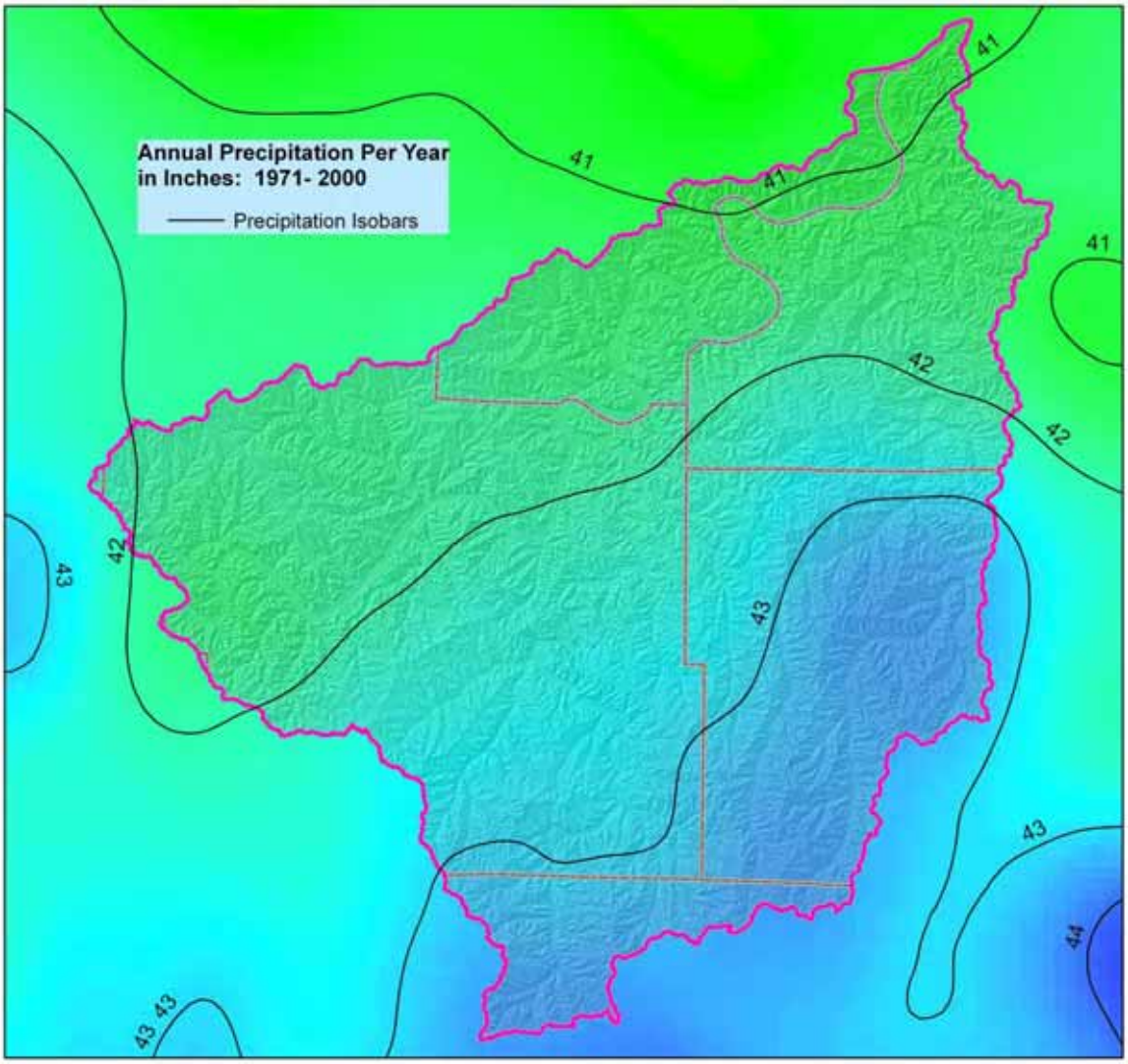
Climate: Average annual precipitation ranges from 1,025 to 1,225 mm. Maximum precipitation events are in spring and early in summer, and the minimum is in midsummer. Average annual temperatures range from 13° to 16°C, with an average freeze-free period of 180 to 200 days.

Water: The moderate precipitation is adequate for crops and pasture. On most farms shallow wells or springs supply water for domestic needs and for livestock, but deep wells are required for large quantities. Water from deep wells is of good quality but is hard. Small ponds on many individual farms provide some water for livestock, and a few large reservoirs are used for flood control and for recreation.

Soils: Most of the soils are Udults and Udalfs. They are deep, medium textured to fine textured, cherty soils that weathered from limestone. They have a mesic temperature regime, an udic moisture regime, and siliceous or mixed mineralogy. Somewhat excessively drained to well drained Paleudults (Clarksville, Coulstone, Macedonia, Noark, and Poynor series) and Paleudalfs (Peridge and Goss series) are on ridges and side slopes. Moderately well drained, nearly level to moderately steep Fragiudults (Captina and Nixa series) are on slopes. Somewhat excessively drained, shallow Hapludolls (Gasconade series) and areas of rock outcrop are on steep, dissected landscapes. Udifluvents (Midco and Elsah series) on flood plains and Hapludalfs (Razort and Secesh series) on terraces are in stream valleys. Fine textured Hapludults (Agnos and Gassville series), Paleudalfs (Gepp series), and Paleudults (Doniphan series) also occur.

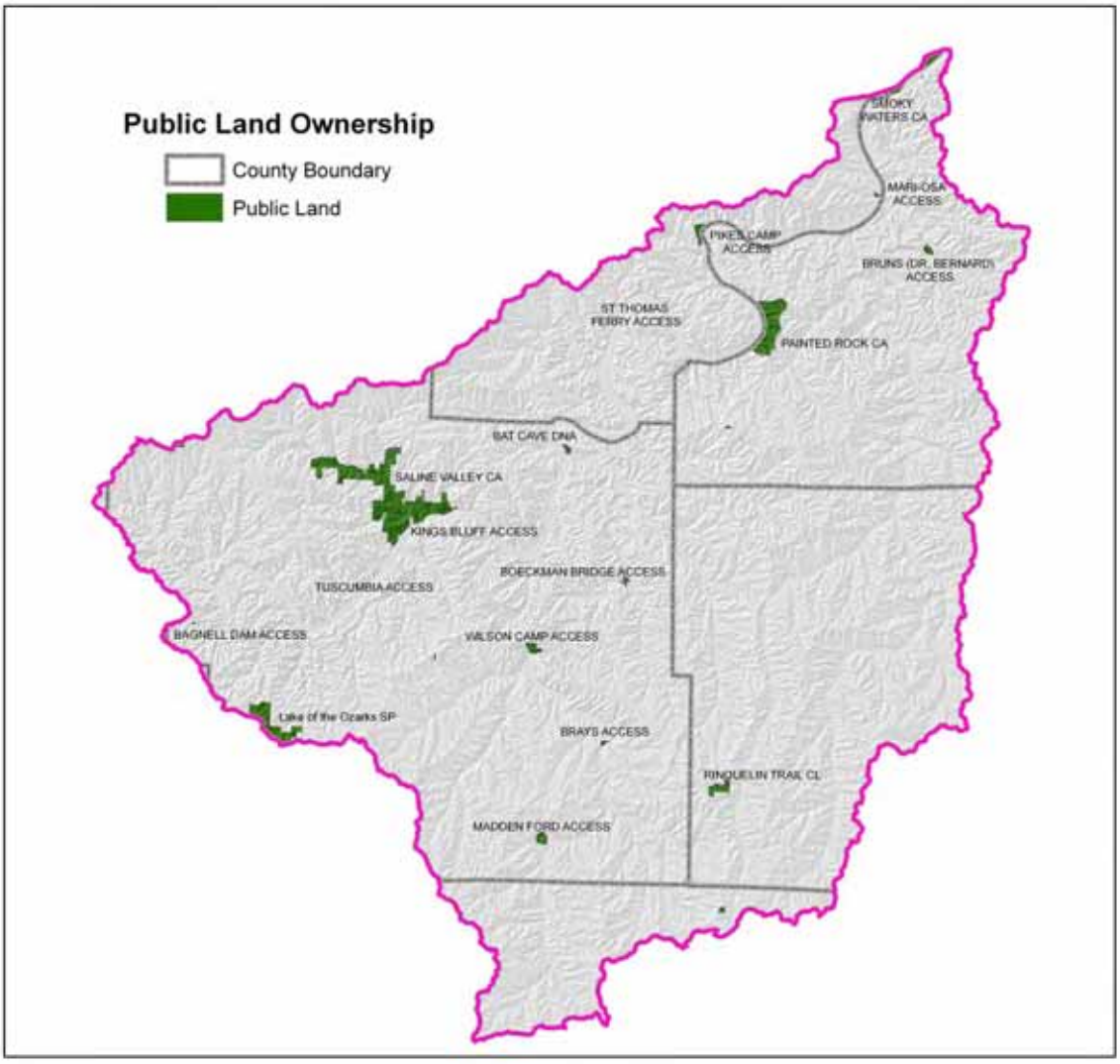
Potential natural vegetation: This area supports oak-hickory and oak-hickory-pine forests. Oak-hickory-pine forests are more dominant in the east. Glades, openings having bedrock outcrops or that are shallow to bedrock, support a more herbaceous vegetation consisting primarily of Indiangrass, little bluestem, and dropseeds. Glades are more common in the southwest.

Average Annual Precipitation



Data collected from 1971 to 2000 shows that the precipitation range for the Lower Osage area is from less than 41 inches per year in the northern areas of the watershed to more than 43 inches per year in the southern reaches that extend into Morgan and Pulaski counties.

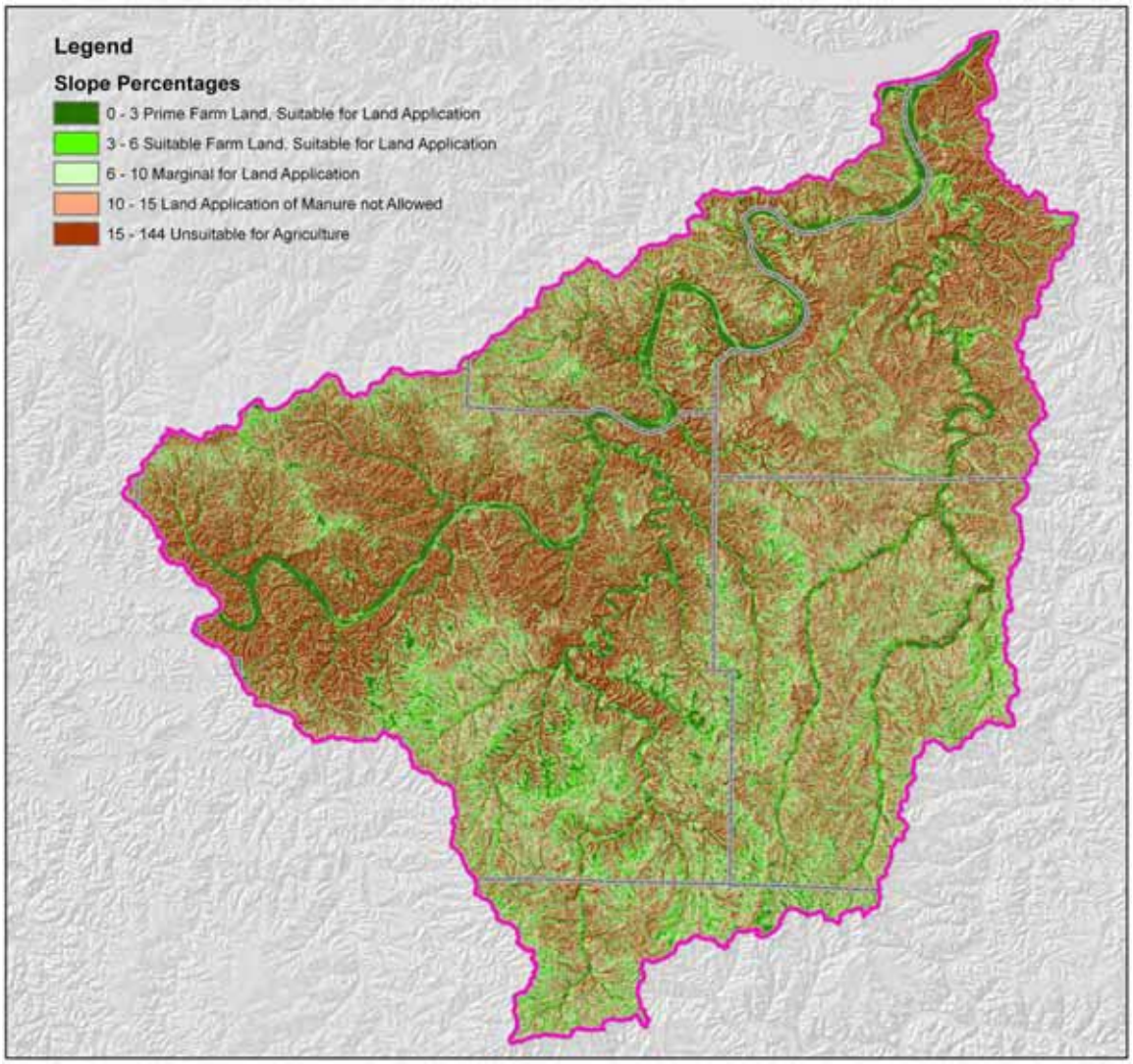
Land Ownership



Of the 689,037 acres that comprise the Lower Osage River sub-basin, only 9,202 acres (or 1.3%) are public holdings. The remaining 679,835 acres (or 98.7%) is owned by private landowners.

The largest public land areas in this watershed are: Saline Valley Conservation Area – *4,940 acres*; Painted Rock Conservation Area - *1,488 acres*; Lake of the Ozarks State Park – *1,155 acres*; and Smoky Waters Conservation Area – *515 acres*.

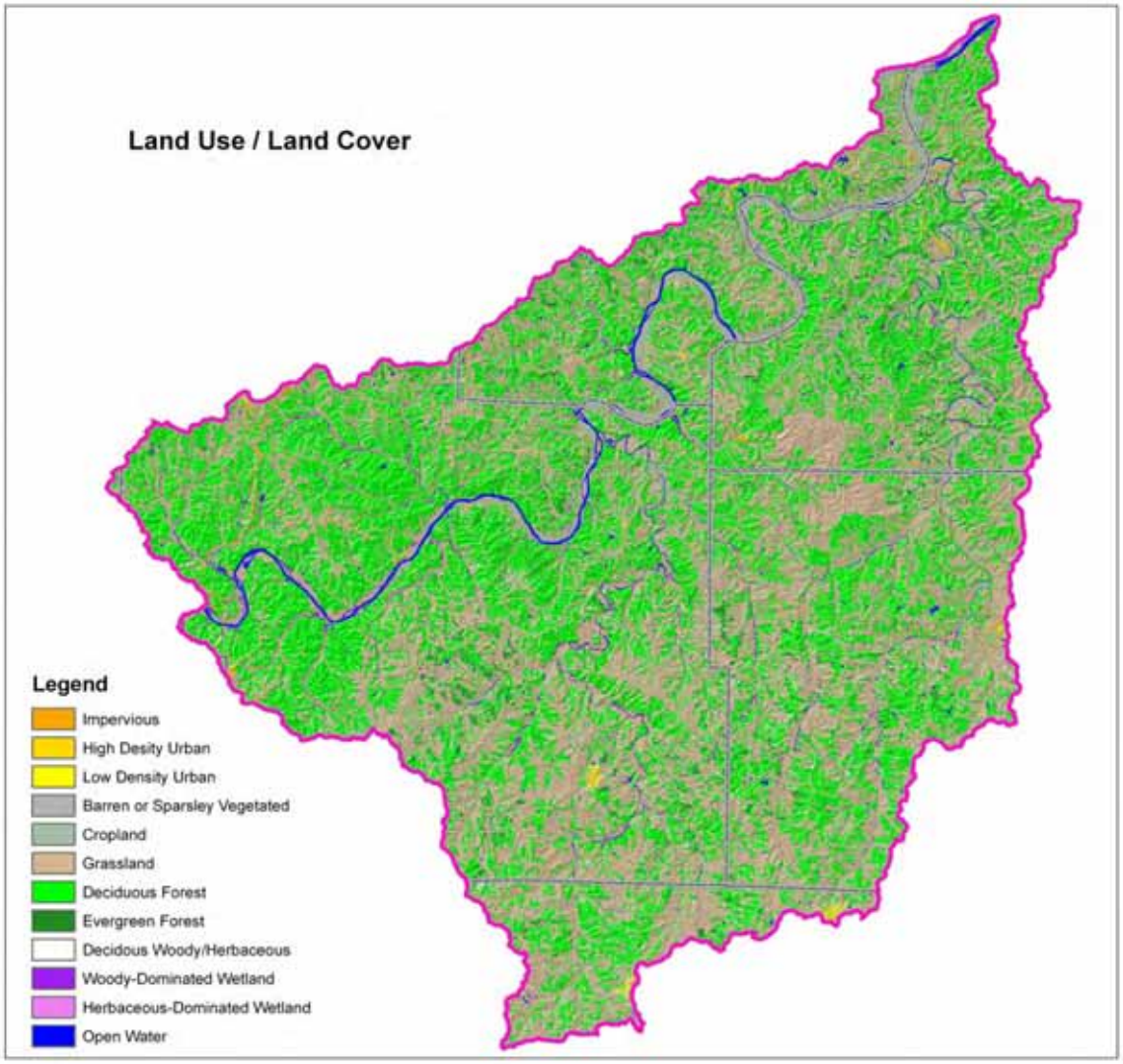
Land Slope



The best slopes for agriculture are located along the flood plain of the Osage and Maries Rivers, along with the broader ridges on the south side of the watershed. Most of the areas unsuitable for farming occur on the steep ridges and gullies that surround stream and river floodplains.

Slope classification is an important factor in determining the potential for runoff of soil and chemicals into surface water. It is not the only determinant. Soil cover, in the form of growing plants and crop residue, aids in reducing runoff. The slope categories describe a site's suitability for crop production and for receiving manure applications. Soil with over 10% slope is unsuitable for manure application according to current environmental regulations. Several opportunities exist to manage steep land to reduce the likelihood of soil erosion or chemical runoff. The University of Missouri Extension has educational materials on installing terraces, planting buffers and other management activities to stabilize land.

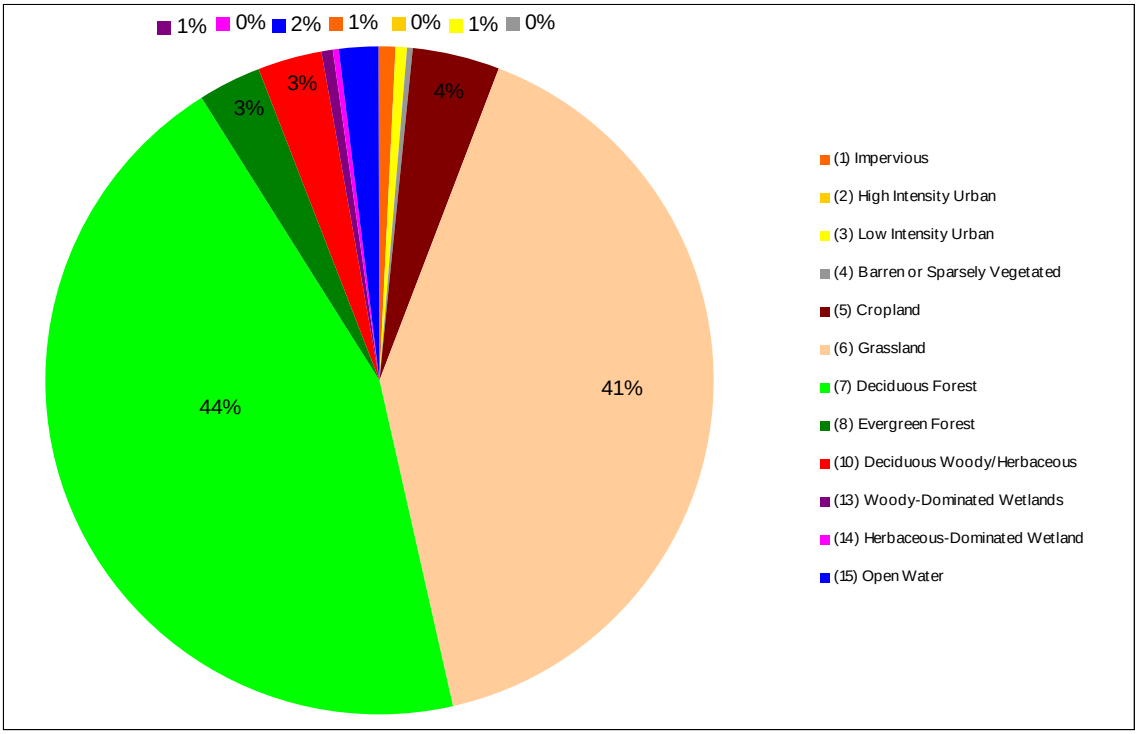
Land Use / Land Cover



Land Use and Land Cover (LULC) describe the vegetation, water, natural surface, and cultural features on the land surface.

Land Use / Land Cover – Continued

Graph of Total Land Cover / Land Use



LAND COVER/LAND USE	PUBLIC Acres	PUBLIC %	PRIVATE Acres	PRIVATE %	TRIBAL Acres	TRIBAL %	TOTALS Acres	TOTALS %
(1) Impervious	43.9	0.48%	5809.4	0.85%	0	0.00%	5853.3	0.85%
(2) High Intensity Urban	0	0.00%	68.9	0.01%	0	0.00%	68.9	0.01%
(3) Low Intensity Urban	9.7	0.11%	3743.7	0.55%	0	0.00%	3753.4	0.54%
(4) Barren or Sparsely Vegetated	19.9	0.22%	2497.6	0.37%	0	0.00%	2517.5	0.37%
(5) Cropland	184.7	2.01%	26908.3	3.96%	0	0.00%	27093	3.93%
(6) Grassland	1089.7	11.85%	278842.4	41.02%	0	0.00%	279932.1	40.63%
(7) Deciduous Forest	6734.1	73.26%	301818.1	44.40%	0	0.00%	308552.2	44.78%
(8) Evergreen Forest	156.3	1.70%	20444.1	3.01%	0	0.00%	20600.4	2.99%
(9) Mixed Forest	0	0.00%	0	0.00%	0	0.00%	0	0.00%
(10) Deciduous Woody/Herbaceous	149.2	1.62%	20474.7	3.01%	0	0.00%	20623.9	2.99%
(11) Evergreen Woody/Herbaceous	0	0.00%	0	0.00%	0	0.00%	0	0.00%
(13) Woody-Dominated Wetlands	396	4.31%	4757.7	0.70%	0	0.00%	5153.7	0.75%
(14) Herbaceous-Dominated Wetland	110.9	1.21%	385.2	0.06%	0	0.00%	496.1	0.07%
(15) Open Water	297.8	3.24%	14042.2	2.07%	0	0.00%	14340	2.08%
TOTALS	9192.2		679792.3		0		688984.5	
% OF TOTAL		1.33%		98.67%				

Only 4% of the watershed is in cropland, 41% is in grassland, and 45% is in deciduous forest.

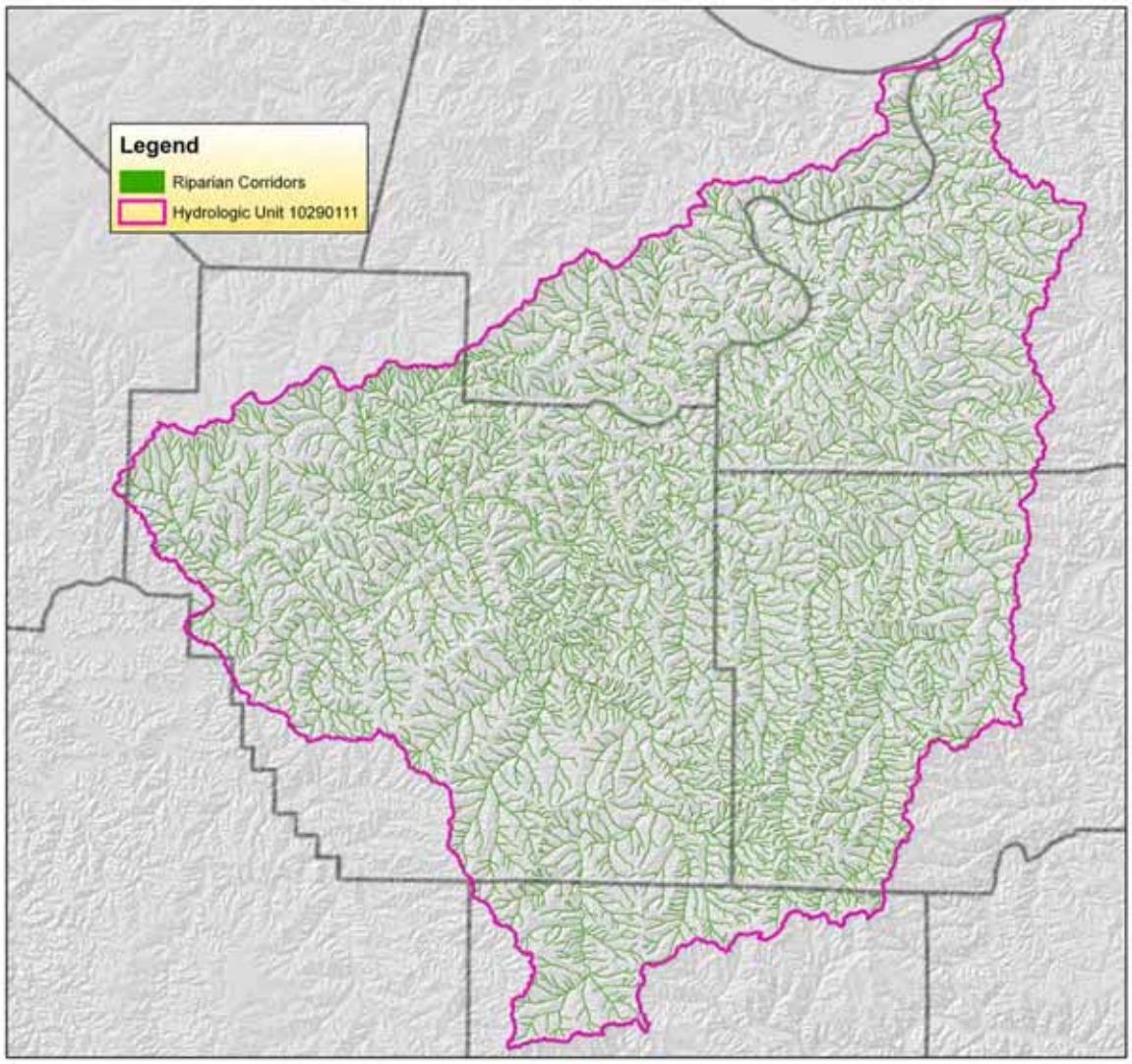
Land Cover / Land Use – Continued

LAND CAPABILITY CLASS		Acres	Percent
~Based on Cropland and Pastureland only	**I**	2469.1	0.81%
~Uses Non-Public Lands only	**II**	31832.8	10.43%
	III	151924.5	49.77%
	IV	55884.5	18.31%
	V	163.2	0.05%
	VI	53816.5	17.63%
	VII	9166.2	3.00%
	VIII	3.9	0.00%
	Total Acres Croplands and Pasturelands	305260.7	

Capability class is the broadest category in the land capability classification system. Class codes 1, 2, 3, 4, 5, 6, 7, and 8 are used to represent both irrigated and non-irrigated land capability classes.

Class I soils have slight limitations that restrict their use.
Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.
Class III soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.
Class IV soils have very severe limitations that restrict the choice of plants or require very careful management, or both.
Class V soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
Class VI soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
Class VIII soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

Riparian Corridors



A Riparian Corridor is a unique plant community that grows near a river, stream, lake, or other natural body of water. This vegetation serves a variety of functions that helps maintain the quality of water which it envelopes, including: filtering sediment from runoff before it enters rivers and streams, helping protect stream banks from erosion, providing storage area for flood waters, and providing habitat and food for fish and wildlife. A Riparian Corridor also maintains green spaces and other aesthetics associated with stream banks and lake shores.

These corridors have been built by buffering the National Hydrology Dataset (NHD) by 50 feet, and using the created buffered lines to clip out data from the Common Land Unit (CLU) dataset.

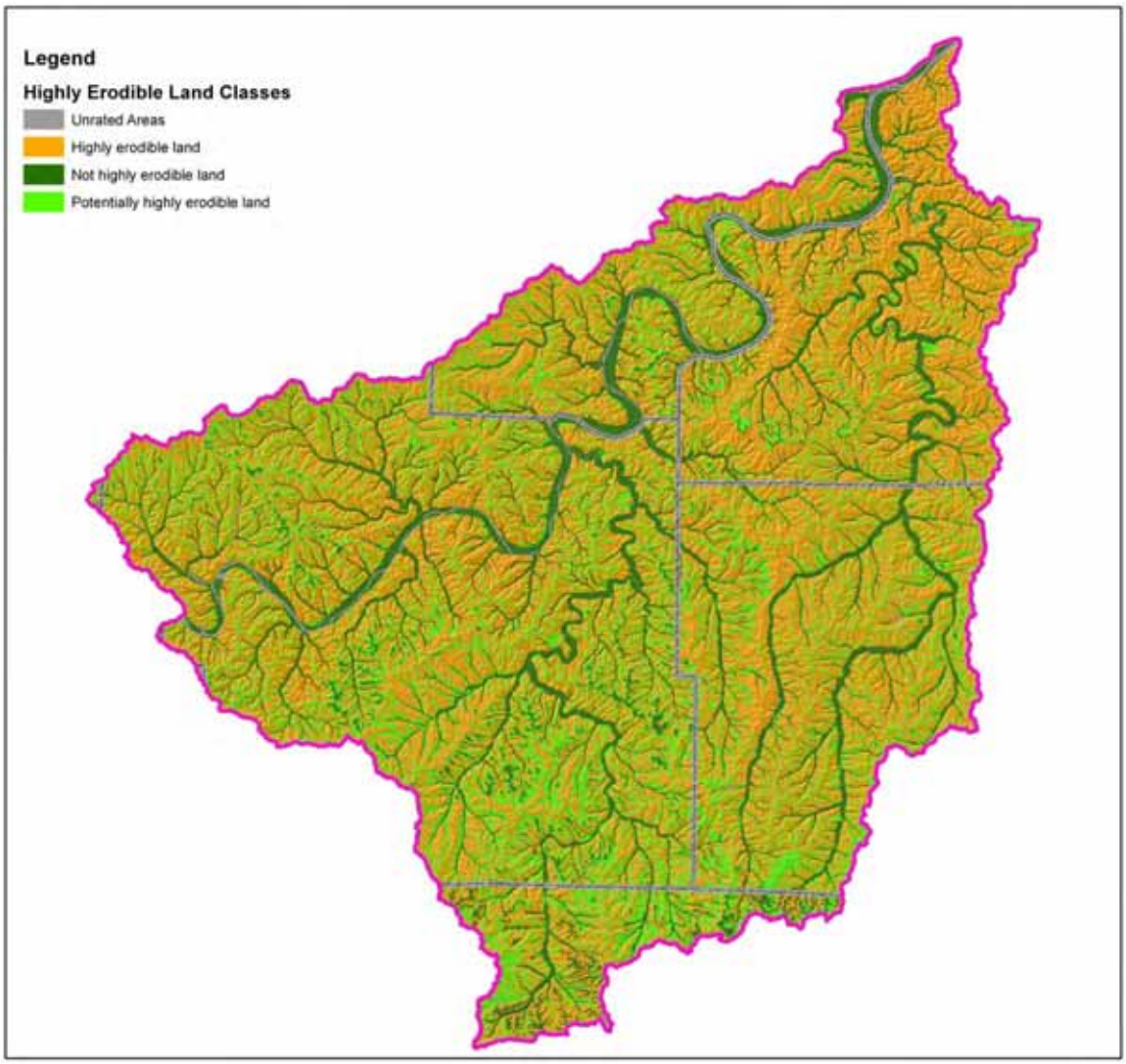
Riparian Corridors – Continued

Most of the Riparian Corridors are found on agricultural land (cropland or forestland) within the watershed.

Riparian Corridor Lands		TOTALS	
		Acres	%
	*Crop OR unclassified OR Public Land	25231	64.42%
	Urban	104	0.27%
	Cropland	2546	6.50%
	Rangeland	40	0.10%
	Forestland	9830	25.10%
	Water	731	1.87%
	Mined Land	1	0.00%
	Other Agriculture Lands	678	1.73%
	Unclassified	4	0.01%
	TOTALS	39165	

* These figures have been developed from attributes usually limited to areas that are not USDA program fields. Sometimes if there are program fields included, it is added as "crop", however it can also just mean that it is public land, has yet to be evaluated, or is undetermined as to what is there.

Highly Erodible Lands

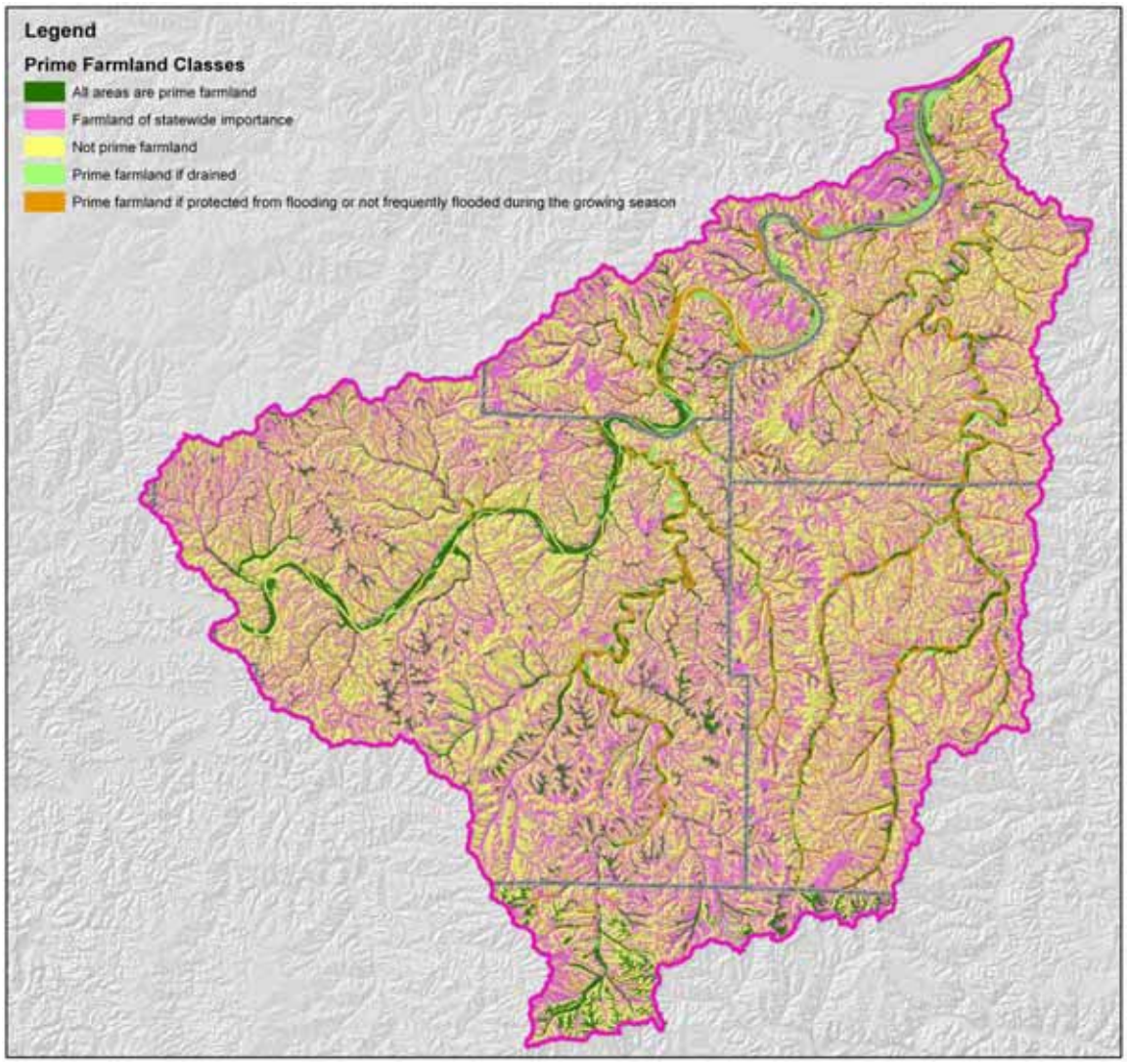


Erosion is defined as the wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Roughly 84% of the lands in the Lower Osage River sub-basin are defined as either Highly Erodible or Potentially Highly Erodible.

HIGHLY ERODIBLE LANDS		Acres	Percent of Total
	Unrated Areas	7125	1.03%
	Highly Erodible Land	411380	59.70%
	Not Highly Erodible Land	106249	15.42%
	Potentially Highly Erodible Land	164283	23.84%
	TOTAL	689037	

Prime Farmland



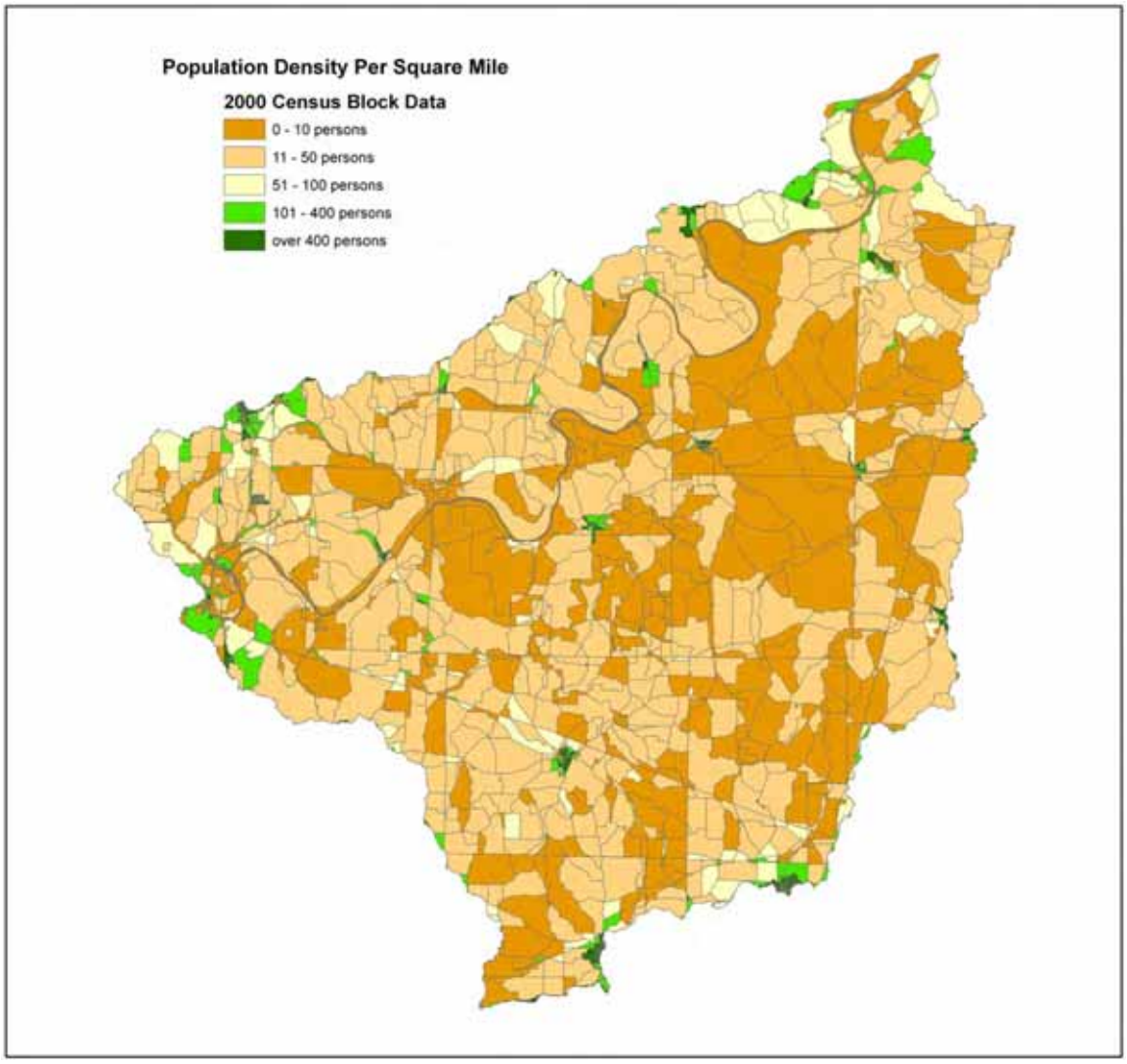
Prime Farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses.

Prime Farmland – Continued

PRIME FARMLANDS		Acres	Percent of Total
	All Areas are Prime Farmland	45268	6.57%
	Farmland of Statewide Importance	241457	35.04%
	Not Prime Farmland	365570	53.06%
	Prime Farmland if Drained	11012	1.60%
	Prime Farmland if Protected from flooding, or not frequently flooded during the growing season	25730	3.73%
	TOTAL	689037	

Just over 41% of the farmland in the watershed is classified as Prime Farmland or Farmland of Statewide Importance; 53% is classified as Not Prime Farmland. Another 5% would be considered prime farmland if it were drained or otherwise protected.

Census Data

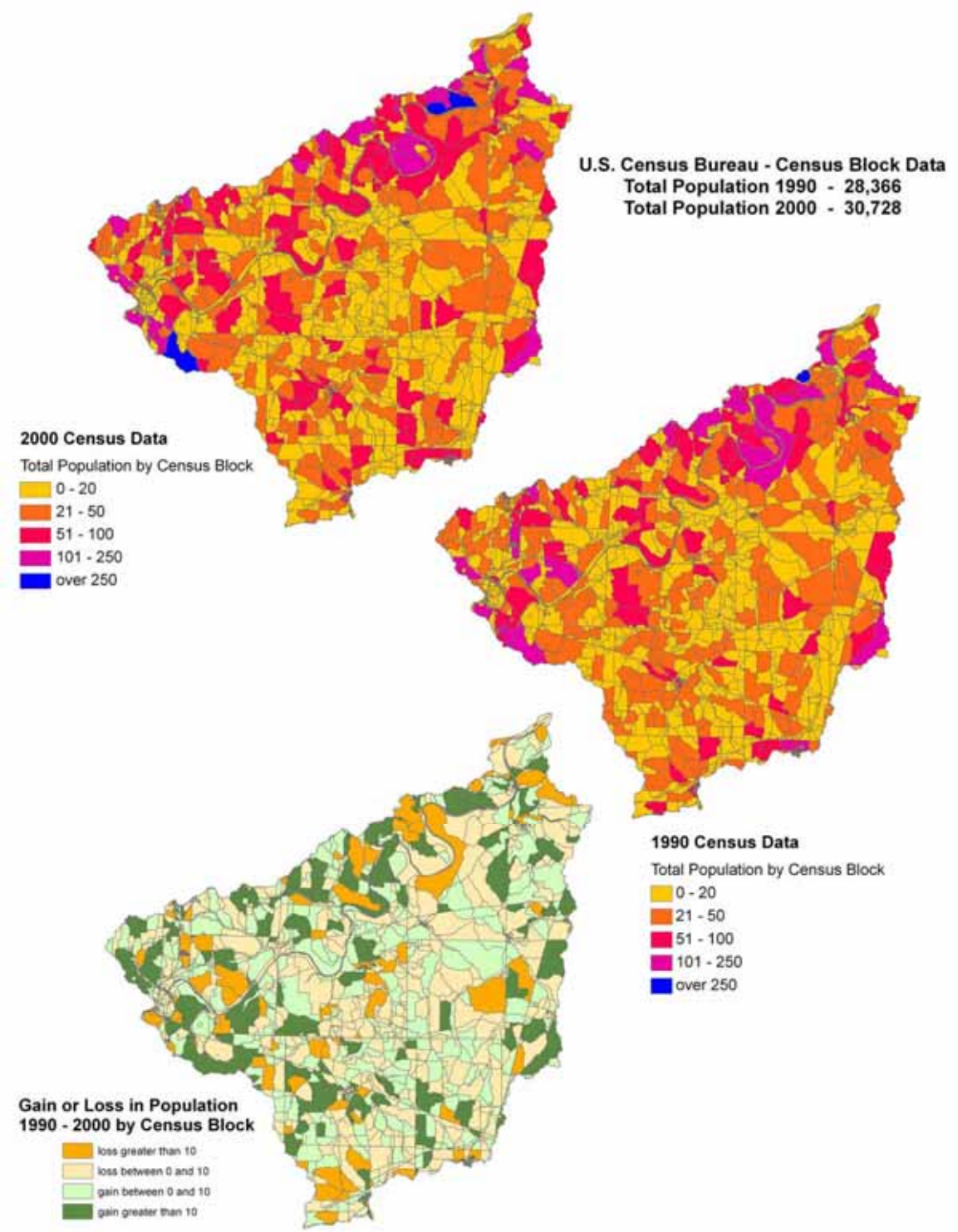


This map is based on 2000 U.S. Census Block data. It distributes the population evenly over the entire area of a block.

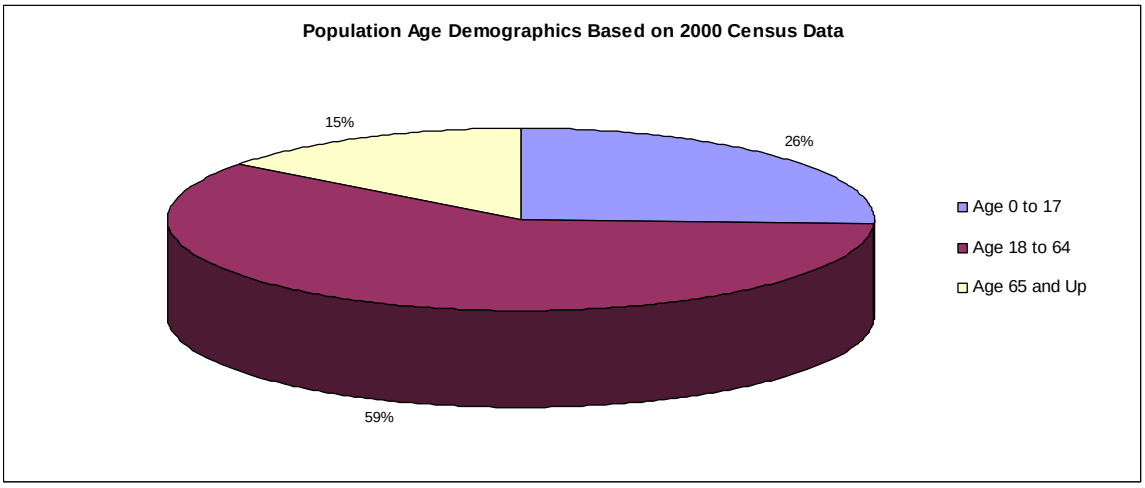
As expected, the higher density areas appear where urban areas are located. In this case, the highest population per square mile occurs where the towns of Eldon, Iberia, and Dixon are located. Other areas of high population (50 – 100 per square mile) are near the towns of Lake Ozark, next to The Lake of the Ozarks, and Taos, which has a close proximity to Jefferson City.

The least dense areas are on the north end of the watershed at the Missouri River, and also on the southern edges in Pulaski and Maries Counties.

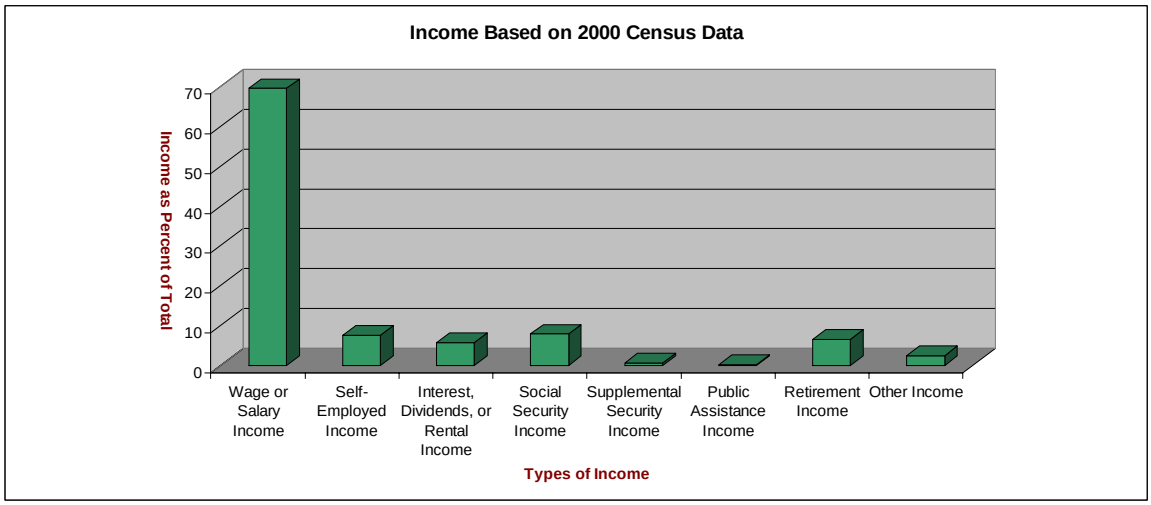
Census Data – Continued



Census Data – Continued

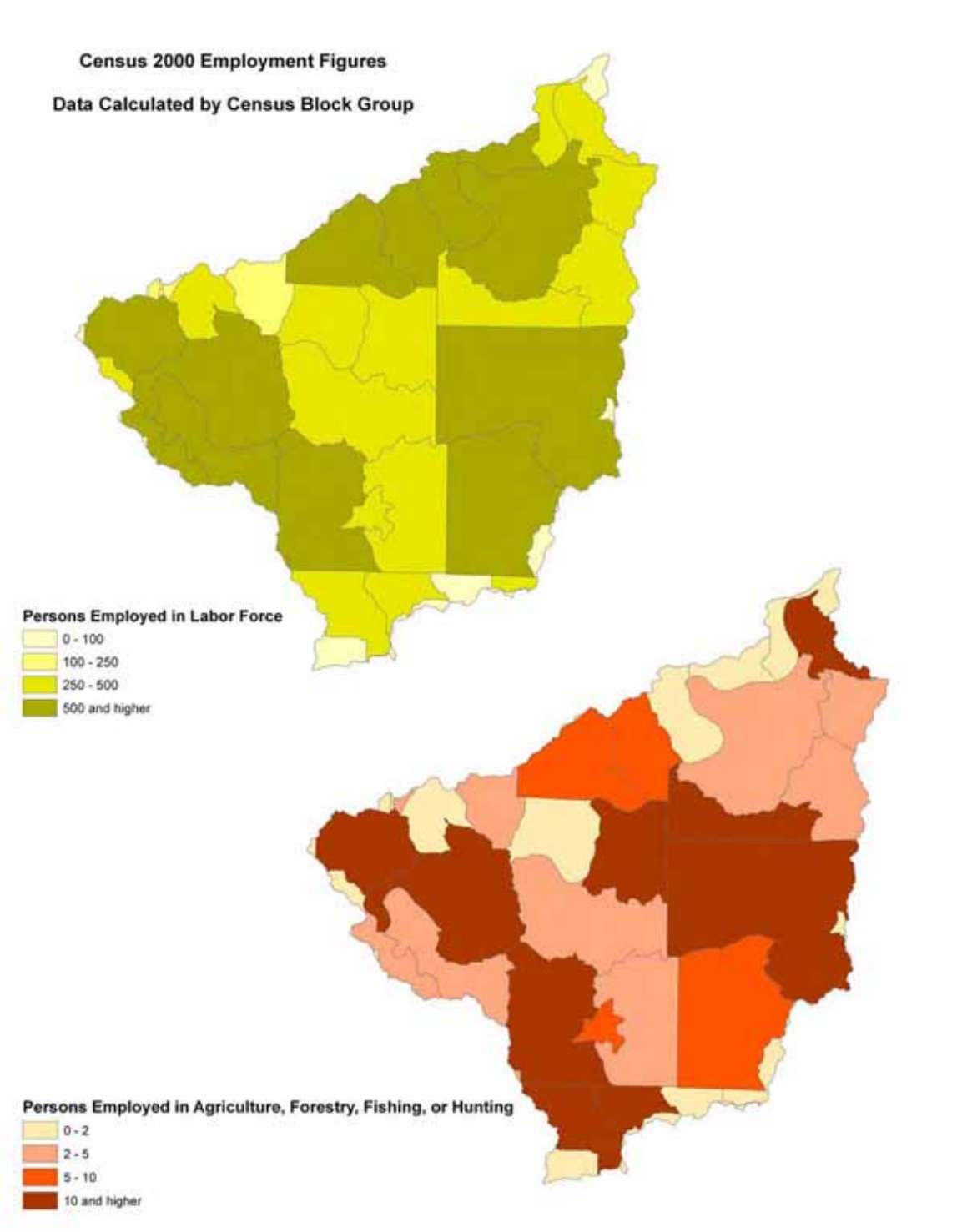


According to the Census Bureau, well over half of the population in the watershed falls between the ages of 18 and 65. Additionally, most of the income earned in this watershed comes from wages or salaries.

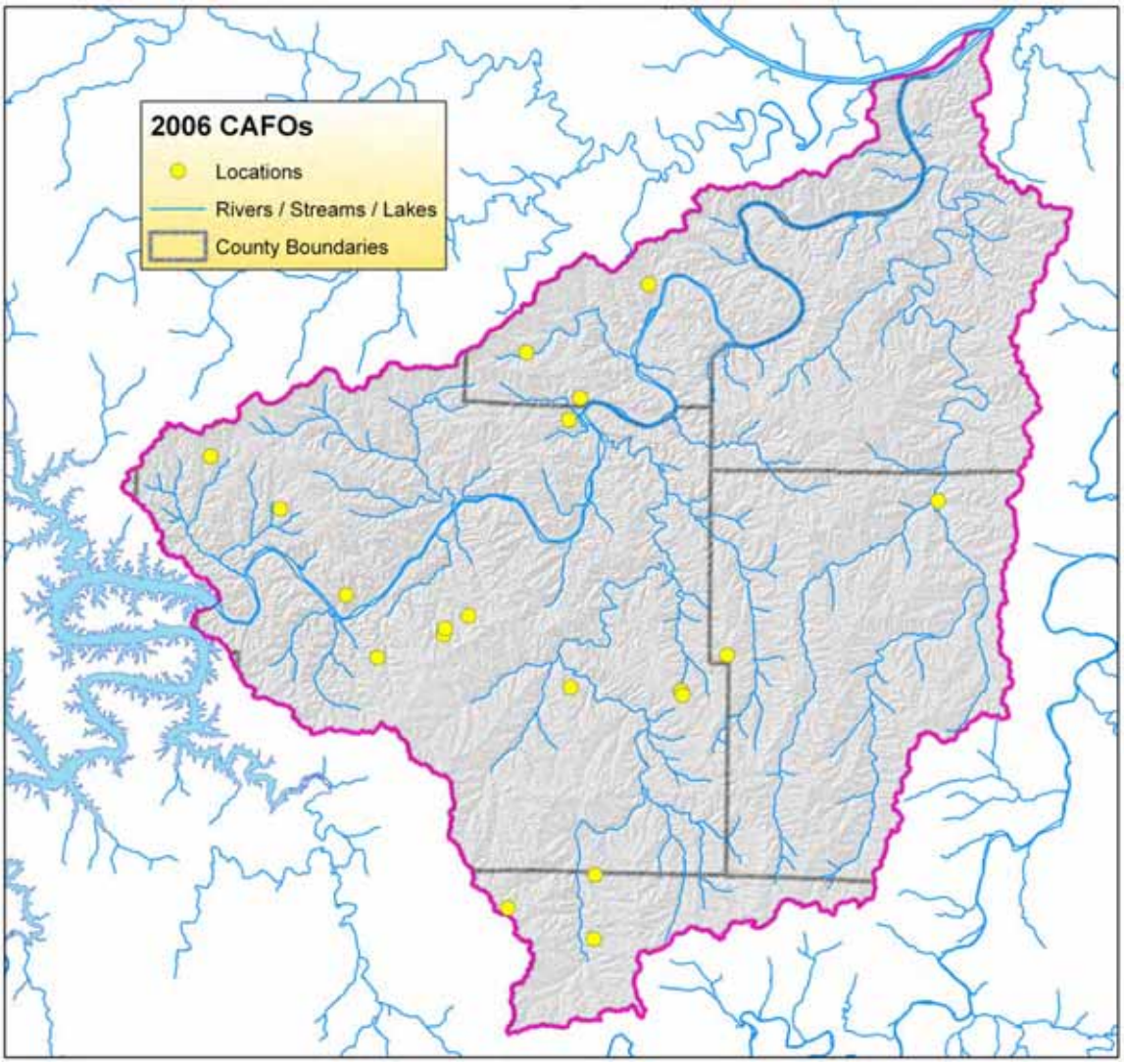


Agriculture income is not separated from other types of income in this graph. Farmers who own and work their own farms or ranches are included as Self-Employed. Farm hands and others who do not work their own land, and are paid employees are included as Wage and Salary Income.

Census Data – Continued



Confined Animal Feeding Operations



Confined Animal Feeding Operations (CAFOs) are special agriculture facilities that consist of large numbers of animals that are housed and fed in a confined space for a limited period of time. The official definition of a CAFO is as follows:

An operating location where animals have been, are, or will be stabled or confined and fed or maintained for a total of forty-five (45) days or more in any twelve (12)-month period, and a ground cover of vegetation is not sustained over at least fifty percent (50%) of the animal confinement area and meets one (1) of the following criteria: A.) Class I operation; or B.) Class II operation that discharges through a man-made conveyance or where pollutants are discharged directly into waters of the state which originate outside of and pass over, across or through the operation or otherwise come into direct contact with the animals confined in the operation.

Confined Animal Feeding Operations - Continued

Of the 20 permitted CAFOs in the watershed, all are swine operations located predominately in the western portion of the watershed.

Definition of Animal Units:

1 Animal Unit =					
1	Beef feeder or slaughter animal	2.5	Swine weighing over 55 lbs.	30	Chicken laying hens
0.5	Horse	15	Swine weighing less than 55 lbs.	60	Chicken layer pullets
0.7	Dairy cow	10	Sheep	55	Turkeys
				100	Broiler chickens

CONFINED ANIMAL FEEDING OPERATIONS - MISSOURI CAFO PERMIT - 2006

Animal Type	No. of Permitted Farms	No. of Permitted Animals
Dairy		
Feedlot		
Poultry		
Swine	20	24,601
Other		

State Regulations restrict where CAFOs can be located, based on setbacks from dwellings and wells. These setbacks are also based on the total number of animal units housed at each facility.

Facility Setback:			
Feature	Facility Size	Requirement	Regulating Authority
Dwelling (Non-Owned)	1000 to 2999 AU 3000 to 6999 AU 7000 AU or more	1000 feet 2000 feet 3000 feet	State of Missouri
Well	All	100 feet (poultry litter) 300 feet (other)	State of Missouri

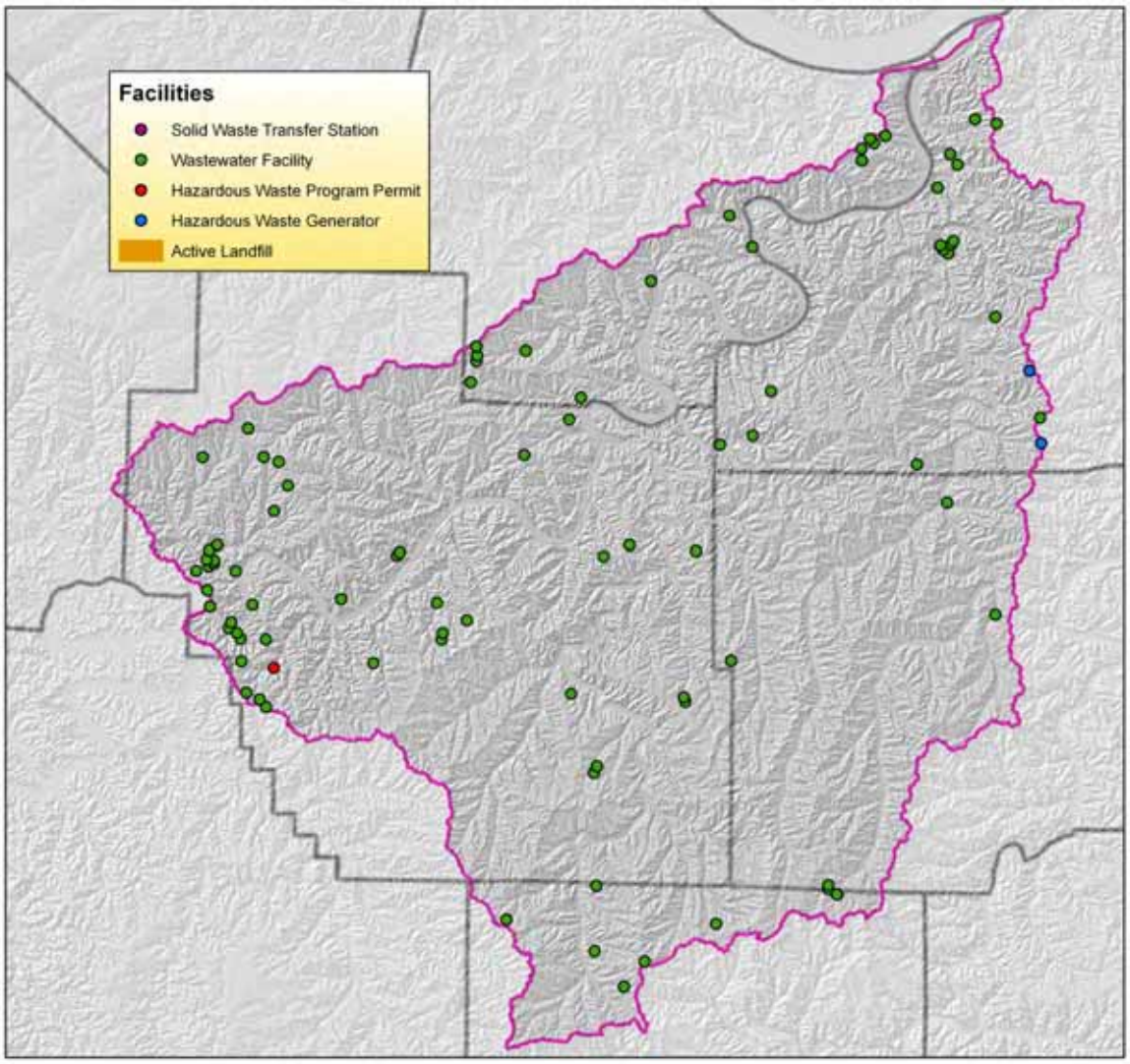
Confined Animal Feeding Operations - Continued

Additional Setbacks:
Of the six counties that contribute area to the Lower Osage River sub-basin, only Camden County has additional restrictions as imposed by County Health Ordinance.

Facility Setback:			
Feature	Facility Size	Requirement	Regulating Authority
Dwelling (Non-Owned), Well, Incorporated Area, Stream, River, Lake, or Water Supply Structure	250 to 2999 AU 3000 to 6999 AU 7000 AU or more	5280 feet 7920 feet 10560 feet	Camden County
Other CAFOs[1]	All	2640 to 10560 feet	Camden County
Lagoon construction is prohibited within 5 miles of the 665 foot elevation of the shoreline of Lake of the Ozarks.			Camden County

[1] County restrictions have different classifications for CAFOs than state standards. You will need to read the county legislation for specifications and size classifications.

Solid Waste and Wastewater Facilities



Solid waste management permitting, monitoring and enforcement efforts can prevent illegal dumping and other factors that may cause long-term social, economic and environmental problems.

Solid Waste Transfer Station: active solid waste transfer stations in Missouri.

Wastewater Facility: outfall locations of wastewater facilities with Missouri National Pollutant Discharge System (NPDES) Operating Permits.

Hazardous Waste Program Permits: sites permitted to treat, store or dispose of hazardous waste and facilities that are certified for resource recovery. Some of the permitted sites have known or suspected hazardous contamination.

Solid Waste and Wastewater Facilities – Continued

Hazardous Waste Generator: large quantity hazardous waste generators registered in Missouri.

Active Landfills: permitted active landfills in Missouri.

Permitted Facilities

Facility Type	Total
Hazardous Waste Generators	2
Hazardous Waste Program Permits	1
Wastewater Facilities	90
Solid Waste Transfer Stations	0
Active Landfills	0

Drinking Water

Ground Water (Public Wells)	
Total population served by public wells	35653
Community population served by wells	33015
Non-community, non-transient population (schools, factories)	1246
Non-community, transient population (campgrounds, state parks)	1392
Total wells	2361
Public wells	67
Community wells	31
Non-community, non-transient population	7
Non-community, transient	14
Private wells	2294

Of the total population served by public wells, approximately 90% are using community wells.

Surface Water (Reservoir Used for Public Drinking)	
Total population served by surface water	0
Community population served by surface water	0
Non-community, non-transient population (schools, factories)	0
Non-community, transient population (campgrounds, state parks)	0
Total number of intakes	0

None of the population is served by surface water.

Resource Concerns

Endangered and Threatened Species

THREATENED AND ENDANGERED SPECIES LISTED FEDERALLY AND BY STATE		
State or Federally listed	**Species**	**Endangered Status**
State	Lake Sturgeon - *Fish*	Endangered
State	Elephantear - *Mollusk*	Endangered
State / Federal	Bald Eagle - *Bird*	State - Endangered / Federal - Threatened
State / Federal	Pink Mucket - *Mollusk*	State - Endangered / Federal - Endangered
State / Federal	Gray Bat - *Mammal*	State - Endangered / Federal - Endangered
State	Flathead Chub - *Fish*	Endangered
Federal	Spectaclecase - *Mollusk*	Candidate
State	Greater Prairie Chicken - *Bird*	Endangered
State / Federal	Niangua Darter - *Fish*	State - Endangered / Federal - Threatened
State	Ebonyshell - *Mollusk*	Endangered
State / Federal	Indiana Bat - *Mammal*	State - Endangered / Federal - Endangered
State	Eastern Hellbender - *Amphibian*	Endangered
Listed by U.S. Fish and Wildlife ***Listed by Missouri Department of Conservation***		

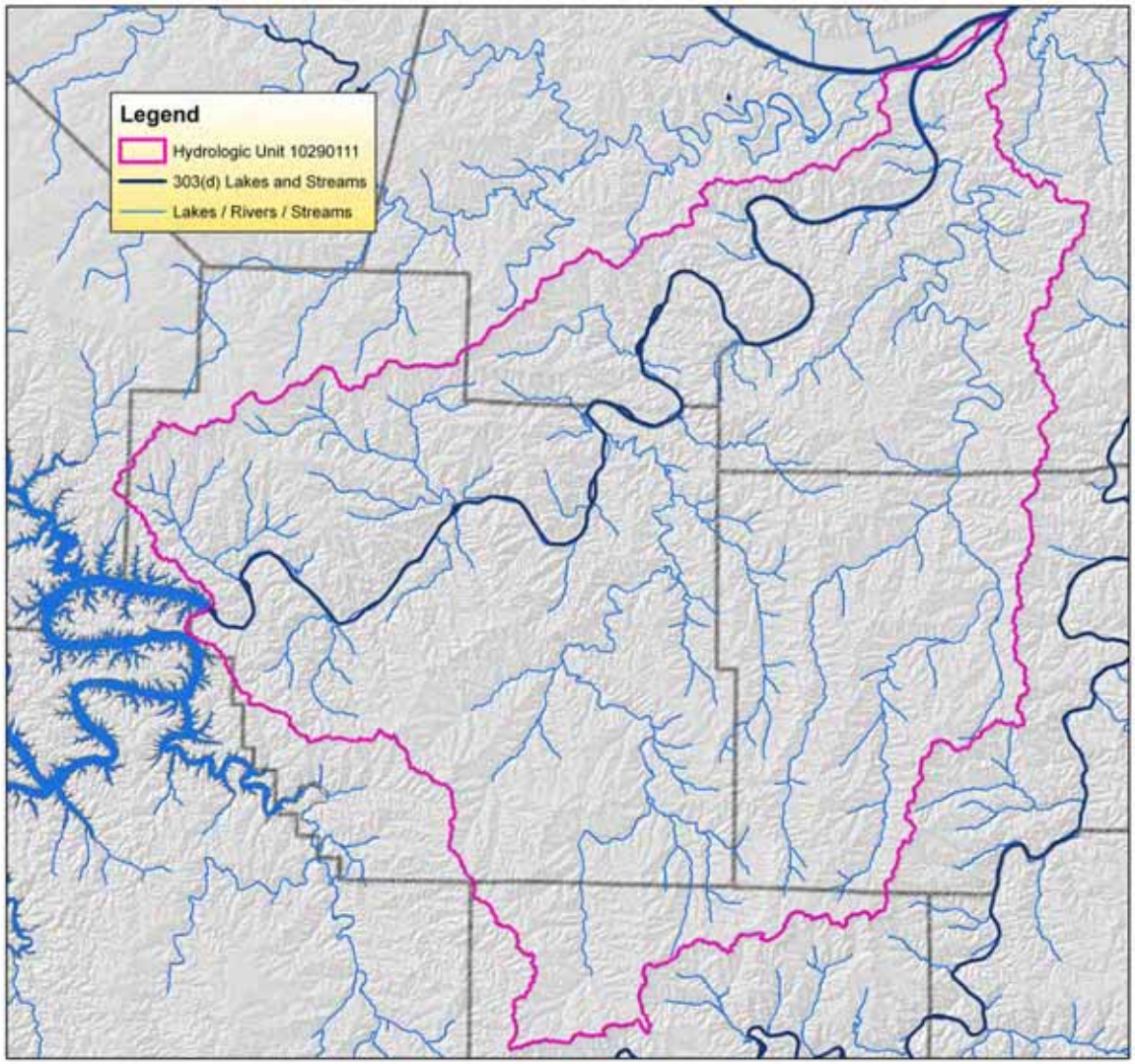
Several of the endangered and threatened species listed at the state and federal levels are dependent upon water.

Stream Flow Data

STREAM FLOW DATA			
	USGS 06926510 Osage River below St. Thomas, MO as recorded 1997-2005	**Total Avg. Yield**	11,489 CFS
		May - Sept. Yield	11,164 CFS
	USGS 06926000 Osage River near Bagnell, MO as recorded 1930-2005	**Total Avg. Yield**	10,193 CFS
		May - Sept. Yield	10,268 CFS

Resource Concerns – Continued

303(d) Listed Lakes and Streams



The only 303(d) listed stream or lake in the Lower Osage River sub-basin is the Osage River as it stretches from Bagnell Dam, at the Lake of the Ozarks, to the Missouri River east of Jefferson City.

303(d) listed waters are named from Section 303(d) of the federal Clean Water Act. This Act requires that each state identify waters that are not meeting water quality standards, and for which adequate water pollution controls have not been required. Additional information on 303(d) listed waters, Impaired Waters, and Total Maximum Daily Loads (TMDL) can be found on the Missouri Department of Natural Resources website at:
http://www.dnr.mo.gov/env/wpp/tmdl/index.html

Resource Concerns – Continued

STREAM DATA		Miles	Percent
	Total Miles - Major Streams	581	100%
	303(d) Listed Streams	82	14.1%

Local Stakeholder Meetings

Meetings with local stakeholders were held at two locations – Westphalia and Tuscumbia (one of the initial meetings was held in Linn, but the second meeting was moved to Westphalia to a more centralized location) – within the Lower Osage Watershed (see following table). These locations were chosen to obtain as widest as possible set of venues that would be convenient for local stakeholders to meet and provide the information needed from them. The information obtained consisted of crops grown in the area, cropping practices, conservation practices and natural resource issues. Two meetings have been held and a third is scheduled (See following table). These meetings are described below.

Attendance at Rapid Watershed Assessment Meetings – Lower Osage Watershed

Initial Meeting			Invitees*	Second Meeting		
Date	Location	Attendees		Date	Location	Attendees
1 - 11	Linn	14	44	3 - 28	Westphalia	18
1 - 30	Tuscumbia	9	24	5 - 30	Tuscumbia	7

* Invitees with verified addresses

Initial meeting – A small group (8 – 12) of key landowners were identified by SWCD and NRCS personnel and invited to attend these meetings. SWCD and agency staff was also invited. At this initial meeting, following a presentation describing the project, we asked attendees to identify other key landowners in the larger watershed so we might invite them to another meeting within a month or so to obtain the information described above.

Following this meeting, mailing addresses were obtained from several sources on the World Wide Web. Letters of invitation were mailed approximately two weeks prior to the actual meeting.

Second meeting - At this second meetings, University of Missouri Extension Water Quality Program personnel facilitated a discussion with the group to elicit crops grown, crop yields, cropping/grazing practices, conservation practices applied, resource concerns and resource issues within the watershed.

Final meeting – In April of 2008, a final series of meetings were held in Eldon and Westphalia where findings were reported back to the groups as a check for accuracy and their opinions regarding the overall utility of the information gathered.

Resource Concerns – Continued

Cropping Practices

Tuscumbia - Row crops are less than 5% of the area

A. Species
1. Corn: some used for feed, ground corn; some cropped; grown primarily in the bottoms
2. Soybeans: primarily single crops; some double cropping
3. Wheat: used for hay and crop; seed is used to replant
4. Milo: few fields

B. Rotation
1. Corn, beans, wheat

C. Yields
1. Corn: average 100 – 150 bushels/acre; silage 16-18 tons per acre
2. Soybeans: average 50-60 bushels/acre (single crop); 2006 average – 40 bushels /acre
3. Wheat: 10-12 tons/ acre (silage)

D. Tillage
1. No-till
2. Conservation
3. Chisel plowing
4. Conventional moldboard (most use a chisel plow)

E. Fertilization
1. Manure- hog, turkey; 60 hog and turkey operations
2. Soil tests about every other year to determine nutrient needs are an exception not the rule
3. Commercial fertilizer
    1. Corn: 150-30-100 will add more nitrogen later if stand is good
    2. Beans: if double cropped not fertilized, fertilized according to soil test
    3. Wheat: fertilized according to expected yield, based on how it is growing, top dress in spring, based on fertilizer prices
4. Lime- based on soil test
5. Herbicides
    1. Corn: atrazine, RoundUp ready, lots of Johnson grass
    2. Beans: RoundUp ready, canopy
    3. Wheat: generally no herbicide used
6. Seed Treatment
    1. Corn: pretreated with Poncho
    2. Beans: can purchase with a fungicide - used for early planting; generally no inoculation

Resource Concerns – Continued

Westphalia

A. Species/Yields
   1. Corn: 125 – 200 bu/ac
   2. Soybeans: 30 – 60 bu/ac
   3. Wheat: 60 – 70 bu/ac
   4. Milo: 80 – 125 bu/ac
   5. Sunflowers: specialty market

   * Rotations depend on time, weather, soil, and price

B. Tillage
   1. No-till
   2. Conventional

C. Fertilization
   1. Commercial
   2. Manure (most likely livestock)
   3. Lime pastures and crops
   4. Soil tests - 3-4 years; used by most

D. Herbicide
   1. Soybeans: 99% RoundUp ready, self-inoculate
   2. Corn: 1/2 RoundUp ready, atrazine, broad-spectrum
   3. No fungicide; seed treatment – Poncho, Gaucho

Resource Concerns – Continued

Pastures/Hay

Tuscumbia

A. Species
   1. Fescue: inter-seeded with red, white, and ladino clover, lespedeza; split nitrogen application; some straight fescue for seed
   2. Orchard grass
   3. Timothy: for horses
   4. Eastern gamma grass
   5. Big Bluestem
   6. Switchgrass
   7. Indiangrass

B. Fescue -
   1. Early April
   2. 200 lbs of 19-19-19

C. Hay - Soil test every 5 years

D. Seed production - Fertilize earlier than for pasture; fertilize in February

E. Pasture - Add nitrogen in August for fall growth

F. Lime - Most fescue grown used for seed and seed is not limed

G. Yields
   1. Fescue: 3-4 tons/ acre; 5 tons in river bottoms; hill ground try to get 4 tons/acre
      - With turkey litter get higher yields
      - Seed up to 500 lbs/acre
      - Plant in August
   2. Rye Grass: 5 tons per acre, graze October through January
      - Based on soil test; in fall put on complete fertilizer; top dressed with 30-40 lbs dry nitrogen
   3. Hay: cut in mid-May (sometimes can get two cuttings will let go to seed to re- establish)

Westphalia

A. Fescue – the number 1 crop in the area
   1. Some legume inter-seeding
   2. >50% spring-fertilize heavy and hay or cut seed, then hay
   3. <50% fertilize spring and fall
   4. Yield- 2 tons/ac, low side; 3-4 tons/ac. if managed well with good weather

B. Orchard grass

C. Rye (annual/perennial)

D. Cereal grains

E. Alfalfa - dairy

F. Warm season grasses – some, experimental

Resource Concerns – Continued

Grazing

Tuscumbia

A. Fescue and other species previously listed
   1. Hill ground: grazed in spring; May - hay, then graze
   2. Bottom ground, graze in the hotter months, May – hay, then graze; October - cattle go back to the hill ground
   3. Winter - back to the bottoms, when grazed off cattle go to hay lot

B. Rotation- most use some form of rotation among pastures on hill ground as well as bottoms; 5-7% of the acreage in intensive short duration systems

C. Water source
   1. Creeks, springs, ponds (about ½ ponds are improved), wells

D. Nutrient management planning
   1. Spread manure on different areas for pasturing cattle to distribute
   2. Less than 10 % of the watershed is under a nutrient management plan

Westphalia

A. Predominately fescue
   1. 50/50 rotational versus continuous; some intensive, high density
   2. Mostly beef cattle

B. Fertility
   1. Fertilize: once each year in the spring
   2. Lime: every 4-5 years

C. Stocking rate
   Continuous: 1 head/acre; begin grazing on April 1; for 7-8 months; provide protein supplement

D. Water
   1. Ponds
   2. Wells - important in the winter
   3. Creeks
   4. Springs

E. Nutrient Management
   1. Becoming a necessity with increasing fertilizer costs
   2. Buy manure- turkey litter: local purchases within 10-15 miles (max.)

Resource Concerns – Continued

Conservation Practices

Tuscumbia

- Rotation grazing
- Nutrient management
- Soil tests
- Fencing cattle out of the woods
- Pond construction
- Fence out waterways
- Spring development
- Wildlife food plots
- Some edge feathering on recreational property
- Terraces
- Minimum tillage and no-till
- Field borders

Westphalia

- Ponds
- No-till
- Terraces (very few)
- Most crops in bottoms
- Grass waterways
- Buffers - some CRP and little riparian
- Livestock excluded from timber and streams
- Wildlife - more popular
- Legume over-seeding
- Timber harvest/TSI - primarily on hunting; new purchases - recreational

Resource Concerns – Continued

Natural Resource Issues

Tuscumbia

- Eroding riverbanks along the Osage River
- Bagnell dam release
- No old timber along river banks
- Drop water level too fast
- Poor water quality along the river due to expensive sewage on LOZ
- Along creeks the creek bed is higher than adjacent land because of restricted gravel removal
- Grassland management lack of management; over grazing
- Too many deer and turkey
- Beavers tear up riparian habitat
- Muskrats tear up lagoons
- Gully erosion
- Urban encroachment in some
- Rising land prices because of recreational land hunting purchases
- Creates higher property taxes
- Number of wells and drought lowered the water table causing some to have deeper wells
- Increased littering and trespass (ATVs) especially during mushroom and hunting seasons
- Liability concerns

Westphalia

- Acreages going to non-agriculture - more wildlife, hunting, and recreation
- Stream bank erosion: wave action/ boating
- Management of Osage River water level because of dam and Lake of the Ozarks
- Increasing land prices - driven by recreation, acreages vary, development
- Houses on river
- Trespassing: arrowhead hunters, hunting, ATV riding
- Majority of water quality problems begin at Lake of the Ozarks
- Trash
- Water quality problems
- Sewage/house -more in Cole County
- Highway construction
- Not enough gravel removal - fear of regulation
- Confined feeding
    - No county regulations
    - Most small enough- no permit required
    - Numbers are decreasing - depends on feed prices and livestock prices

Rapid Watershed Assessments – Matrix Data

Rapid watershed assessments provide initial estimates of where conservation investments would best address the concerns of landowners, conservation districts, and other community organizations and stakeholders. These assessments help land-owners and local leaders set priorities and determine the best actions to achieve their goals.

The rapid assessment matrix summarizes, in tabular form, current and future resource conditions and their qualitative effect on primary resource concerns. The matrix also summarizes future resource conditions by cost, including: installation, annual operations, initial and annual management, and technical assistance.

The following matrix model was developed from Oregon NRCS, but has been customized to represent Missouri conditions and related economic figures. Input for the model was solicited from district conservationists from each watershed, who identified the resource concerns and typical conservation practice systems installed. As with any modeling effort, it is necessary to make assumptions and generalizations. However, these reports contain estimates from local and experienced field conservationists.

For the Lower Osage River Watershed, the assessment is comprised of four separate land uses – in the following table, the pages in parenthesis show where the respective assessment summary matrices are located.

Land use characteristics used in Assessment Matrix development.

Land Use	Watershed Total (acres)	Typical Unit Size (acres)	Estimated Participation* (%)
Cropland (p. 45-46)	27,097	20	14
Forestland (p. 47-48)	349,780	80	11
Grassland (p. 49-51)	279,934	20	22
Urban (p. 52-53)	3,822	5	24

* Calculated Participation Rate = Future Treated Acres / (Current Base Acres + Current Progressive Acres)

The assessment matrix for each land use identified is presented as two tables.

Assessment Information – summarizes the practices at each treatment level, the quantities of practices for current benchmark conditions and projected future conditions. It also displays the four major resource concerns along with practice effects and adds a "systems rating" indicating the overall effectiveness of the conservation system used at each level.

Rapid Watershed Assessments Matrix – Continued

Conservation Systems are identified by different conservation practices within **Treatment Levels**, as described below.
Baseline System – represents those landowners who typically are not participating in conservation programs.
Progressive System – is a level of conservation adoption that is leading to a full Resource Management System (RMS).
Resource Management System – is a system of conservation practices that address all the SWPA resource concerns typically seen for this land use in the watershed.

Each table includes the four highest priority **Resource Concerns** that typically must be dealt with for that particular land use in the watershed. Other resource concerns might be identified in the profile, but they will not be identified in the matrix. For each resource concern, a numerical **Practice Effect** rating is identified which is the default rating from the statewide Conservation Practice Physical Effects (CPPE) for both the selected resource concerns and conservation practices. The **System Rating** shown for each conservation system indicates the overall effectiveness of the conservation system used at each treatment level.

Current Conditions and Future Conditions, in terms of units of practices within the respective conservation systems, are shown for current benchmark conditions as well as for projected future conditions for each particular conservation practice that is identified within the resource concerns.

Conservation Investment Information – summarizes the installation, management, operation and maintenance costs, by practice and treatment level, for the projected future conditions by federal and private share of the costs. This table also includes the current benchmark and projected future conditions conservation status bars for the Progressive System and the Resource Management System.

USDA Investment costs are shown for each practice included within the different conservation systems.
Installation Costs are shown at a 50% cost-share rate.
Management Costs are shown for a 3-year period, at a 100% rate.
Technical Assistance Costs are shown at a 20% cost-share rate.
Total Present Value of Costs is the summation of all of the preceding costs, by conservation practice.

Private Investment costs are shown for each practice included within the different conservation systems.
Installation Costs are shown at a 50% cost-share rate.
Annual Operation and Management Costs are shown at a 100% rate.
Total Present Value of Costs is the summation of all of the preceding costs, by conservation practice.

WATERSHED NAME & CODE	LOWER OSAGE - 10290111	LANDUSE ACRES	27,097
LANDUSE TYPE	CROPLAND	TYPICAL UNIT SIZE ACRES	20
ASSESSMENT INFORMATION		ESTIMATED PARTICIPATION	14%

CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Soil Erosion – Classic Gully	Soil Condition – Contaminants: Animal Waste and Other Organics – P	Plant Condition – Productivity, Health and Vigor
Baseline System			System Rating ->		3	4	1	4
Total Acreage at Baseline Level	**21,678**	**18,426**	**0**	**18,426**				
Critical Area Planting (ac.) 342	1,084	921	0	921	5	4	0	5
Fence (ft.) 382	4,292,165	3,648,340	0	3,648,340	0	0	0	0
Grade Stabilization Structure (no.) 410	1,084	921	0	921	0	5	0	0
Manure Transfer (no.) 634	1,084	921	0	921	0	0	1	1
Nutrient Management (ac.) 590	21,678	18,426	0	18,426	0	0	2	3
Progressive System			System Rating ->		3	4	2	4
Total Acreage at Progressive Level	**4,065**	**3,658**	**2,168**	**5,826**				
Critical Area Planting (ac.) 342	203	291	0	291	5	4	0	5
Fence (ft.) 382	804,781	1,153,519	0	1,153,519	0	0	0	0
Grade Stabilization Structure (no.) 410	203	291	0	291	0	5	0	0
Manure Transfer (no.) 634	203	291	0	291	0	0	1	1
Nutrient Management (ac.) 590	4,065	5,826	0	5,826	0	0	2	3
Pipeline (ft.) 516	203,228	182,905	108,388	291,293	0	0	0	2
Waste Treatment Lagoon (no.) 359	203	183	108	291	0	0	3	2
Resource Management System (RMS)			System Rating ->		3	4	2	4
Total Acreage at RMS Level	**1,355**	**1,355**	**1,490**	**2,845**				
Animal Mortality Facility (no.) 316	68	68	75	142	0	0	0	0
Critical Area Planting (ac.) 342	68	142	0	142	5	4	0	5
Fence (ft.) 382	268,260	563,347	0	563,347	0	0	0	0
Grade Stabilization Structure (no.) 410	68	142	0	142	0	5	0	0
Manure Transfer (no.) 634	68	142	0	142	0	0	1	1
Nutrient Management (ac.) 590	1,355	2,845	0	2,845	0	0	2	3
Pipeline (ft.) 516	67,743	88,065	54,194	142,259	0	0	0	2
Waste Treatment Lagoon (no.) 359	68	88	54	142	0	0	3	2
Well Decommissioning (no.) 351	68	68	75	142	0	0	0	0

WATERSHED NAME & CODE	LOWER OSAGE - 10290111	LANDUSE ACRES	27,097
LANDUSE TYPE	CROPLAND	TYPICAL UNIT SIZE ACRES	20
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	14%

CONSERVATION SYSTEMS BY TREATMENT LEVELS	FUTURE	USDA INVESTMENT				PRIVATE INVESTMENT		
	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
Progressive System Acres Treated	**2167.76**							
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	0	$0	$0	$0	$0	$0	$0	$0
Grade Stabilization Structure (no.) 410	0	$0	$0	$0	$0	$0	$0	$0
Manure Transfer (no.) 634	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	0	$0	$0	$0	$0	$0	$0	$0
Pipeline (ft.) 516	108,388	$116,517	$0	$23,303	$139,821	$116,517	$0	$116,517
Waste Treatment Lagoon (no.) 359	108	$2,794,225	$0	$558,845	$3,353,070	$2,794,225	$167,654	$3,500,443
	Subtotal	**$2,910,742**	**$0**	**$582,148**	**$3,492,891**	**$2,910,742**	**$167,654**	**$3,616,960**
Resource Management System (RMS) Acres Treated	**1490.335**							
Animal Mortality Facility (no.) 316	75	$335,198	$0	$67,040	$402,237	$335,198	$33,520	$476,395
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	0	$0	$0	$0	$0	$0	$0	$0
Grade Stabilization Structure (no.) 410	0	$0	$0	$0	$0	$0	$0	$0
Manure Transfer (no.) 634	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	0	$0	$0	$0	$0	$0	$0	$0
Pipeline (ft.) 516	54,194	$58,259	$0	$11,652	$69,910	$58,259	$0	$58,259
Waste Treatment Lagoon (no.) 359	54	$1,397,113	$0	$279,423	$1,676,535	$1,397,113	$83,827	$1,750,221
Well Decommissioning (no.) 351	75	$20,820	$0	$4,164	$24,984	$20,820	$0	$20,820
	Subtotal	**$1,811,389**	**$0**	**$362,278**	**$2,173,667**	**$1,811,389**	**$117,347**	**$2,305,695**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**3658.095**	**$4,722,132**	**$0**	**$944,426**	**$5,666,558**	**$4,722,132**	**$285,000**	**$5,922,655**

WATERSHED NAME & CODE	LOWER OSAGE - 10290111				LANDUSE ACRES	349,780		
LANDUSE TYPE	FORESTLAND				TYPICAL UNIT SIZE ACRES	80		
ASSESSMENT INFORMATION					ESTIMATED PARTICIPATION	11%		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Soil Erosion – Classic Gully	Soil Erosion – Streambank	Plant Condition – Productivity, Health and Vigor
Baseline System				**System Rating ->**	**2**	**2**	**1**	**3**
Total Acreage at Baseline Level	**279,824**	**251,842**	**0**	**251,842**				
Brush Management (ac.) 314	13,991	12,592	0	12,592	3	3	1	3
Fence (ft.) 382	4,617,096	4,155,386	0	4,155,386	0	0	0	0
Use Exclusion (ac.) 472	274,228	246,805	0	246,805	2	2	2	4
Progressive System				**System Rating ->**	**4**	**3**	**3**	**5**
Total Acreage at Progressive Level	**34,978**	**29,731**	**13,991**	**43,723**				
Brush Management (ac.) 314	1,749	2,186	0	2,186	3	3	1	3
Fence (ft.) 382	577,137	721,421	0	721,421	0	0	0	0
Forest Stand Improvement (ac.) 666	33,229	28,245	13,292	41,536	3	3	0	5
Pond (no.) 378	437	372	175	547	0	4	1	2
Riparian Forest Buffer (ac.) 391	1,049	892	420	1,312	2	3	4	4
Tree/Shrub Establishment (ac.) 612	1,049	892	420	1,312	5	2	0	5
Tree/Shrub Site Preparation (ac.) 490	1,049	892	420	1,312	-1	-2	0	5
Use Exclusion (ac.) 472	34,278	42,848	0	42,848	2	2	2	4
Wildlife Watering Facility (no.) 648	437	372	175	547	0	1	4	0
Resource Management System (RMS)				**System Rating ->**	**4**	**4**	**4**	**5**
Total Acreage at RMS Level	**34,978**	**34,978**	**19,238**	**54,216**				
Brush Management (ac.) 314	1,749	2,711	0	2,711	3	3	1	3
Fence (ft.) 382	577,137	894,562	0	894,562	0	0	0	0
Forest Stand Improvement (ac.) 666	33,229	38,213	13,292	51,505	3	3	0	5
Forest Trails and Landings (ac.) 655	1,749	1,749	962	2,711	-1	1	0	2
Pond (no.) 378	437	503	175	678	0	4	1	2
Prescribed Forestry (ac.) 409	34,978	34,978	19,238	54,216	5	2	5	5
Riparian Forest Buffer (ac.) 391	1,049	1,207	420	1,626	2	3	4	4
Tree/Shrub Establishment (ac.) 612	1,049	1,207	420	1,626	5	2	0	5
Tree/Shrub Site Preparation (ac.) 490	1,049	1,207	420	1,626	-1	-2	0	5
Upland Wildlife Habitat Management (ac.) 645	34,978	34,978	19,238	54,216	3	2	1	4
Use Exclusion (ac.) 472	34,278	53,132	0	53,132	2	2	2	4
Wildlife Watering Facility (no.) 648	437	503	175	678	0	1	4	0

WATERSHED NAME & CODE	LOWER OSAGE - 10290111				LANDUSE ACRES	349,780	
LANDUSE TYPE	FORESTLAND				TYPICAL UNIT SIZE ACRES	80	
CONSERVATION INVESTMENT INFORMATION					ESTIMATED PARTICIPATION	11%	
	FUTURE	USDA INVESTMENT				PRIVATE INVESTMENT		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
Progressive System Acres Treated	**13991.2**							
Brush Management (ac.) 314	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	0	$0	$0	$0	$0	$0	$0	$0
Forest Stand Improvement (ac.) 666	13,292	$595,000	$0	$119,000	$714,000	$595,000	$11,900	$645,127
Pond (no.) 378	175	$524,670	$0	$104,934	$629,604	$524,670	$20,987	$613,074
Riparian Forest Buffer (ac.) 391	420	$68,417	$0	$13,683	$82,100	$68,417	$1,368	$74,181
Tree/Shrub Establishment (ac.) 612	420	$68,417	$0	$13,683	$82,100	$68,417	$0	$68,417
Tree/Shrub Site Preparation (ac.) 490	420	$0	$56,400	$11,280	$61,533	$0	$18,800	$28,940
Use Exclusion (ac.) 472	0	$0	$0	$0	$0	$0	$0	$0
Wildlife Watering Facility (no.) 648	175	$64,203	$0	$12,841	$77,044	$64,203	$0	$64,203
	Subtotal	**$1,320,707**	**$56,400**	**$275,421**	**$1,646,381**	**$1,320,707**	**$53,055**	**$1,493,942**
Resource Management System (RMS) Acres Treated	**19237.9**							
Brush Management (ac.) 314	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	0	$0	$0	$0	$0	$0	$0	$0
Forest Stand Improvement (ac.) 666	13,292	$595,000	$0	$119,000	$714,000	$595,000	$11,900	$645,127
Forest Trails and Landings (ac.) 655	962	$573,063	$0	$114,613	$687,676	$573,063	$22,923	$669,621
Pond (no.) 378	175	$524,670	$0	$104,934	$629,604	$524,670	$20,987	$613,074
Prescribed Forestry (ac.) 409	19,238	$480,948	$0	$96,190	$577,137	$480,948	$0	$480,948
Riparian Forest Buffer (ac.) 391	420	$68,417	$0	$13,683	$82,100	$68,417	$1,368	$74,181
Tree/Shrub Establishment (ac.) 612	420	$68,417	$0	$13,683	$82,100	$68,417	$0	$68,417
Tree/Shrub Site Preparation (ac.) 490	420	$0	$56,400	$11,280	$61,533	$0	$18,800	$28,940
Upland Wildlife Habitat Management (ac.) 645	19,238	$0	$865,706	$173,141	$944,488	$0	$288,569	$444,208
Use Exclusion (ac.) 472	0	$0	$0	$0	$0	$0	$0	$0
Wildlife Watering Facility (no.) 648	175	$64,203	$0	$12,841	$77,044	$64,203	$0	$64,203
	Subtotal	**$2,374,718**	**$922,105**	**$659,365**	**$3,855,682**	**$2,374,718**	**$364,546**	**$3,088,719**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**33229.1**	**$3,695,425**	**$978,505**	**$934,786**	**$5,502,064**	**$3,695,425**	**$417,601**	**$4,582,662**

WATERSHED NAME & CODE	LOWER OSAGE - 10290111				LANDUSE ACRES	279,934		
LANDUSE TYPE	GRASSLAND				TYPICAL UNIT SIZE ACRES	20		
ASSESSMENT INFORMATION PART 1					ESTIMATED PARTICIPATION	22%		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Classic Gully	Soil Condition – Compaction	Plant Condition – Productivity, Health and Vigor	Plant Condition – Forage Quality and Palatability
Baseline System			System Rating ->		3	1	4	4
Total Acreage at Baseline Level	**195,954**	**146,965**	**0**	**146,965**				
Fence (ft.) 382	38,798,852	29,099,139	0	29,099,139	0	0	0	0
Grade Stabilization Structure (no.) 410	9,798	7,348	0	7,348	5	0	0	0
Manure Transfer (no.) 634	9,798	7,348	0	7,348	0	-1	1	0
Nutrient Management (ac.) 590	195,954	146,965	0	146,965	0	-2	3	4
Pasture and Hay Planting (ac.) 512	195,954	146,965	0	146,965	1	4	5	5
Progressive System			System Rating ->		4	3	5	4
Total Acreage at Progressive Level	**41,990**	**37,791**	**29,393**	**67,184**				
Composting Facility (no.) 317	2,100	1,890	1,470	3,359	0	0	0	0
Critical Area Planting (ac.) 342	2,100	1,890	1,470	3,359	4	3	5	0
Fence (ft.) 382	9,699,713	14,549,570	969,971	15,519,541	0	0	0	0
Forage Harvest Management (ac.) 511	41,990	37,791	29,393	67,184	0	4	4	4
Grade Stabilization Structure (no.) 410	2,100	3,359	0	3,359	5	0	0	0
Manure Transfer (no.) 634	2,100	3,359	0	3,359	0	-1	1	0
Nutrient Management (ac.) 590	41,990	67,184	0	67,184	0	-2	3	4
Pasture and Hay Planting (ac.) 512	41,990	67,184	0	67,184	1	4	5	5
Pest Management (ac.) 595	41,990	37,791	29,393	67,184	0	2	5	4
Well Decommissioning (no.) 351	2,100	1,890	1,470	3,359	0	0	0	0

WATERSHED NAME & CODE	LOWER OSAGE - 10290111				LANDUSE ACRES	279,934		
LANDUSE TYPE	GRASSLAND				TYPICAL UNIT SIZE ACRES	20		
ASSESSMENT INFORMATION PART 2					ESTIMATED PARTICIPATION	22%		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Classic Gully	Soil Condition – Compaction	Plant Condition – Productivity, Health and Vigor	Plant Condition – Forage Quality and Palatability
Resource Management System (RMS)			System Rating ->		4	2	5	5
Total Acreage at RMS Level	41,990	41,990	23,794	65,784				
Brush Management (ac.) 314	4,199	4,199	2,379	6,578	3	-1	3	4
Composting Facility (no.) 317	2,100	2,309	980	3,289	0	0	0	0
Critical Area Planting (ac.) 342	2,100	2,309	980	3,289	4	3	5	0
Fence (ft.) 382	12,471,060	17,320,916	2,217,077	19,537,994	0	0	0	0
Forage Harvest Management (ac.) 511	41,990	46,189	19,595	65,784	0	4	4	4
Grade Stabilization Structure (no.) 410	2,100	3,289	0	3,289	5	0	0	0
Manure Transfer (no.) 634	2,100	3,289	0	3,289	0	-1	1	0
Nutrient Management (ac.) 590	41,990	65,784	0	65,784	0	-2	3	4
Pasture and Hay Planting (ac.) 512	41,990	65,784	0	65,784	1	4	5	5
Pest Management (ac.) 595	41,990	46,189	19,595	65,784	0	2	5	4
Pipeline (ft.) 516	2,099,505	2,099,505	1,189,720	3,289,225	0	0	2	0
Pond (no.) 378	2,100	2,100	1,190	3,289	4	0	2	0
Pumping Plant (no.) 533	2,100	2,100	1,190	3,289	0	0	3	0
Upland Wildlife Habitat Management (ac.) 645	2,100	2,100	1,190	3,289	2	0	4	4
Waste Storage Facility (no.) 313	2,100	2,100	1,190	3,289	0	1	2	0
Waste Utilization (ac.) 633	41,990	41,990	23,794	65,784	0	-1	3	4
Well Decommissioning (no.) 351	2,100	2,309	980	3,289	0	0	0	0

WATERSHED NAME & CODE	LOWER OSAGE - 10290111	LANDUSE ACRES	279,934
LANDUSE TYPE	GRASSLAND	TYPICAL UNIT SIZE ACRES	20
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	22%

CONSERVATION SYSTEMS BY TREATMENT LEVELS	FUTURE	USDA INVESTMENT				PRIVATE INVESTMENT		
	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
Progressive System Acres Treated	**29393.07**							
Composting Facility (no.) 317	1,470	$8,462,632	$0	$1,692,526	$10,155,159	$8,462,632	$507,758	$10,601,493
Critical Area Planting (ac.) 342	1,470	$349,910	$0	$69,982	$419,892	$349,910	$6,998	$379,389
Fence (ft.) 382	969,971	$708,079	$0	$141,616	$849,695	$708,079	$70,808	$1,006,348
Forage Harvest Management (ac.) 511	29,393	$117,572	$0	$23,514	$141,087	$117,572	$35,272	$266,149
Grade Stabilization Structure (no.) 410	0	$0	$0	$0	$0	$0	$0	$0
Manure Transfer (no.) 634	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	0	$0	$0	$0	$0	$0	$0	$0
Pasture and Hay Planting (ac.) 512	0	$0	$0	$0	$0	$0	$0	$0
Pest Management (ac.) 595	29,393	$0	$1,881,744	$376,349	$2,052,991	$0	$627,248	$965,556
Well Decommissioning (no.) 351	1,470	$410,629	$0	$82,126	$492,754	$410,629	$0	$410,629
	Subtotal	**$10,048,822**	**$1,881,744**	**$2,386,113**	**$14,111,577**	**$10,048,822**	**$1,248,084**	**$13,629,563**
Resource Management System (RMS) Acres Treated	**23794.39**							
Brush Management (ac.) 314	2,379	$105,516	$0	$21,103	$126,619	$105,516	$2,110	$114,406
Composting Facility (no.) 317	980	$5,641,755	$0	$1,128,351	$6,770,106	$5,641,755	$338,505	$7,067,662
Critical Area Planting (ac.) 342	980	$233,273	$0	$46,655	$279,928	$233,273	$4,665	$252,926
Fence (ft.) 382	2,217,077	$1,618,466	$0	$323,693	$1,942,160	$1,618,466	$161,847	$2,300,223
Forage Harvest Management (ac.) 511	19,595	$78,382	$0	$15,676	$94,058	$78,382	$23,514	$177,433
Grade Stabilization Structure (no.) 410	0	$0	$0	$0	$0	$0	$0	$0
Manure Transfer (no.) 634	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	0	$0	$0	$0	$0	$0	$0	$0
Pasture and Hay Planting (ac.) 512	0	$0	$0	$0	$0	$0	$0	$0
Pest Management (ac.) 595	19,595	$0	$1,254,496	$250,899	$1,368,660	$0	$418,165	$643,704
Pipeline (ft.) 516	1,189,720	$1,278,948	$0	$255,790	$1,534,738	$1,278,948	$0	$1,278,948
Pond (no.) 378	1,190	$3,569,159	$0	$713,832	$4,282,990	$3,569,159	$142,766	$4,170,542
Pumping Plant (no.) 533	1,190	$4,760,216	$0	$952,043	$5,712,260	$4,760,216	$190,409	$5,562,287
Upland Wildlife Habitat Management (ac.) 645	1,190	$0	$53,537	$10,707	$58,409	$0	$17,846	$27,471
Waste Storage Facility (no.) 313	1,190	$39,735,965	$0	$7,947,193	$47,683,158	$39,735,965	$2,384,158	$49,778,905
Waste Utilization (ac.) 633	23,794	$0	$1,070,748	$214,150	$1,168,190	$0	$356,916	$549,419
Well Decommissioning (no.) 351	980	$273,752	$0	$54,750	$328,503	$273,752	$0	$273,752
	Subtotal	**$57,295,433**	**$2,378,781**	**$11,934,843**	**$71,349,779**	**$57,295,433**	**$4,040,902**	**$72,197,679**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**53187.46**	**$67,344,255**	**$4,260,525**	**$14,320,956**	**$85,461,356**	**$67,344,255**	**$5,288,986**	**$85,827,243**

WATERSHED NAME & CODE	LOWER OSAGE - 10290111				LANDUSE ACRES	3,822		
LANDUSE TYPE	HIGH AND LOW INTENSITY URBAN				TYPICAL UNIT SIZE ACRES	5		
ASSESSMENT INFORMATION					ESTIMATED PARTICIPATION	24%		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Soil Erosion – Classic Gully	Water Quality – Excessive Nutrients and Organics in Groundwater	Plant Condition – Productivity, Health and Vigor
Baseline System			**System Rating ->**		**4**	**3**	**0**	**4**
Total Acreage at Baseline Level	**3,058**	**2,293**	**0**	**2,293**				
Brush Management (ac.) 314	306	229	0	229	3	3	0	3
Critical Area Planting (ac.) 342	153	115	0	115	5	4	1	5
Pond (no.) 378	612	459	0	459	0	4	-1	2
Progressive System			**System Rating ->**		**4**	**4**	**0**	**4**
Total Acreage at Progressive Level	**382**	**325**	**459**	**784**				
Brush Management (ac.) 314	38	78	0	78	3	3	0	3
Critical Area Planting (ac.) 342	19	39	0	39	5	4	1	5
Fence (ft.) 382	151,351	128,649	181,621	310,270	0	0	0	0
Forage Harvest Management (ac.) 511	96	81	115	196	3	0	2	4
Grade Stabilization Structure (no.) 410	76	65	92	157	0	5	0	0
Mulching (ac.) 484	57	49	69	118	4	1	-1	3
Pond (no.) 378	76	157	0	157	0	4	-1	2
Resource Management System (RMS)			**System Rating ->**		**4**	**4**	**2**	**4**
Total Acreage at RMS Level	**382**	**382**	**363**	**745**				
Brush Management (ac.) 314	38	75	0	75	3	3	0	3
Critical Area Planting (ac.) 342	19	37	0	37	5	4	1	5
Fence (ft.) 382	151,351	174,054	121,081	295,135	0	0	0	0
Filter Strip (ac.) 393	11	11	11	22	3	0	3	4
Forage Harvest Management (ac.) 511	191	205	167	373	3	0	2	4
Grade Stabilization Structure (no.) 410	76	88	61	149	0	5	0	0
Pond (no.) 378	76	149	0	149	0	4	-1	2
Well Decommissioning (no.) 351	76	76	73	149	0	0	3	0

WATERSHED NAME & CODE	LOWER OSAGE - 10290111	LANDUSE ACRES	3,822
LANDUSE TYPE	HIGH AND LOW INTENSITY URBAN	TYPICAL UNIT SIZE ACRES	5
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	24%

CONSERVATION SYSTEMS BY TREATMENT LEVELS	FUTURE	USDA INVESTMENT				PRIVATE INVESTMENT		
	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
Progressive System Acres Treated	**458.64**							
Brush Management (ac.) 314	0	$0	$0	$0	$0	$0	$0	$0
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	181,621	$132,584	$0	$26,517	$159,100	$132,584	$13,258	$188,433
Forage Harvest Management (ac.) 511	115	$459	$0	$92	$550	$459	$138	$1,038
Grade Stabilization Structure (no.) 410	92	$466,889	$0	$93,378	$560,266	$466,889	$28,013	$584,891
Mulching (ac.) 484	69	$0	$20,639	$4,128	$22,517	$0	$6,880	$10,590
Pond (no.) 378	0	$0	$0	$0	$0	$0	$0	$0
	Subtotal	**$599,931**	**$20,639**	**$124,114**	**$742,434**	**$599,931**	**$48,289**	**$784,952**
Resource Management System (RMS) Acres Treated	**363.09**							
Brush Management (ac.) 314	0	$0	$0	$0	$0	$0	$0	$0
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Fence (ft.) 382	121,081	$88,389	$0	$17,678	$106,067	$88,389	$8,839	$125,622
Filter Strip (ac.) 393	11	$381	$0	$76	$457	$381	$23	$478
Forage Harvest Management (ac.) 511	167	$669	$0	$134	$803	$669	$201	$1,514
Grade Stabilization Structure (no.) 410	61	$311,259	$0	$62,252	$373,511	$311,259	$18,676	$389,927
Pond (no.) 378	0	$0	$0	$0	$0	$0	$0	$0
Well Decommissioning (no.) 351	73	$20,290	$0	$4,058	$24,348	$20,290	$0	$20,290
	Subtotal	**$420,988**	**$0**	**$84,198**	**$505,186**	**$420,988**	**$27,738**	**$537,831**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**821.73**	**$1,020,919**	**$20,639**	**$208,312**	**$1,247,620**	**$1,020,919**	**$76,027**	**$1,322,783**

Footnotes / Bibliography

All data is provided "as is". There are no warranties, expressed or implied, including the warranty of fitness for a particular purpose, accompanying this document. Use for general planning purposes only.

Some data that was provided was given for areas that do not match up perfectly with the watershed. For these areas, such as county wide and census data, figures were adjusted by percent of the HUC in the area.

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Land Use / Land Cover Graph:

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Prime Farmlands Map:

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