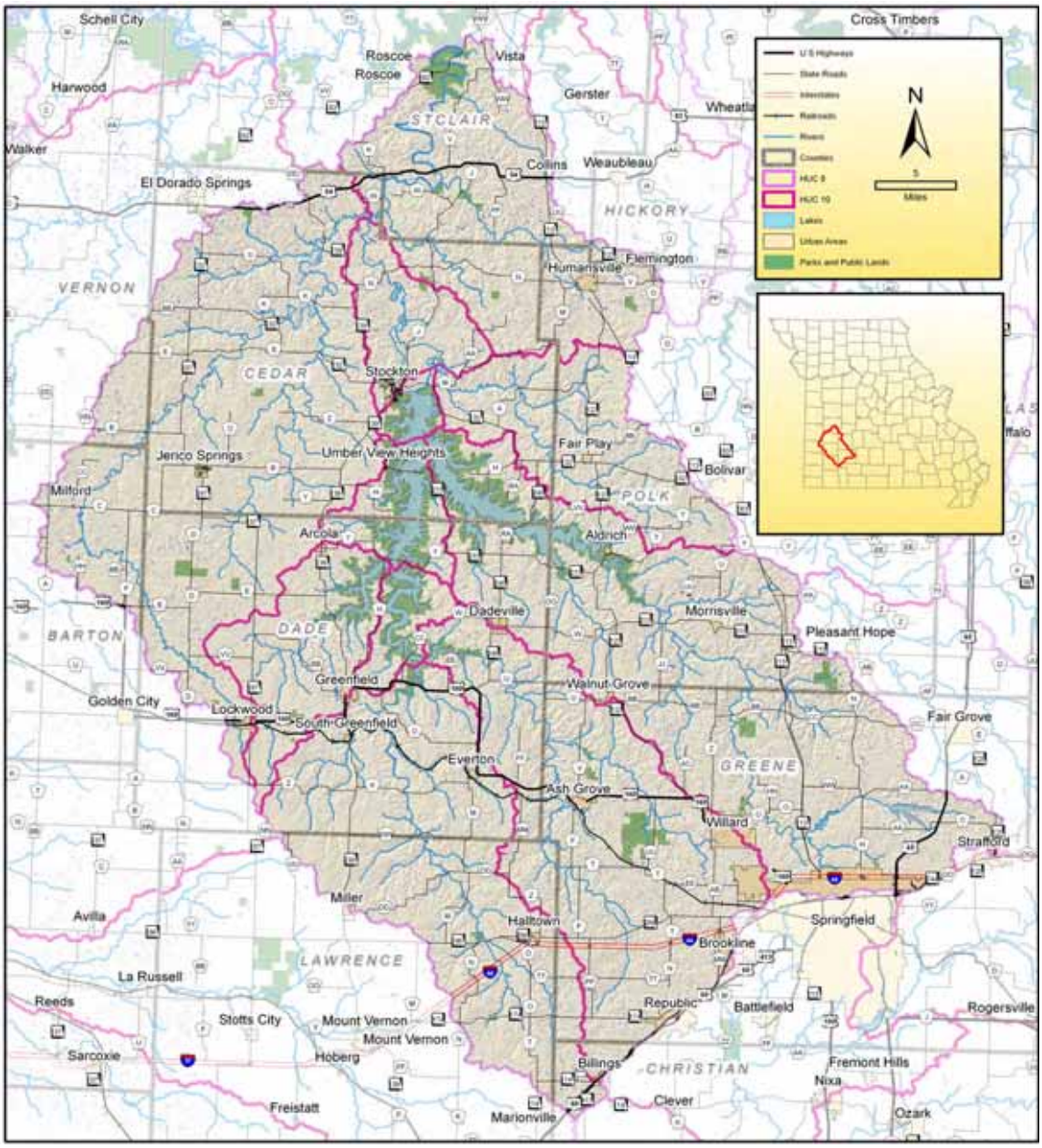
Sac River – 10290106

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 Sac Watershed (Hydrologic Unit 10290106) is a 1,975 square mile watershed in southwest Missouri. The watershed is primarily rural, but with a growing urban/suburban component. Agricultural activity is predominately livestock grazing, although some crop farms are in operation. The topography of the watershed is generally rolling, with large expanses of grasslands and some forested areas. The watershed is predominately private land, with only 6.0 percent in public holding.

The watershed is situated on Karst topography with a large number of springs and sinkholes located in the southern one half. The watershed contains four Common Resource Areas (CRAs) – Central Plateau, Cherokee Plains, Osage River Hills and the Springfield Plain. The Springfield Plain and the Cherokee Plains are the major CRAs in the watershed. Cropland comprises only 7.3 percent of the land cover, while grassland is 55.9 percent, and deciduous forest is 24.6 percent. Highly erodible land is some 50.4 percent of the watershed, followed by 31.7 percent of potentially highly erodible land; 24.5 percent is identified as prime farmland. Only 19 Confined Animal Feeding Operations are permitted in the watershed – 17 are swine operations, one is dairy and one is poultry; these are located primarily in the western portion of the watershed. There are only three 303(d) listed streams in the watershed – a 27 mile stretch of the Little Sac River that runs north into Stockton Lake from roughly the confluence of the Little Sac River and the South Dry Sac River. There also is a 1.7 mile stretch of the Stockton Branch as it flows out of Stockton, and a .2 mile section of Brush Creek near Humansville.

Local stakeholder meetings held at Springfield, Arcola and Humansville in April, March and May of 2007, respectively, identified corn, soybeans, wheat and milo as the primary crops. Fescue is the predominate species grown for pastures. However, some warm season grasses are being used for forage in the area. Most livestock management is cow-calf operations, primarily with continuous grazing. Some rotational grazing takes place. 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 urban encroachment.

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	23,090	20,781		
Progressive	46,180	48,488	232,675	109,473
Resource Mgmt.	23,090	23,090	0	0
Total		2,309.0	232,675	109.473
Forestland				
Baseline	345,133	310,620		
Progressive	23,009	56,372	1,583,197	1,783,906
Resource Mgmt.	15,339	16,490	39,368	26,684
Total		35,664	1,622,565	1,810,590
Grassland				
Baseline	387,592	329,453		
Progressive	211,414	241,012	5,964,160	6,052,386
Resource Mgmt.	105,707	134,248	52,851,781	59,193,235
Total		75,052	58,815,942	65,245,621
Urban				
Baseline	11,133	10,576		
Progressive	619	1,144	57,466	55,938
Resource Mgmt.	619	649	2,047	1,073
Total		588	59,494	57,011

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 Sac 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.

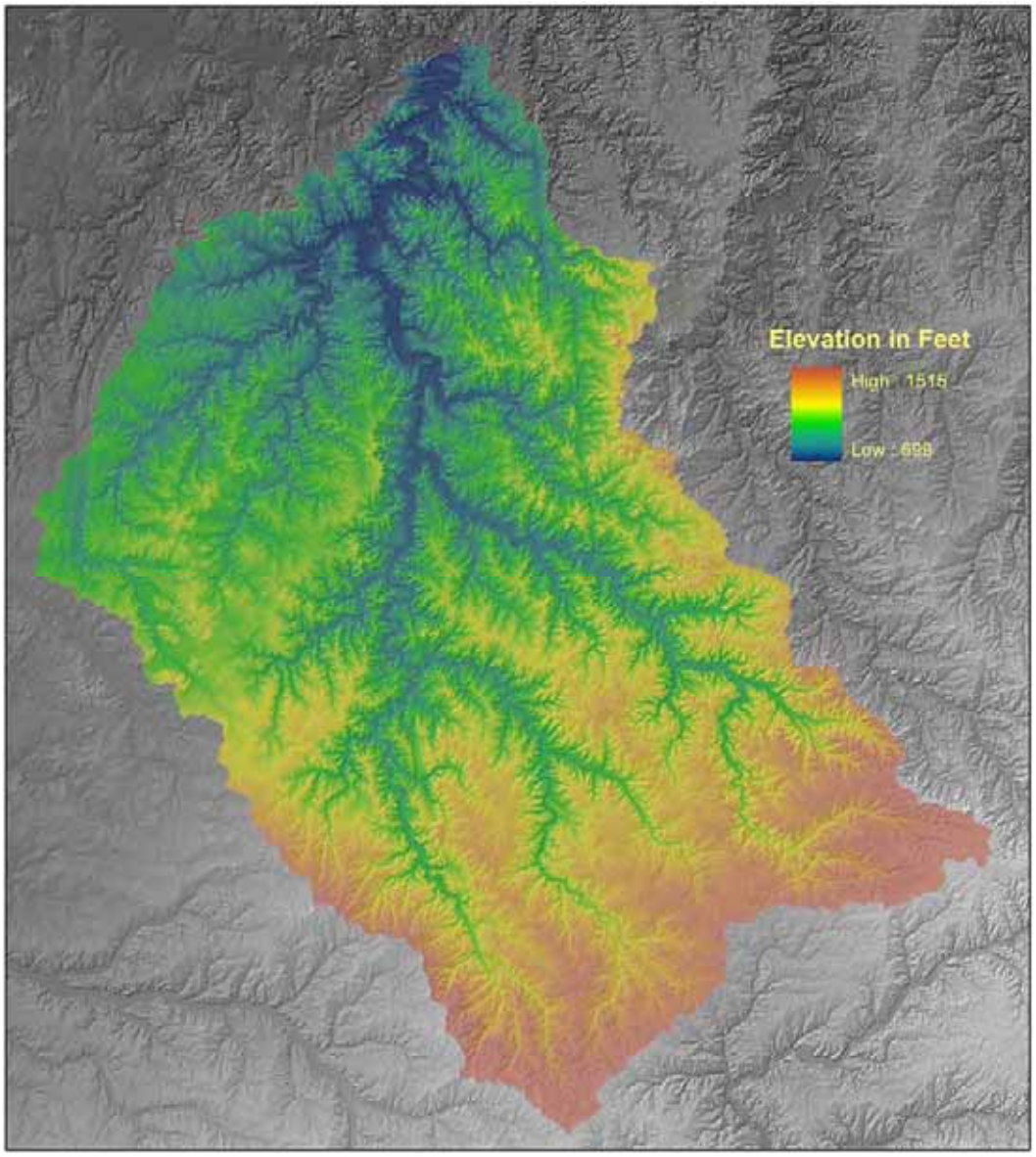
The Sac Watershed (Hydrologic Unit – 10290106) is a 1,975 square mile watershed located in southwest Missouri. It was selected for the diversity of activities which are included within its boundaries as well as the fact that it is a watershed that supports livestock grazing throughout. The watershed is predominately rural with growing urban/suburban areas.

Drainage within the watershed flows north from the Springfield metropolitan area to Harry S Truman Reservoir, a major public drinking water, recreation, and power generation lake. Within the watershed is a significant reservoir, Stockton Lake, which

Introduction - Continued

provides both public drinking water and recreation benefits. The southern portion of the watershed, where the headwaters are located, is crossed by Interstate 44, and includes a portion of Springfield, as well as the growing communities of Republic, Strafford, Willard and Brookline, which surround Springfield. The basin also is noted as containing a large number of National Heritage Database sites, an indication of its diverse population of uncommon species. Concerns for this area include a high potential for groundwater contamination, multiple lakes and streams on the 303(d) list of impaired streams, the need to supply a large population with drinking water, and increasing human population, and a high density of animal units.

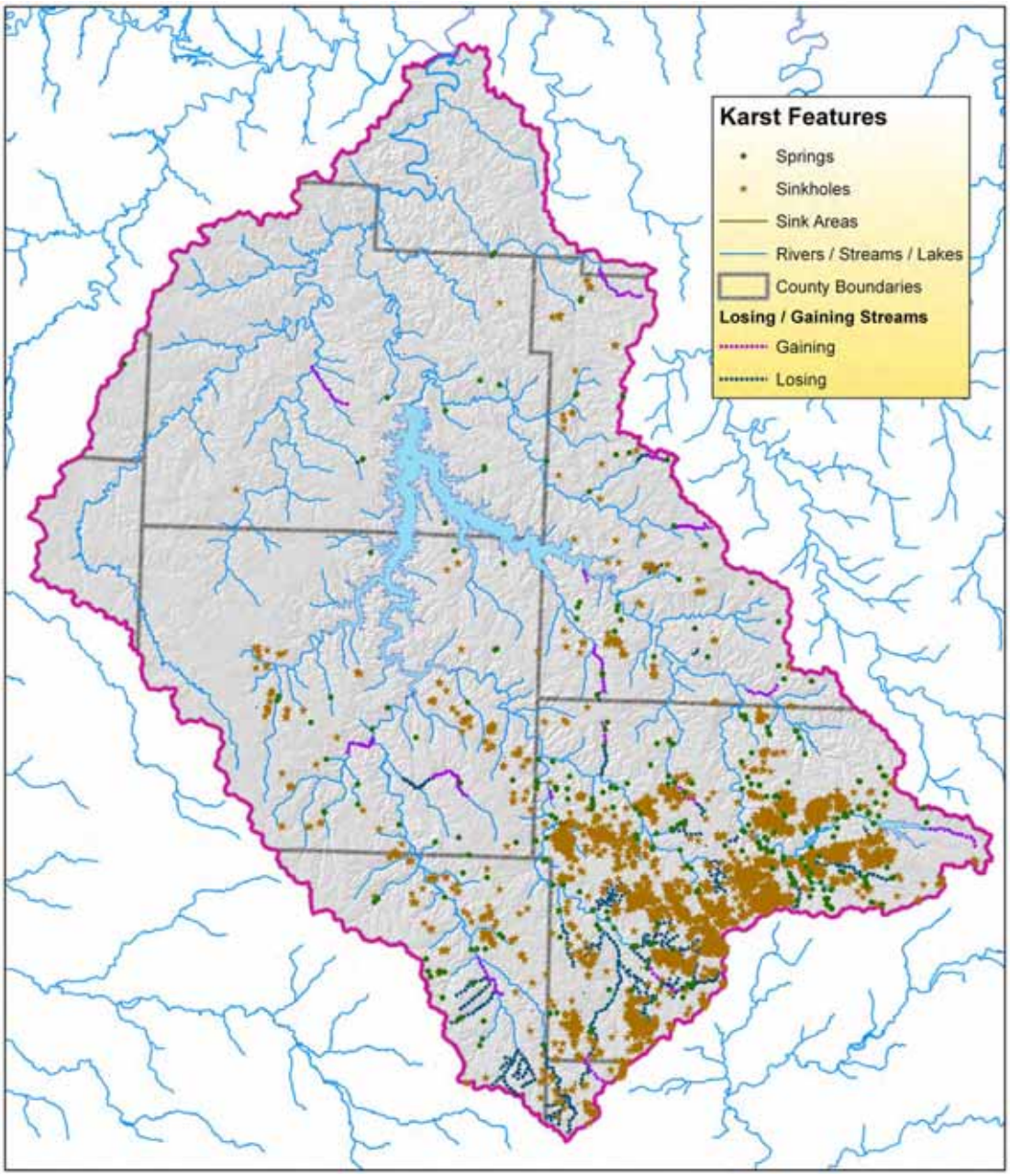
Relief Map



The Sac River Watershed is located on the northern edge of the Ozark Plateau, where it is bisected by numerous streams.

The topography is predominately rolling, with the more abrupt changes in relief along the eastern boarder.

Karst Features



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.

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.

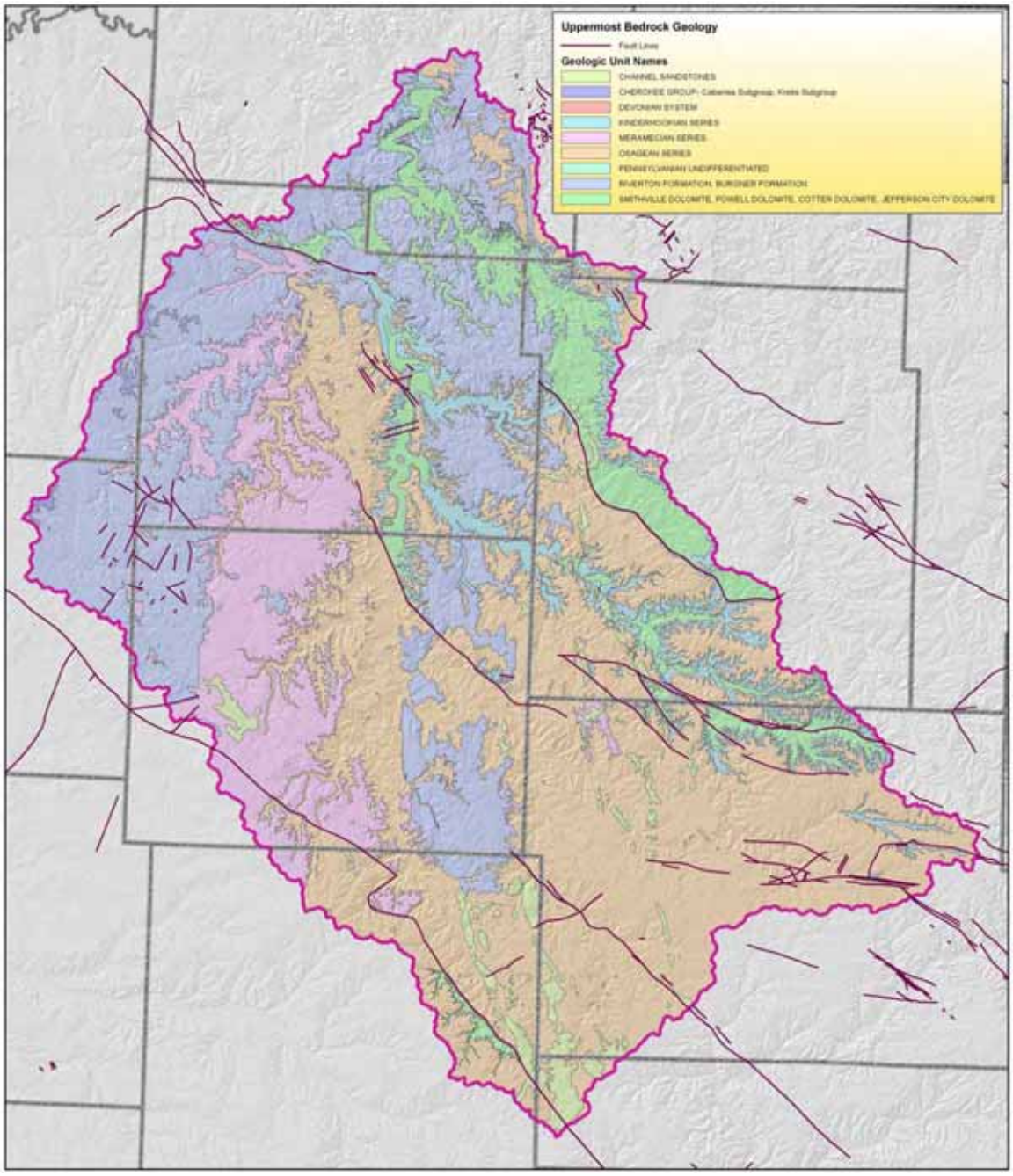
Karst Features - Continued

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.

In this watershed, the largest concentration of sinkholes and losing streams are in the northeast areas.

For the Sac River sub-basin, there are a total of 18 gaining streams and 77 losing streams. There are also 3,710 sinkholes and 984 sink areas. There are 300 total springs, with 169 being named. Of the named springs, the largest is a magnitude 2 (10-100 cfs) named Dickerson Park Spring. A total of 85 springs have had been measured for flow.

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 southeastern areas is made up of Osagean Series. Meramecian Series and Riverton Formation, Burgner Formation makes

Geologic Features – Continued

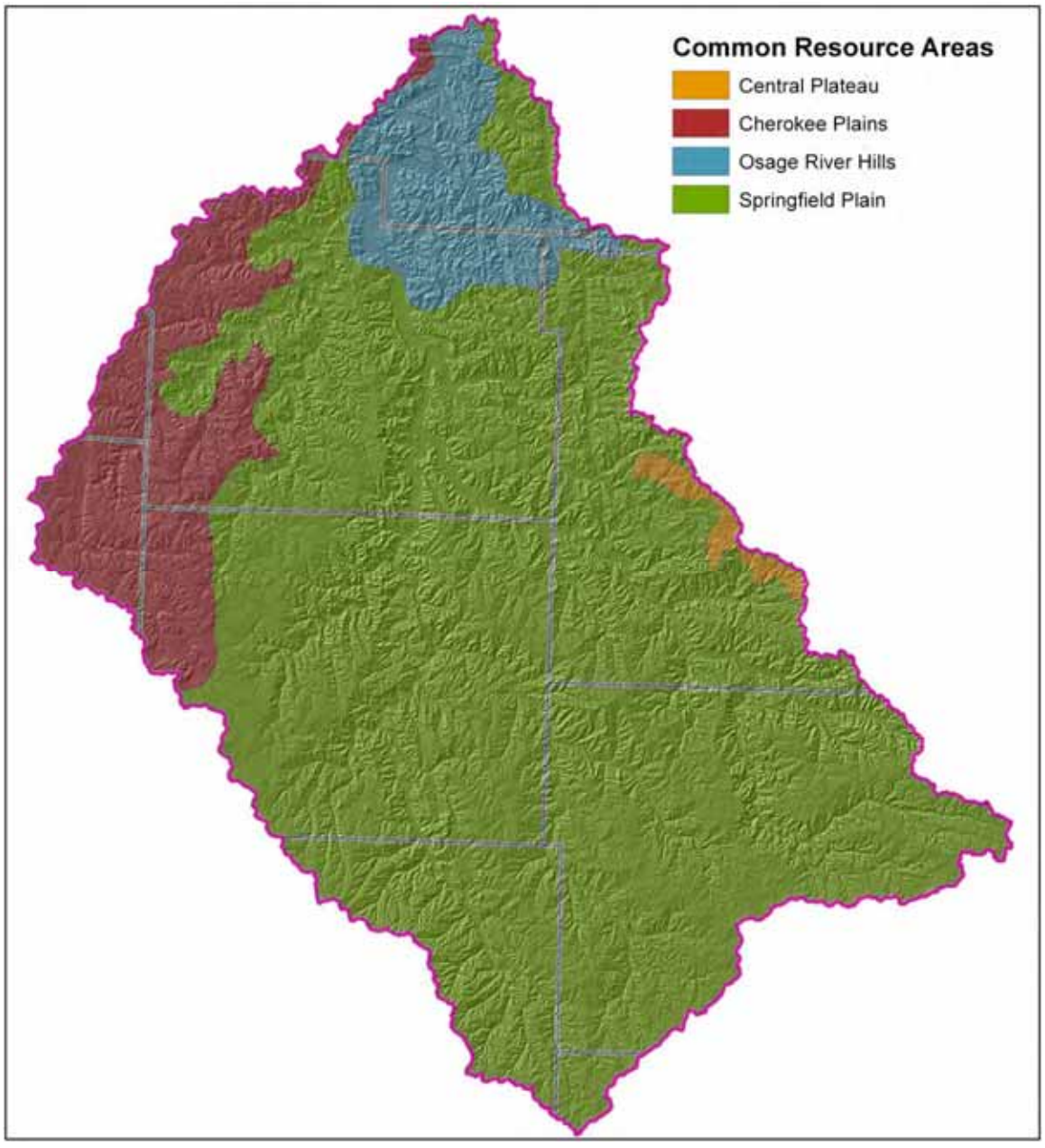
are found in the northwestern areas. There are some Kinderhookian Series found in channel bottoms.

There is some impact from surface fault lines, with faults running in a general direction from the southeast to the northwest.

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
Channel Sandstones	sandstone
Cherokee Group	shale; sandstone; siltstone, clay, limestone, coal
Pennsylvanian Undifferentiated	shale; limestone; sandstone, coal
Osagean Series	limestone; chert; dolostone (dolomite), shale
Meramecian Series	limestone
Kinderhookian Series	limestone; siltstone; shale, sandstone
Devonian System	limestone; sandstone; shale, chert
Riverton Formation, Burgner formation	shale; siltstone; limestone, clay, coal

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 Sac River Watershed is comprised of four Common Resource Areas (CRAs), described as:

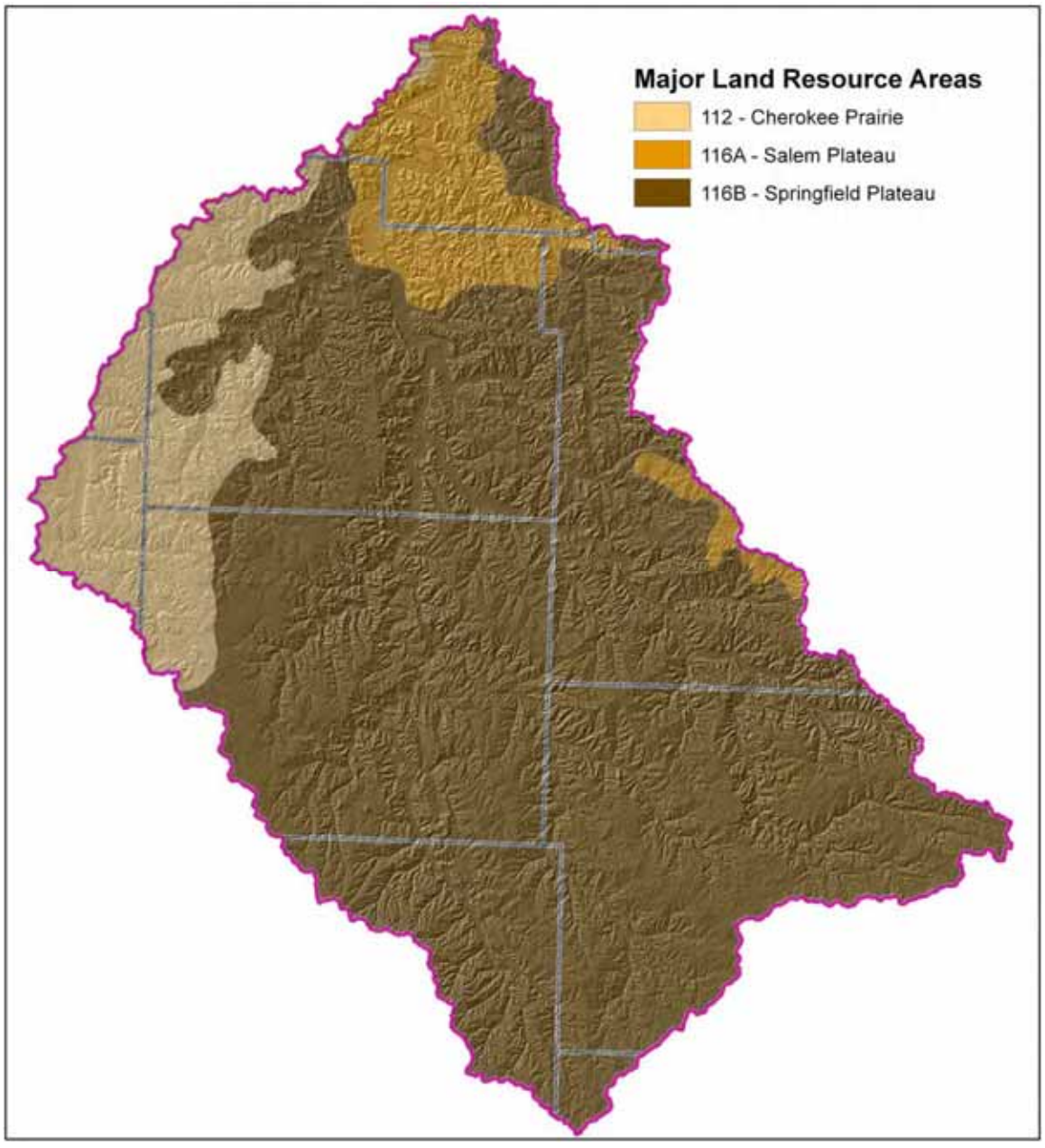
Central Plateau – Consists of some of the least dissected portions of the Ozark Highlands. Dominated by carbonate lithology, it is strongly karstic in many portions and is mantled by a very thick solution residuum. Lack of surface water and droughty soils are characteristics. Much of the land has been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

Cherokee Plains – A continuous plain of very low relief (usually less than 80 feet) on Pennsylvanian sandstones and shales. Streams have hardly dissected the surface, and valleys are topographically subdued. Wetlands are present on the wide, flat alluvial plains. Claypan soils add further distinction to the CRA. Most of the land is in pasture and cropland, with local areas of extensive strip mines.

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.

Springfield Plain – A large smooth plain. Relief is generally less than 150 feet, which is accounted for by slight dissection along streams. The plain is underlain by Mississippian cherty limestones that are responsible for several areas of well-developed karst and numerous springs. Much of the subsection is pasture, but forests occur in hillier portions.

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 Areas - Continued

Major Land Resource Area (MLRA) Descriptions

The Sac River Watershed is located in three MLRAs as described below:

112 – Cherokee Prairies

Land use: Nearly all this area is in farms, and approximately one-half is cropland. Winter wheat, soybeans, corn, grain sorghum, other feed grains, and hay are the major crops. Some cotton is grown in a few counties in Oklahoma. Some one-third of the area is in pasture grasses and legumes; native grasses grow on the more sloping parts. Approximately one-tenth of the area, the steeper valley slopes and some of the wet bottom land, is woodland. The acreage of woodland in Kansas is considerably less than in Missouri and in Oklahoma.

Elevation and topography: Elevation ranges from 100 to 400m. These gently sloping to rolling dissected plains are underlain by sandstone, shale, and limestone. The northern part has a thin mantle of loess. Even though the area is thoroughly dissected, local relief is in meters, and large valleys are about 25m below the adjacent uplands.

Climate: Average annual precipitation ranges from 900 to 1,050 mm. Maximum precipitation occurs from late in spring through autumn. Annual snowfall ranges from about 12 cm in the south to 45 cm in the north. Average annual temperature varies by 13 to 17°C, with an average freeze-free period of 190 to 235 days.

Water: In many years, the moderate precipitation is adequate for crops and pasture, but in some years summer droughts reduce crop yields. In much of the area, shallow wells are the principal source of water for domestic use and for livestock, but small ponds and reservoirs on individual farms are increasingly important sources of water for livestock. Deep wells, especially in limestone areas, also provide water.

Soils: Most of the soils are Aqualfs and Udolls. They are shallow to deep and medium textured and moderately fine textured. These soils have a thermic temperature regime, an aquic or udic moisture regime, and mixed mineralogy. Somewhat poorly drained nearly level and gently sloping Albaqualfs (Parsons and Taloka series), Argiaquolls (Woodson series), and Argialbolls (Hartwell series) are on clay-mantled uplands. Moderately well drained and well drained, gently sloping and sloping Paleudolls (Dennis and Okemah series), Hapludalfs (Barden and Liberal series), and Argiudolls (Bates and Eram series) are on uplands underlain by silty and sandy shale and sandstone. Well drained, gently sloping Argiudolls (Lula and Catoosa series) are underlain by limestone and are on uplands; shallower and more stony Argiudolls (Clareson series), Haplustolls (Shidler series), and Hapludolls (Coweta and Collinsville series) are on steeper slopes of limestone, sandstone, and loamy shale. Gently sloping to moderately sloping clayey Argiudolls (Summit series) are underlain by clayey shale and clay beds and are on foot slopes. Haplaquolls (Osage series), Hapludolls (Verdigris and Wynona series), and Ochraqualfs (Hepler series) are on the flood plains of most streams.

Potential natural vegetation: The western part of this area supports tall grass prairie vegetation. Big bluestem, little bluestem, Indiangrass, and switchgrass are the dominant species. The eastern part and the valleys in the western part support natural vegetation characterized by trees. Red oak, white oak, and shagbark hickory are major species. Islands of tall grass prairie vegetation are common.

Major Land Resource Areas - 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. These 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.

Climate: Average annual precipitation varies from 1,025 to 1,225 mm. Maximum precipitation occurs in spring and early in summer, and the minimum is in midsummer. Average annual temperature varies from 13° to 16°C. The average freeze-free period is 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.

116B – Springfield Plain

Land use: Farms and ranches make up most of this area. Forage and grain are grown for beef, dairy cattle, and other livestock. Raising beef cattle is one of the major industries in the area. In addition, the poultry business has grown into a major industry, and has developed into a very specialized multimillion-dollar industry. Soybeans and winter wheat are the major cash crops. Loss of farmland is a concern in the area. Urbanization pressures are greatest in the Springfield and Joplin areas.

Major Land Resource Areas – Continued

Elevation and topography: Elevation ranges from 200 to 500m. The broad limestone ridges and remnants of plateaus have gently sloping to moderately sloping tops and strongly sloping to steep side slopes. Stream valleys are narrow to moderately wide and have relatively steep gradients. Local differences in elevation range from 1 to 10 meters.

Climate: Average annual precipitation ranges from 975 to 1,225 mm. Maximum precipitation is in spring and early in summer, and the minimum is in midsummer. Average annual temperature varies by 13 to 16°C. Average freeze-free period is from 180 to 200 days.

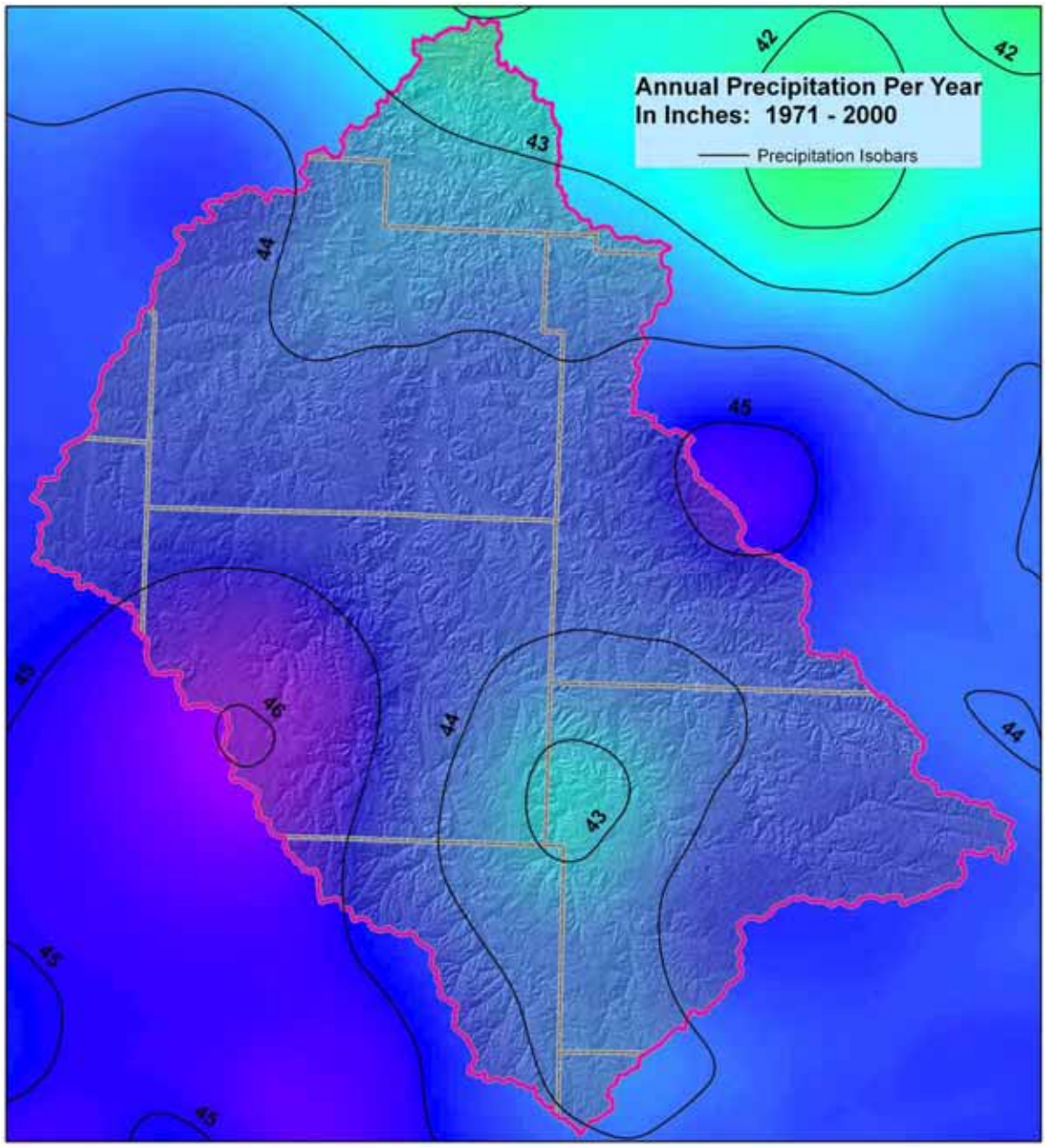
Water: In many years, the moderate precipitation is adequate for crops and pastures, but summer droughts of sufficient severity and duration to reduce crop yields are common. On most farms, shallow wells or springs supply water for domestic needs and for livestock, but deep wells are required for large 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 in the alfisol, ultisol, or mollisol orders. They formed in materials weathered from cherty limestone partly covered with a thin mantle of loess. Physical and chemical weathering has caused the cherty limestone to disintegrate into its least soluble components, which are chert and clay. The chert remains in the form of angular fragments or wavy horizon beds sandwiched between layers of clay. Down slope movement by gravitational creep has altered the upper cherty material on some soils. In general, the soils are moderately deep to very deep, moderately well drained to well drained, and medium to fine textured.

The temperature regime is typically mesic and extends slightly into thermic. The moisture regime is udic and the mineralogy is mixed or siliceous. Soils on the nearly level to moderately sloping upland divides are frequently Paleudolls (Newtonia and Wanda series), Paleudalfs (Peridge series), Fragiudalfs (Creldon, Hoberg, Keeno, and Viraton series), Fragiaqualfs (Bado and Gerald series), Fragiudults (Captina, Needleye, Nixa, and Tonti series) and Hapludalfs (Barden and Bolivar series). Soils on the moderately sloping to steep upland side slopes are frequently Paleudalfs (Eldon, Goss, and Rueter series), and Paleudults (Clarksville series). Soils on the terraces and adjacent floodplains are frequently Hapludalfs (Razort, Secesh, and Waben series), Hapludolls (Cedargap and Huntington series), Paleudalfs (Britwater and Pembroke series) and Eutrudepts (Jamesfin series).

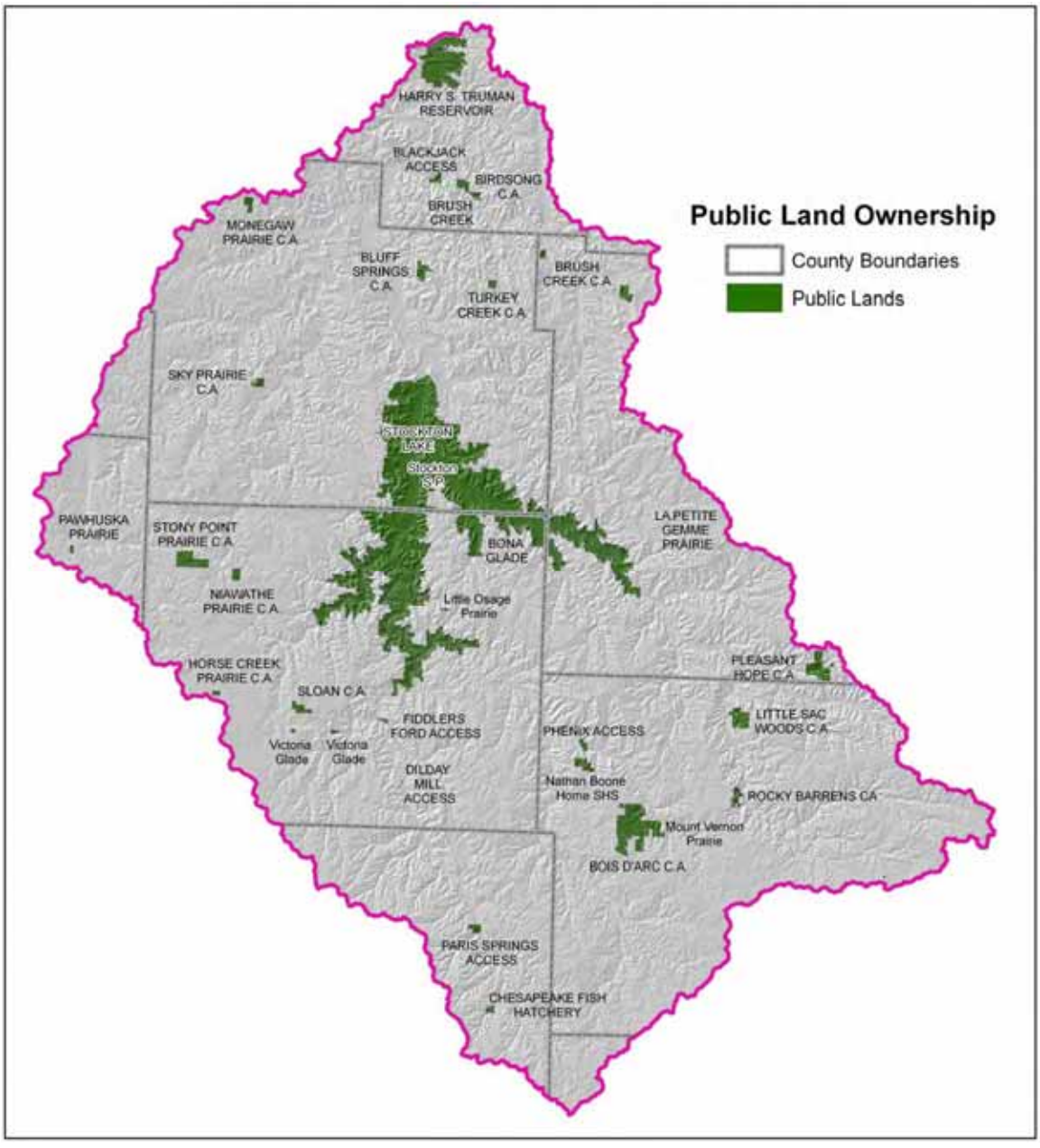
Biological Resources: This area supports oak-hickory savanna vegetation. It is a transitional area between oak-hickory forests and bluestem prairies. Big bluestem, little bluestem, Indiangrass, and switchgrass are the dominant grassland species. The forests and grasslands are interspersed. The oak hickory forests are more common on north slopes and on deeper soils and the grasslands on south slopes and on soils with low available moisture capacity.

Average Annual Precipitation



Data collected from 1971 to 2000 shows that the precipitation range for the Sac River area is from 42 inches per year in the extreme northern edge of the watershed to 46 inches per year in the near the southwest corner of Dade County.

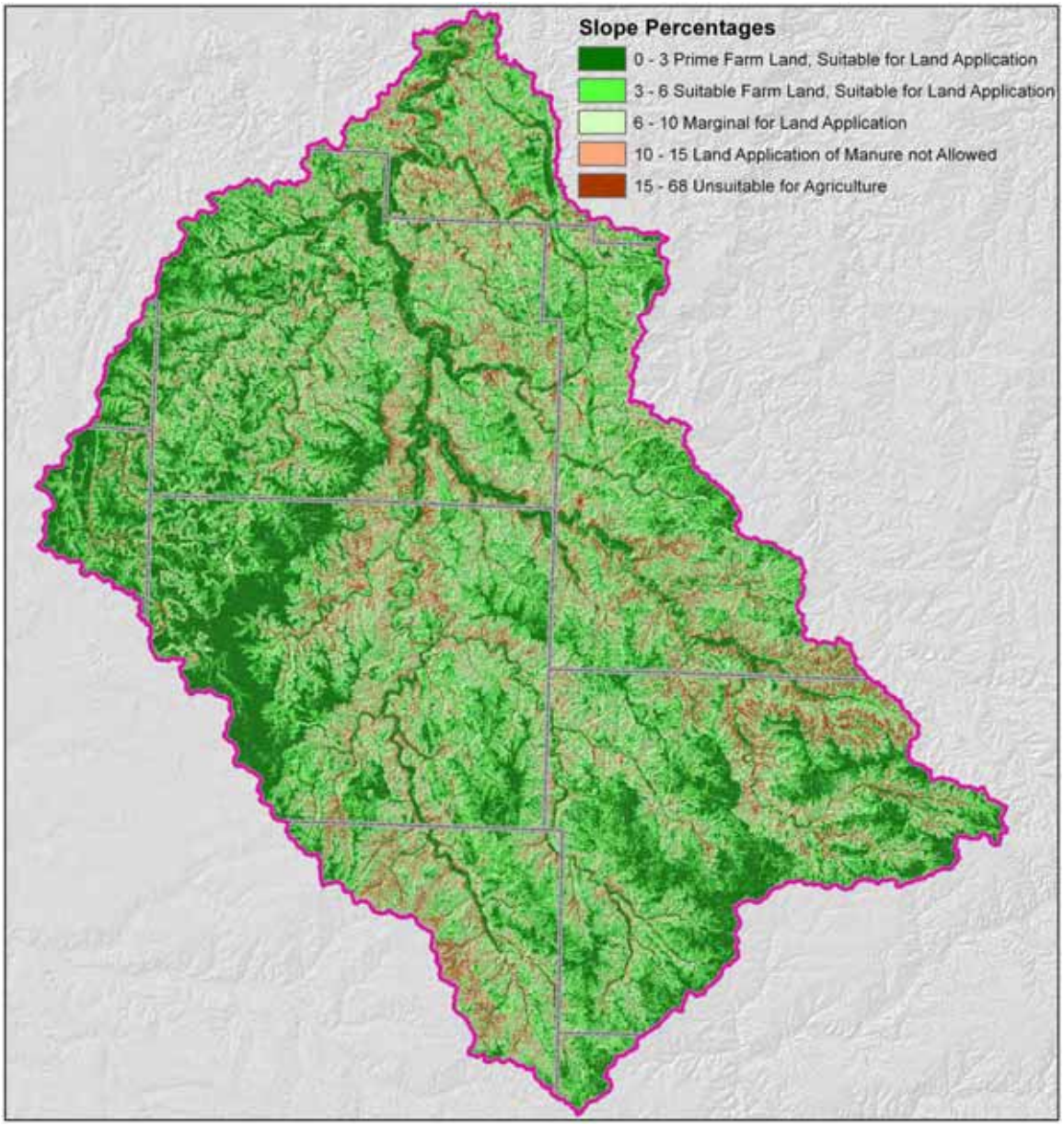
Land Ownership



Of the 1,260,119 acres that comprise the Sac River sub-basin, only 76,703 (or 6%) are public holdings. The remaining 1,183,416 acres (or 94%) is owned by private landowners.

The largest public land areas in this watershed are: Stockton Lake – *59,943 acres*; Harry S Truman Reservoir – *4,284 acres*; Bois D'Arc Conservation Area – *3,202 acres*; Stockton State Park – *2,063 acres*; and Pleasant Hope Conservation Area – *1,110 acres*.

Land Slope



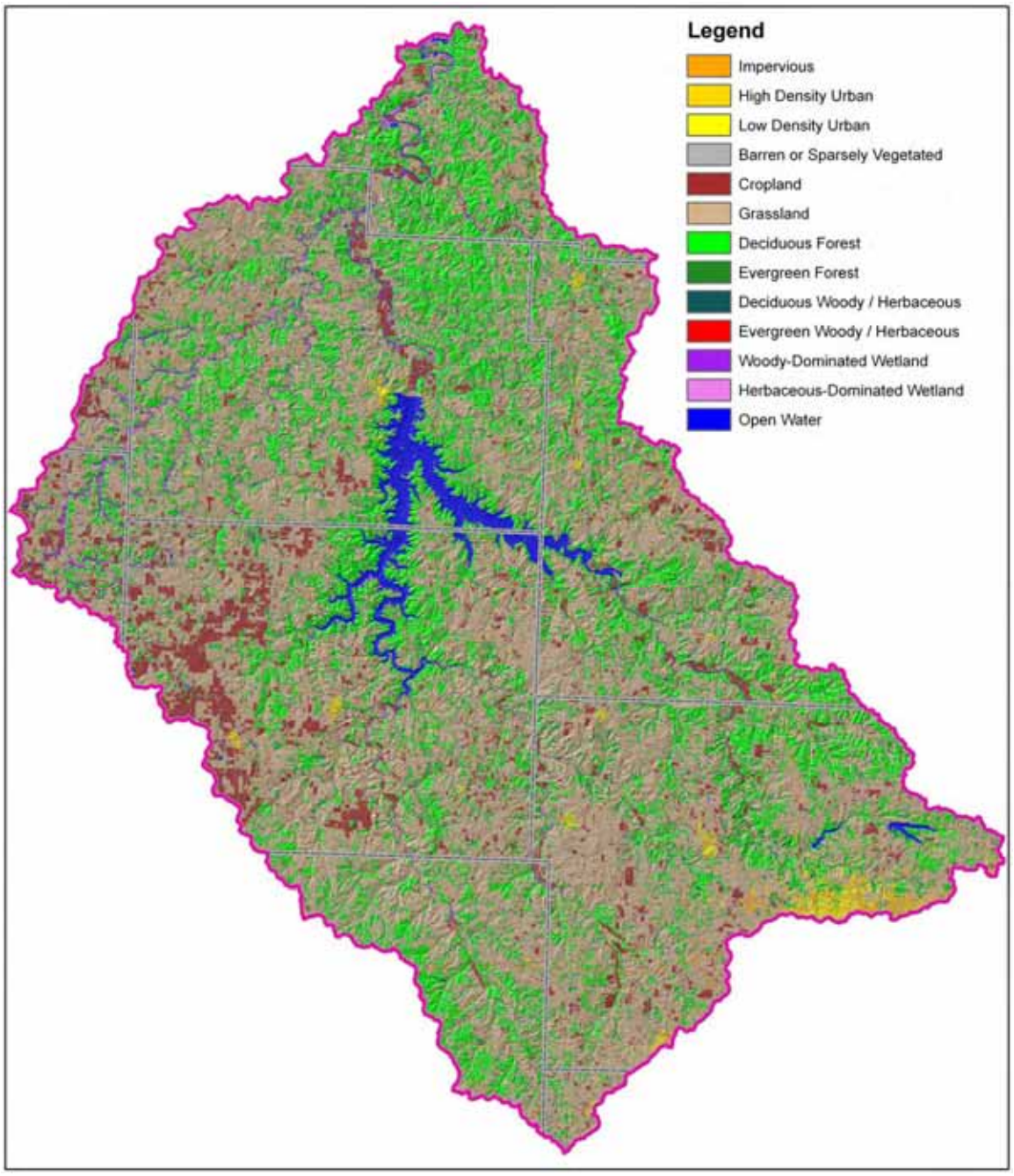
Slope classification is an important factor in determining the potential for runoff of soil and chemicals into surface water. It is not the only determinant. Soil cover, in the form of growing plants and crop residue, aids in reducing runoff.

The best slopes for agriculture are located along the flood plain of the Sac River, along with the broad, flat ridges on the west and southeast side of the watershed. Most of the areas unsuitable for farming occur on the steeper ridges and gullies that surround stream and river floodplains.

Land Slope – Continued

The slope categories describe their 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.

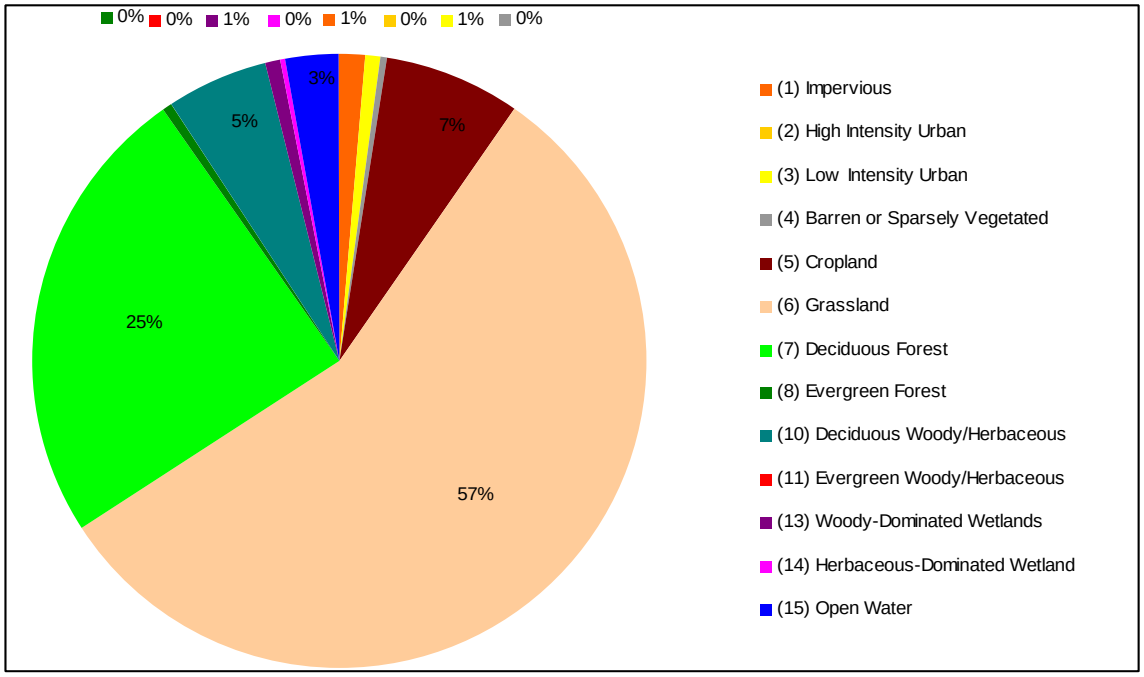
Land Use / Land Cover



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	489.1	0.64%	16285	1.38%	0	0.00%	16774.1	1.33%
(2) High Intensity Urban	5.7	0.01%	402.4	0.03%	0	0.00%	408.1	0.03%
(3) Low Intensity Urban	203.3	0.27%	11759	0.99%	0	0.00%	11962.3	0.95%
(4) Barren or Sparsely Vegetated	48.1	0.06%	1956.8	0.17%	0	0.00%	2004.9	0.16%
(5) Cropland	1870	2.44%	90489.1	7.65%	0	0.00%	92359.1	7.33%
(6) Grassland	13933.2	18.17%	690775.4	58.37%	0	0.00%	704708.6	55.92%
(7) Deciduous Forest	27523	35.88%	281889	23.82%	0	0.00%	309412	24.55%
(8) Evergreen Forest	324.1	0.42%	5088.7	0.43%	0	0.00%	5412.8	0.43%
(9) Mixed Forest	0	0.00%	0	0.00%	0	0.00%	0	0.00%
(10) Deciduous Woody/Herbaceous	4238.7	5.53%	63718.2	5.38%	0	0.00%	67956.9	5.39%
(11) Evergreen Woody/Herbaceous	28.6	0.04%	669.5	0.06%	0	0.00%	698.1	0.06%
(13) Woody-Dominated Wetlands	570.5	0.74%	10033.6	0.85%	0	0.00%	10604.1	0.84%
(14) Herbaceous-Dominated Wetland	276.6	0.36%	2922.3	0.25%	0	0.00%	3198.9	0.25%
(15) Open Water	27188.2	35.45%	7422.6	0.63%	0	0.00%	34610.8	2.75%
TOTALS	76699.1		1183411.6		0		1260110.7	
% OF TOTAL		6.09%		93.91%		0.00%		100.00%

Over one-half of the Sac River Watershed is in grassland; another one-fourth is in deciduous forests; cropland comprises only 7 percent.

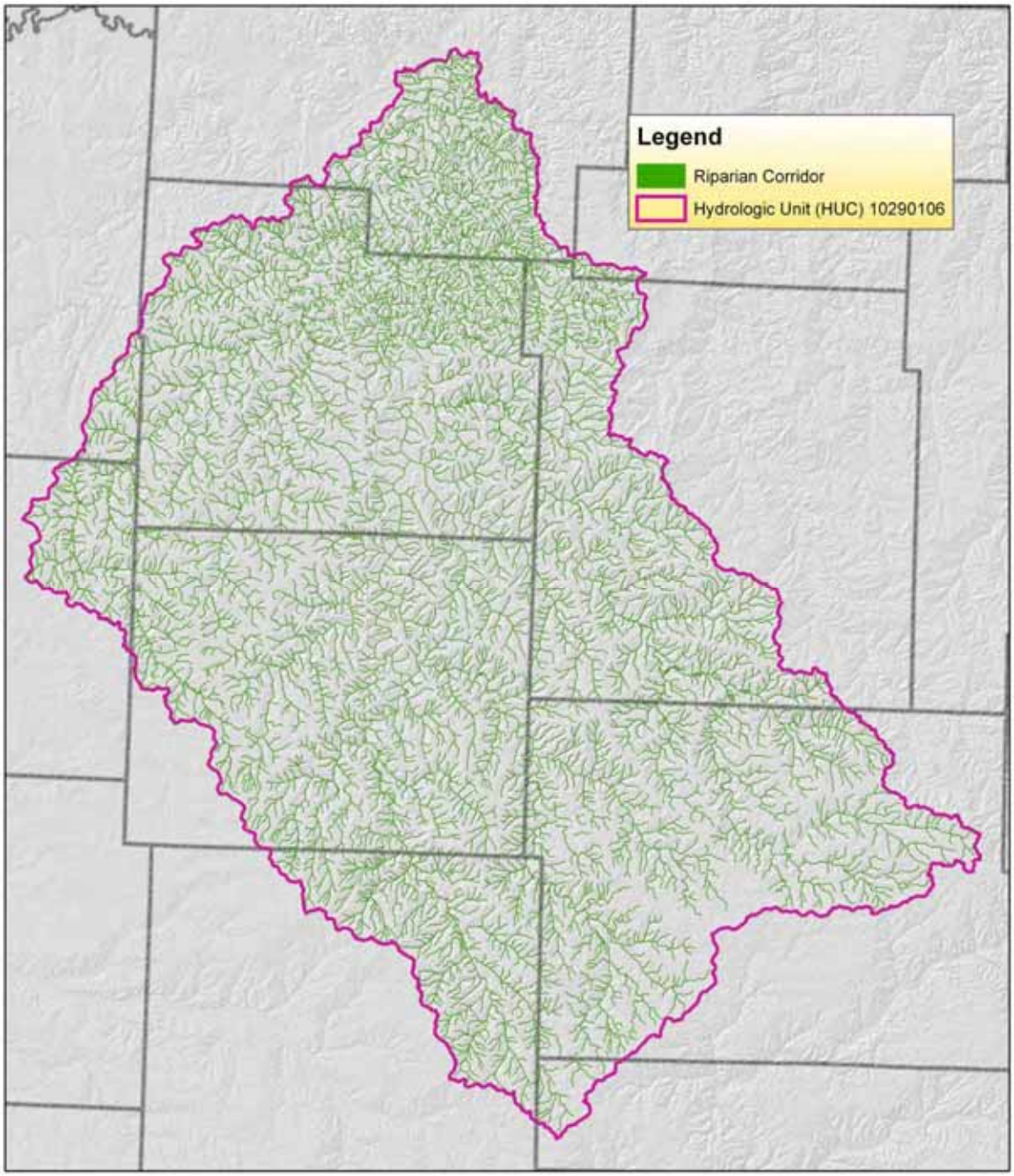
Land Cover / Land Use – Continued

LAND CAPABILITY CLASS *~Based on Cropland and Pastureland only* *~Uses Non-Public Lands only*		Acres	Percent
	I	4233.6	0.54%
	II	273236.5	35.02%
	III	224970.8	28.83%
	IV	194040.8	24.87%
	V	2.6	0.00%
	VI	36444.8	4.67%
	VII	32097.3	4.11%
	VIII	15194.9	1.95%
	Total Acres Croplands and Pasturelands	780221.3	

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



Riparian Corridors - Continued

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.

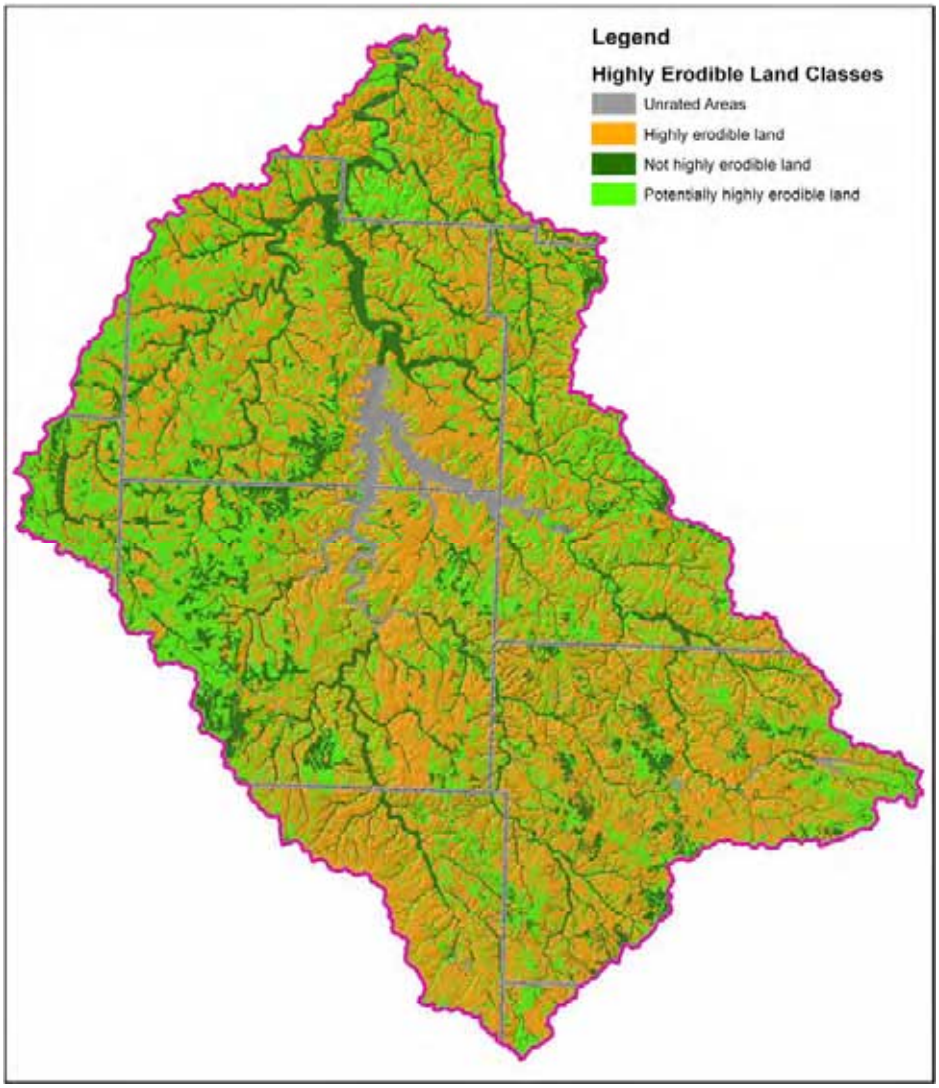
These corridors have been built by buffering the National Hydrology Dataset (NHD) by 50 feet, and using the created buffered lines to clip out data from the Common Land Unit (CLU) dataset.

Riparian Corridor Lands	TOTALS	
	Acres	%
*Crop OR unclassified OR Public Land	9653	16.48%
Urban	1576	2.69%
Cropland	10346	17.66%
Rangeland	122	0.21%
Forestland	23819	40.67%
Water	4437	7.58%
Mined Land	4	0.01%
Barren Land	1	0.00%
Other Agriculture Lands	8600	14.68%
Unclassified	15	0.03%
TOTALS	58573	

* 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.

The bulk of riparian corridors are found on agricultural land (cropland or forestland) within the watershed.

Highly Erodible Lands

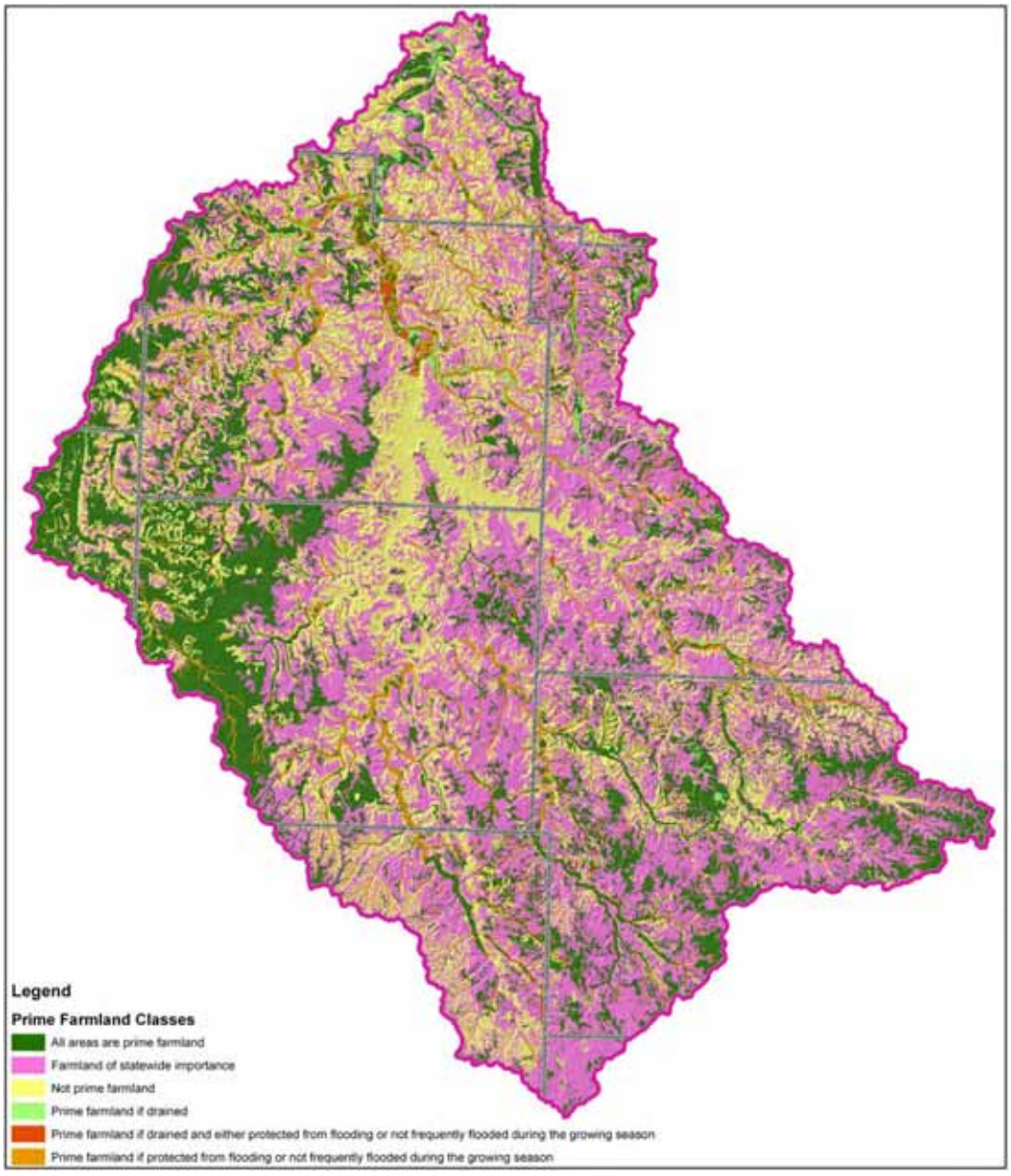


Erosion is defined as the wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Roughly 82% of the lands in the Sac River sub-basin are defined as either Highly Erodible or Potentially Highly Erodible.

HIGHLY ERODIBLE LANDS		Acres	Percent of Total
	Unrated Areas	29295	2.32%
	Highly Erodible Land	635219	50.41%
	Not Highly Erodible Land	195776	15.54%
	Potentially Highly Erodible Land	399827	31.73%
	TOTAL	1260117	

Prime Farmland



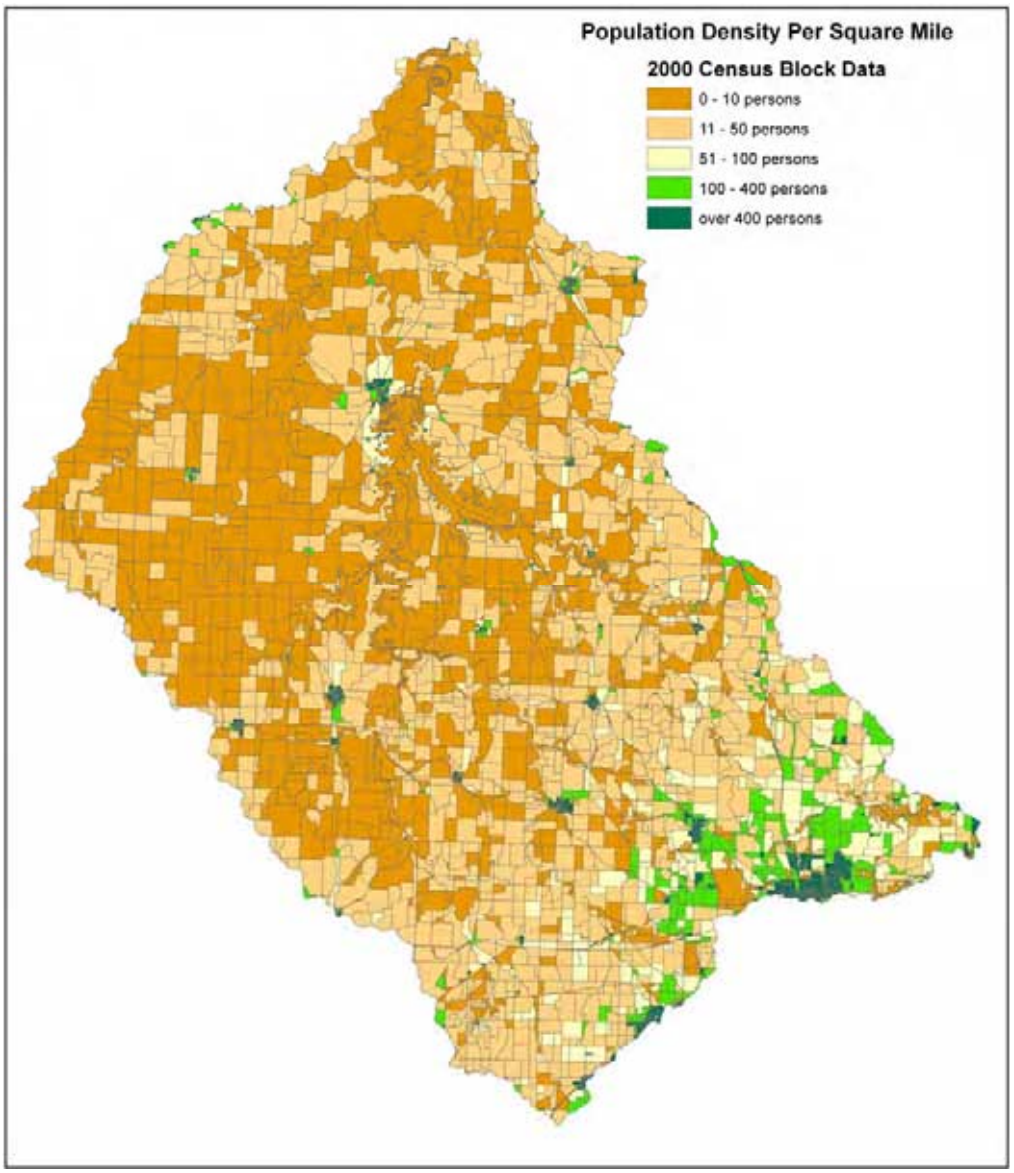
Prime Farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses.

Prime Farmland - Continued

PRIME FARMLANDS		Acres	Percent of Total
	All Areas are Prime Farmland	308167	24.46%
	Farmland of Statewide Importance	531181	42.15%
	Not Prime Farmland	329907	26.18%
	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	5961	0.47%
	Prime Farmland if Drained	17081	1.36%
	Prime Farmland if Protected from flooding, or not frequently flooded during the growing season	67821	5.38%
	TOTAL	1260118	

Approximately two-thirds of the farmland in the watershed is classified as Prime Farmland or Farmland of Statewide Importance; 26% is classified as Not Prime Farmland. Another 7 percent would be considered prime if it were drained or otherwise protected.

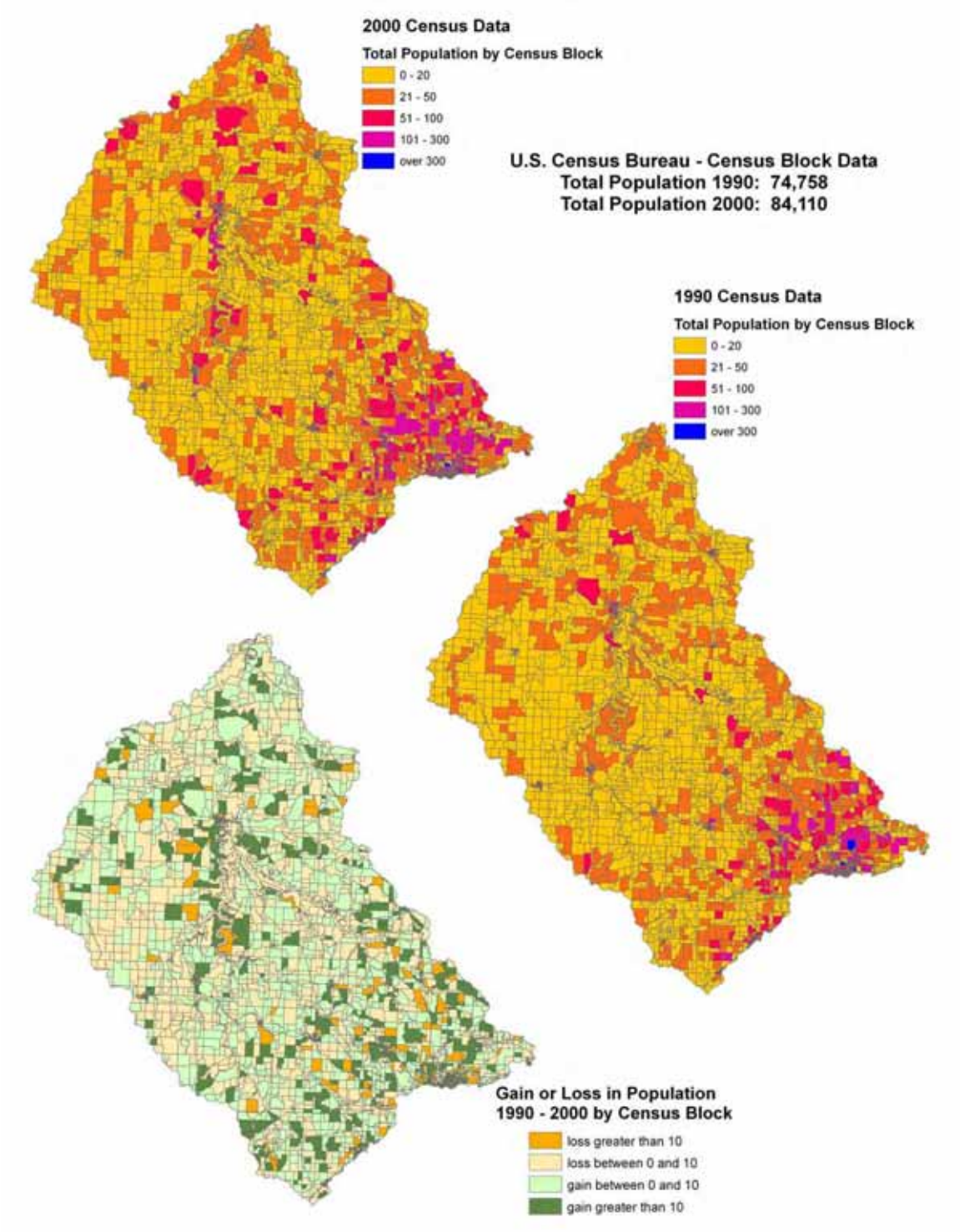
Census Data



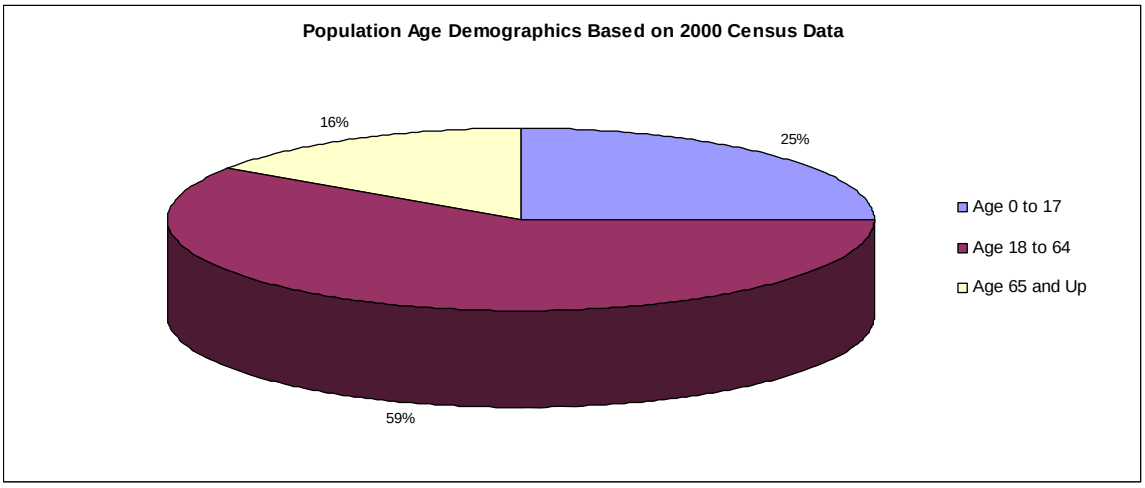
This map is based on 2000 U.S. Census Block data. It distributes the population evenly over the entire area of a block.

As expected, the higher density areas appear where urban areas are located. In this case, the highest population per square mile occurs where the city of Springfield is located. Other areas of high population (100-500 per square mile) are near the towns of El Dorado Springs, Humansville, Stockton, Bolivar, Greenfield, Lockwood, Willard, and Republic. The least dense areas are on the north end of the watershed in St. Clair County, on the western half of Dade County, and also in Vernon and Barton Counties.

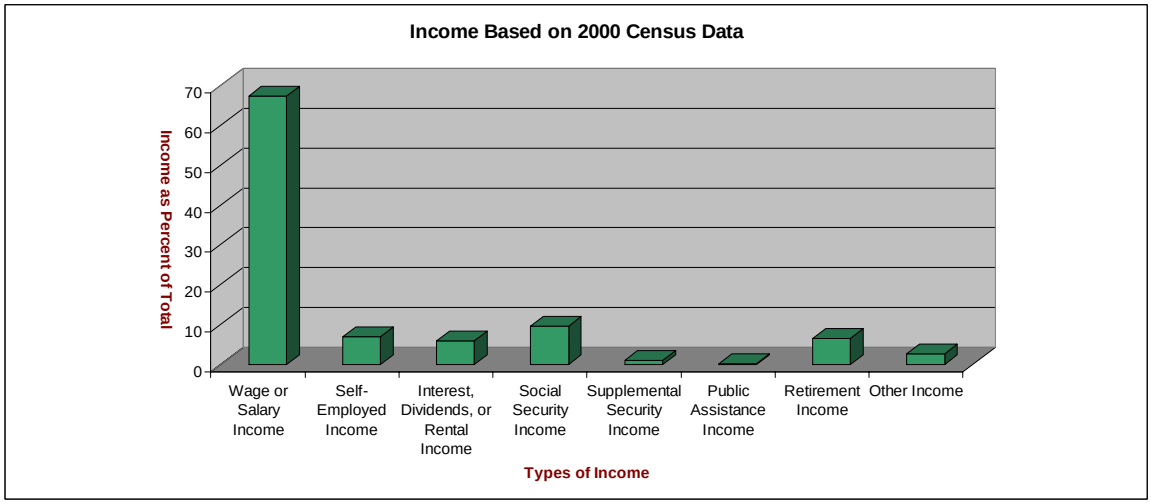
Census Data – Continued



Census Data – Continued

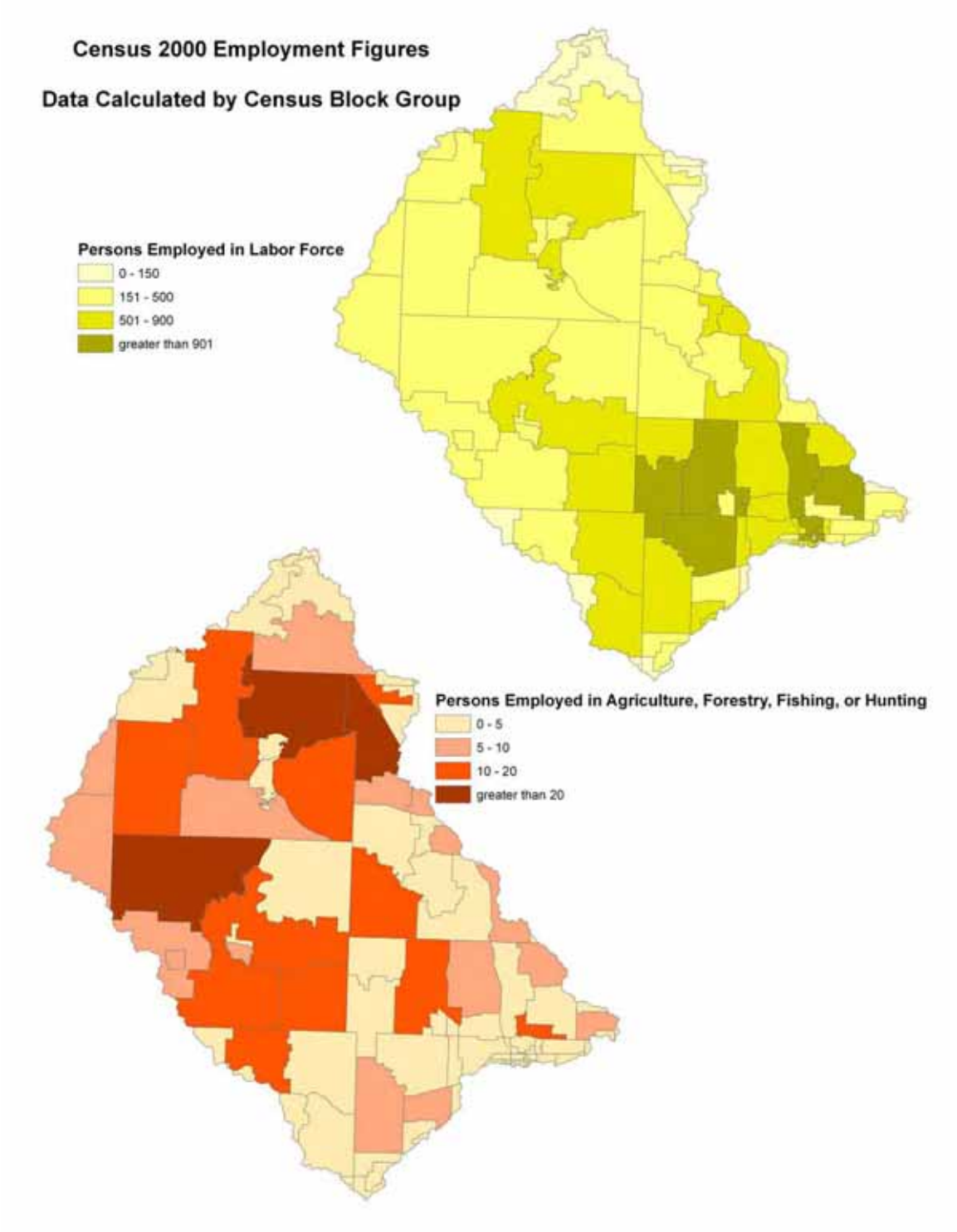


According to the Census Bureau, well over half of the population in the watershed falls between the ages of 18 and 65. Additionally, most of the income earned in this watershed comes from wages or salaries.

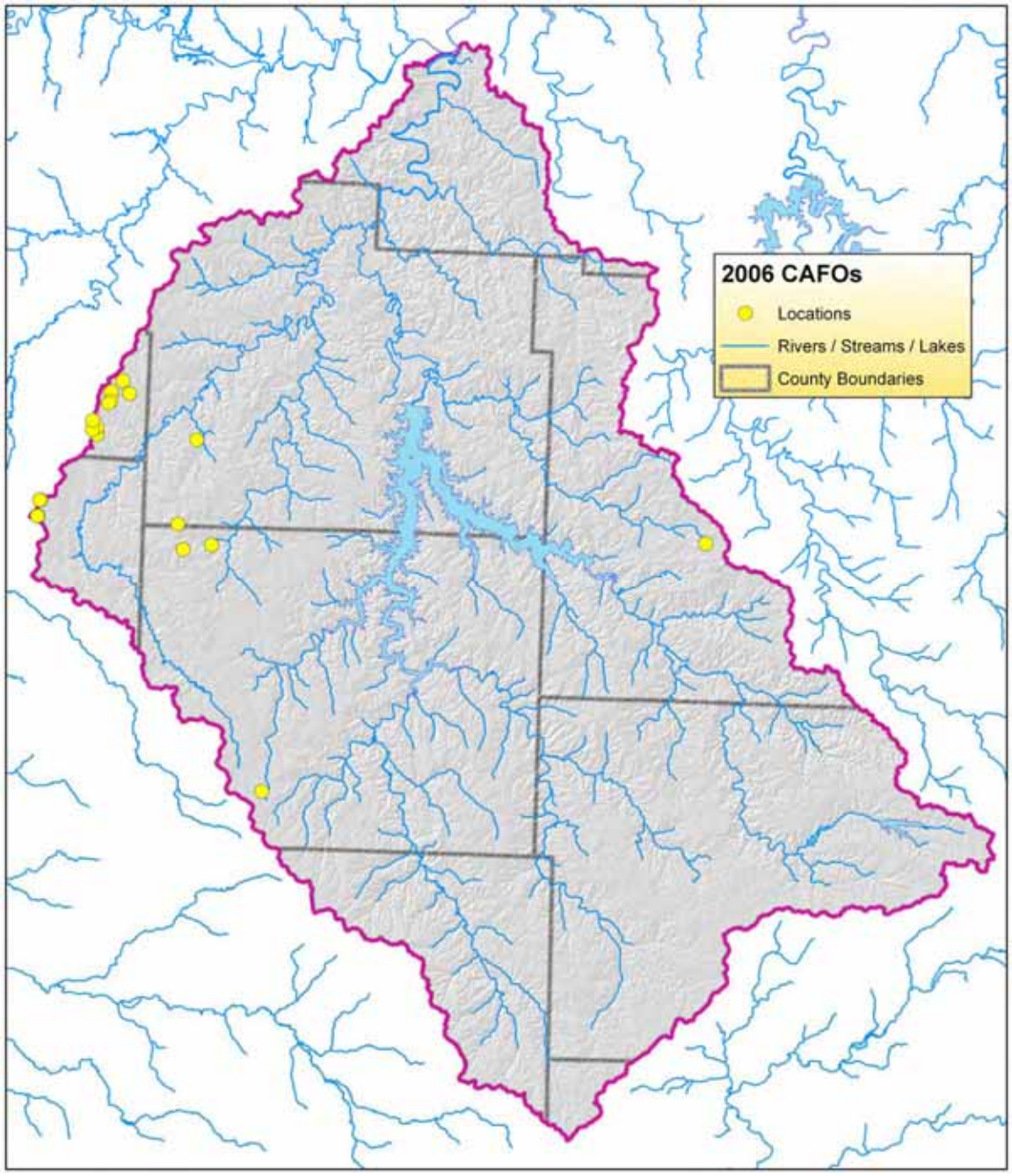


Agriculture income is not separated from other types of income in this graph. Farmers who own and work their own farms or ranches are included as Self-Employed. Farm hands and others who do not work their own land, and are paid employees are included as Wage and Salary Income.

Census Data – Continued



Confined Animal Feeding Operations



There are 19 permitted CAFOs in the watershed, predominately located on the extreme western side.

Confined Animal Feeding Operations - Continued

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.

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	1	714
Feedlot		
Poultry	1	1194
Swine	17	30001
Other		

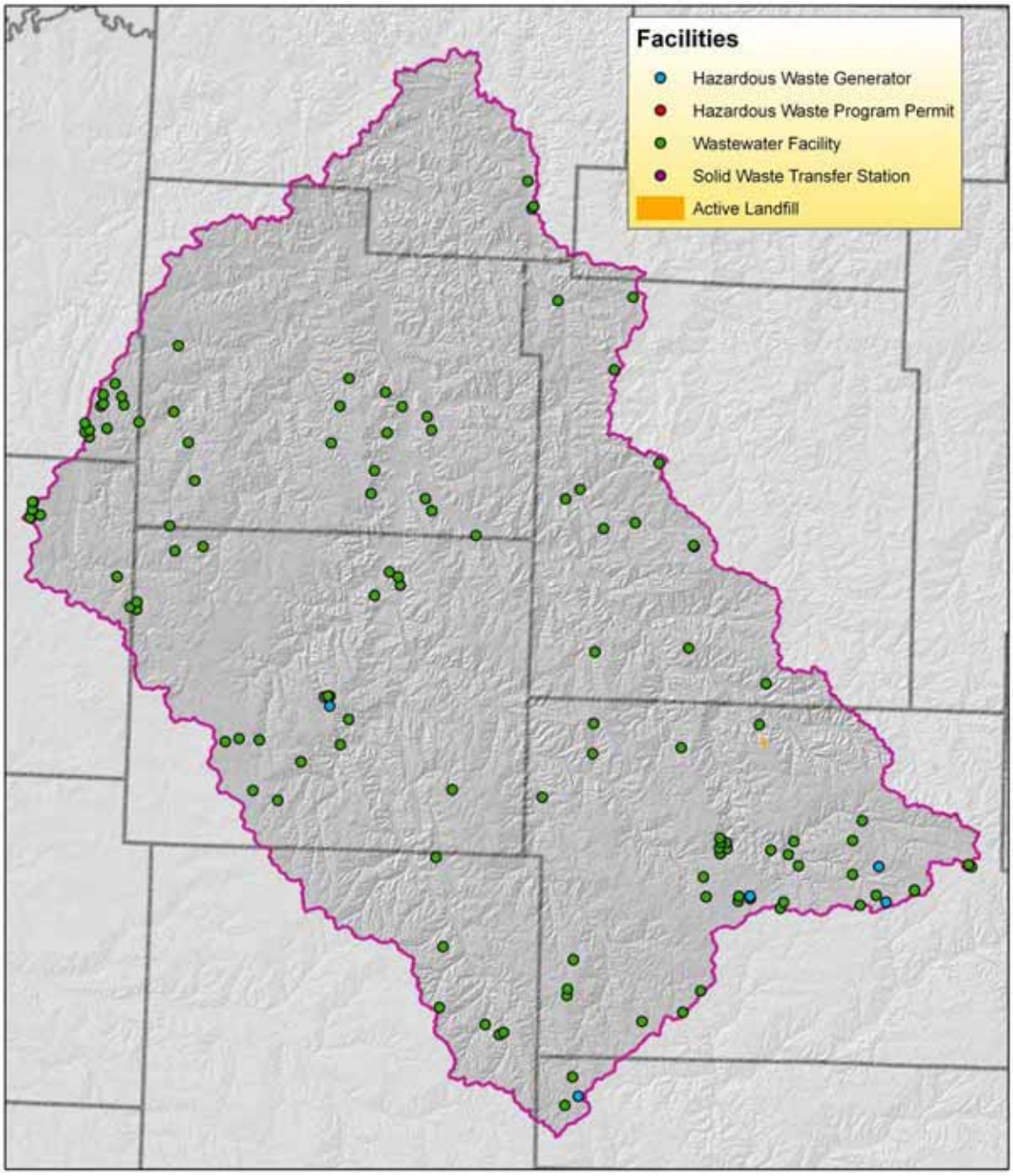
Confined Animal Feeding Operations - Continued

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

Additional Setbacks:
Of the ten counties that contribute area to the Sac River sub-basin, none have additional restrictions as imposed by County Health Ordinance.

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 and Wastewater Facilities – Continued

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.

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	5
Hazardous Waste Program Permits	1
Wastewater Facilities	126
Solid Waste Transfer Stations	0
Active Landfills	1

Drinking Water

Ground Water (Public Wells)	
Total population served by public wells	65946
Community population served by wells	55420
Non-community, non-transient population (schools, factories)	2287
Non-community, transient population (campgrounds, state parks)	8239
Total wells	5298
Public wells	122
Community wells	50
Non-community, non-transient population	11
Non-community, transient	52
Private Wells	5176

Of the total population served by public wells, over 85 percent are using community wells.

Surface Water (Reservoir Used for Public Drinking)	
Total population served by surface water	134313
Community population served by surface water	134313
Non-community, non-transient population (schools, factories)	0
Non-community, transient population (campgrounds, state parks)	0
Total number of intakes	4

All of the population served by surface water is in communities.

Resource Concerns

Endangered and Threatened Species

THREATENED AND ENDANGERED SPECIES LISTED FEDERALLY AND BY STATE		
State or Federally listed	**Species**	**Endangered Status**
State	Greater Prairie Chicken - *Bird*	Endangered
State	Northern Harrier - *Bird*	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 / Federal	Geocarpon - *Plant*	State - Endangered / Federal - Threatened
State / Federal	Mead's Milkweed - *Plant*	State - Endangered / Federal - Threatened
State	Barn Owl - *Bird*	Endangered
State	Black-tailed Jackrabbit - *Mammal*	Endangered
State	Plains Spotted Skunk - *Mammal*	Endangered
Federal	Spectaclecase - *Mollusk*	Candidate
State	Redfin Darter - *Fish*	Endangered
State / Federal	Missouri Bladder-pod - *Plant*	State - Endangered / Federal - Threatened
Federal	Arkansas Darter - *Fish*	Candidate
State / Federal	Ozark Cavefish - *Fish*	State - Endangered / Federal - Threatened
Federal	Neosho Mucket - *Fish*	Candidate
Listed by U.S. Fish and Wildlife ***Listed by Missouri Department of Conservation***		

The majority of the state and federal listed endangered and threatened species are dependent on water.

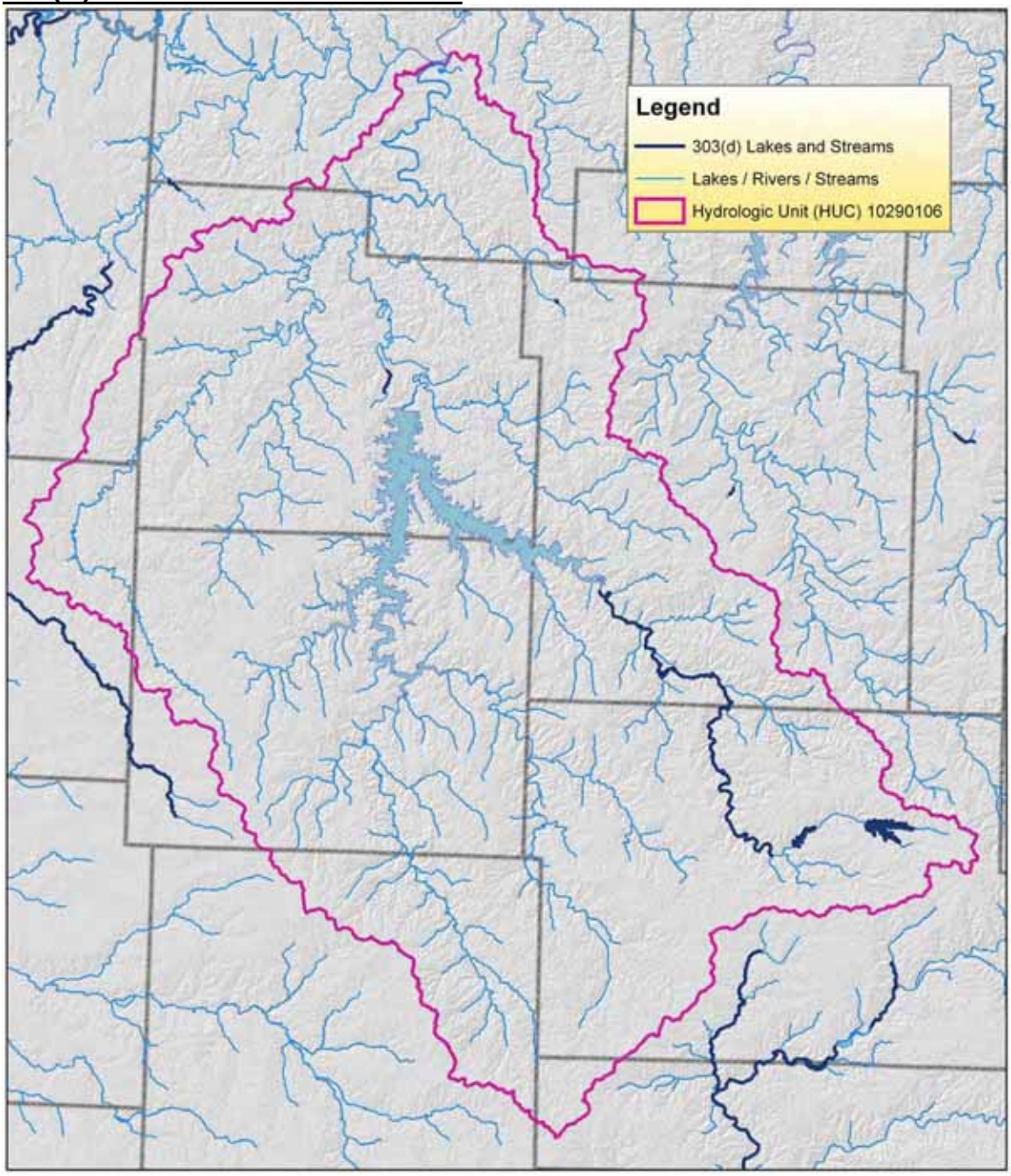
Resource Concerns – Continued

Stream Flow Data

STREAM FLOW DATA	USGS 06918740 Little Sac River near Morrisville, MO as recorded 1969 - 2006	**Total Avg. Yield**	228.09 CFS
		May - Sept. Yield	149.60 CFS
	USGS 06918493 South Fork Dry Sac River near Springfield, MO as recorded 1997 - 2006	**Total Avg. Yield**	15.23 CFS
		May - Sept. Yield	10.94 CFS
	USGS 06919900 Sac River near Caplinger Mills, MO as recorded 1975 - 2006	**Total Avg. Yield**	1599.73 CFS
		May - Sept. Yield	1524.00 CFS
	USGS 06919500 Cedar Creek near Pleasant View, MO as recorded 1924 - 2006	**Total Avg. Yield**	322.03 CFS
		May - Sept. Yield	264.20 CFS
	USGS 06919020 Sac River at HWY J below Stockton, MO as recorded 1974 - 2006	**Total Avg. Yield**	1132.43 CFS
		May - Sept. Yield	1174.60 CFS
	USGS 06919000 Sac River near Stockton, MO as recorded 1922 - 1989	**Total Avg. Yield**	990.69 CFS
		May - Sept. Yield	1006.6 CFS
	USGS 06918440 Sac River near Dadeville, MO as recorded 1967 - 2006	**Total Avg. Yield**	236.16 CFS
		May - Sept. Yield	168.60 CFS
	USGS 06918460 Turnback Creek above Greenfield, MO as recorded 1966 - 2006	**Total Avg. Yield**	256.71 CFS
		May - Sept. Yield	192.60 CFS

Resource Concerns – Continued

303(d) Listed Lakes and Streams



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.

Resource Concerns – Continued

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

There are only three 303(d) listed streams in the Sac River sub-basin. The longest is a 27 mile stretch of the Little Sac River that runs north into Stockton Lake from roughly the confluence of Little Sac River and South Dry Sac River. There is also a 1.7 mile stretch of the Stockton Branch as it flows out of the town of Stockton, and a .2 mile section of Brush Creek near the town of Humansville.

There are also two separate water bodies that are 303(d) listed. They are the 820 acre Fellows Lake and 300 acre McDaniel Lake, both north of Springfield on the Little Sac River.

STREAM DATA		Miles	Percent
	Total Miles - Major Streams	847.14	100%
	303(d) Listed Streams	28.9	3.41%

Resource Concerns – Continued

Local Stakeholder Meetings

Initial meetings with local stakeholders were held at four locations – Springfield, Greenfield, Osceola and Fair Play – within the Sac Watershed (see following table). The second round of only three meetings were held at different locations – Springfield, Arcola and Humansville – 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 – Sac Watershed

Initial Meeting			Invitees*	Second Meeting		
Date	**Location**	**Attendees**		**Date**	**Location**	**Attendees**
2 – 27	Springfield	11	46	4 – 3	Springfield	10
2 – 28	Greenfield	7	45	3 - 29	Arcola	12
3 – 26	Osceola**	7	31	5 – 8	Humansville	15
3 - 26	Fair Play**	4	37			

* Invitees with verified addresses

** Fair Play and Osceola invitees were combined into a single meeting in Humansville

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 also was 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 – A final series of meetings was scheduled for April and May 2008 within each watershed. Findings were to be reported back to the groups as a check for accuracy and their opinions regarding the overall utility of the information gathered. However, because of the unusually wet spring, these meetings were subsequently cancelled.

Resource Concerns – Continued

Cropping Practices

Arcola –

A. Crops
- Soybeans
- Milo
- Corn
- Wheat
- Cucumbers
- Green beans

B. Rotations
1. Wheat-double crop with soybeans or cucumbers
2. Corn-wheat-soybeans

C. Yields
1. Soybeans: 30-50 bu/ac
2. Corn: Irrigated 160-165 bu/ac; Dry land 100-150 bu/ac
3. Wheat: 40-60 bu/ac
4. Milo: 60-130 bu/ac

D. Tillage Practices
1. No-till: >90% soybeans
2. Minimum till: nearly all corn
3. Conventional: negligible

E. Fertilization
1. Poultry litter: more used each year
2. Commercial: some anhydrous on corn
    - 75% is farmer-applied; farmers are using GPS
4. Soybeans: December or January application
5. Corn: P & K in the fall; N – pre-plant

F. Lime
- Soil test - most use
- Grain farms - 5 years or more frequently

G. Herbicides
1. Beans: RoundUp
2. Corn: RoundUp (little used); atrazine, Lasso, depends on costs

H. Seed treatment
1. Beans: inoculate for new plantings
    - Little fungicide because of late planting

Resource Concerns – Continued

Humansville –

A. Crops - yield
1. Corn: 120-150 bushel/acre
2. Soybeans: 30-60 bushel/acre
3. Wheat: 40-80 bushel/acre
4. Oats: little grown
5. Milo: little grown
6. Cucumbers

B. Rotations
1. Soybeans-wheat (fall)-soybeans
2. Wheat-soybeans-corn
3. Continuous soybeans (some)
4. Continuous corn (some)

C. Tillage
1. Conventional till: very little
2. Minimum till: 70%
3. No-till: 30%

D. Fertilization
1. Chicken litter: some in south and west part of watershed
2. Commercial:
   Corn: fertilized at planting; very little side-dressing; N, P, K
   Soybeans: fertilized at planting; P and K
3. Wheat: N-P-K at planting; additional N in March

E. Lime
1. Applied about every three years
2. Applied according to soil test
3. Apply 2-3 tons/acre

F. Herbicides
1. Corn: atrazine, RoundUp (on RoundUp ready corn)
2. Beans: RoundUp ready beans
3. Wheat: No herbicides used

L. Seed treatment
1. Corn, Beans, and Wheat; seeds pretreated with fungicide

Springfield –

A. Crops - yield
1. Corn-chopped: 15-20 tons/acre
2. Soybeans: 40 bu/acre
3. Milo: 2500 lb/acre (forage)
4. Wheat: 30-40 bu/acre (forage)
5. Rye: 7-8 ton/acre [wet] (forage)
6. Sudan: 2-3 ton [dry]/acre (1-2 cuttings)

Resource Concerns – Continued

B. Rotations
1. Sudan (summer)-rye (fall)
2. Sudan (summer)-wheat (fall)
3. Corn (summer)-rye/wheat (fall)

C. Tillage
1. Highly erodible: no-till
2. Less erodible: minimum-till
3. Chisel plow - little usage

D. Fertilization – Price affects application rates of commercial fertilizer
{Ammonium nitrate)
- Majority of row crops are owned by dairy farmers who use manure
- Sludge also used
- Some poultry litter used throughout the watershed
- Row crop rates (Silage):100-30-50
- Fertilization rates based on production, what is removed, and soil test

E. Liming
- Soil tests are done every 3-5 years
- Lime: based on pH

F. Herbicides
1. Corn and soybeans: RoundUp
2. Atrazine: Being replaced by RoundUp ready corn
3. Seed treatment - yes
- Fungicides, herbicides

Pastures/Hay

Arcola –

A. Fescue and fescue legume mix
- Legumes are re-seeded every year or two

B. Fertilizer
- Turkey litter: 2 tons/ac
- Commercial: 3-1-2; 200lbs/ac
- Some farmers are cutting back on application rates of P; has a lot to do with costs
*Example; applied straight chicken manure; 3 years late P is back down

C. Yields
1. Alfalfa:
- 1 cutting: 2 ½ tons/acre
- 2 cuttings: 4 tons/acre

D. Lime
1. Based on soil test

Resource Concerns – Continued

Humansville –

A. Fescue: mostly for seed
- Hay: 3 bales/acre, 1400 lbs/bale
- Seed: 200-400lbs/acre

B. Orchard grass: same as fescue
C. Hop clover and clover
D. Lespedeza: mixed with pasture; mixed with wheat for seed
E. Brome: 3 tons/acre (2 cuttings with adequate rain)
F. Timothy: mixed with other grasses
G. Swithgrass: 4 tons/acre
H. Native warm season grasses: 2.5 tons/acre
I. Fescue is inter-seeded with lespedeza, clover
- Orchard grass same as fescue
- Wheat is inter-seeded with lespedeza

J. Fertilization
1. Fescue: based on soil test: 40-20-20, applied Feb. – April
2. Better practice would be to put P and K on in fall and N in spring
3. Important for seed production: 60 lbs of N

K. Lime
1. Based on soil test
2. Applied in late summer or winter

Springfield –

A. Fescue
- Fescue: seed production - straight fescue
- Fescue: fall fertilization will have legumes
- Fescue: spring fertilization - no legumes
- Rainfall pattern is changing - less June and August rain- forages are not well adapted
- Warm season grasses: Acres are expanding
- Fertilization: Most fescue is fertilized in the spring for hay and/or seed
  -. Fertilizer: most is commercial N - 50# - 60# per acre 40-30-40 (based on soil test)

B. Alfalfa
1. Fertilization: 0-15-60/ton
2. New stand: 4 tons per acre - 4 cuttings
3. Old stand: 2 cuttings

C. Other forages: 2-3 tons/acre
D. Orchard grass: Cool season; less endophyte; matures early

Resource Concerns – Continued

E. Warm season grasses
* Burned every 3 – 5 years
1. Red River crabgrass
2. Caucasian Bluestem
3. Big Bluestem
4. Indian Grass
5. Switch Grass - some
6. Eastern Gama Grass - some
7. Bermuda grass

F. Cool Season management
1. Cut hay in early-May-early June and then graze

F. Warm Season Management
1. Cut hay or graze- but not crabgrass
*Concern over invasive species - need to use herbicides to control

G. Yields
1. Fescue:
- Seed production: 200 – 600 lbs per acre
- Hay: 2 – 3 ton per acre
2. Other forages:
- Warm season grasses: 2 – 25 tons per acre, based on soil conditions

Grazing

Arcola – Beef cattle - cow/calf

A. Stocking rate: 5 acres/cow-calf pair with hay supplement (comes from 5 acres)

B. Rotation: 10 - 40 acre fields - 1 ½-4 cows/acre
- 25% of people who graze rotate out 30 days or less per rotation of all paddocks
- April – November/December
- Warm season grasses: 5-10% warm season grasses; more farmers are including them in rotation
- Switchgrass, Bermuda grass, big blue, little blue

C Continuous: 3-5 acres/cow; 10 acres/cow with timber;

D. Supplements:
- Hay
- 20% protein range cubes
- Corn gluten
- Dry distillers, grains
- Soy hull pellets

* In normal years with good quality hay don't supplement

Resource Concerns – Continued

E. Water source
    1. Wells, springs, ponds, creeks, rural water
F Nutrient management
    1. Planning/testing done by poultry litter applicator
    2. Cropland: till in within 2 hours not on pasture
    3. CAFO: about 10-12 will have NMP if permitted
        - Poultry industry is pushing for nutrient management plans

Humansville – Beef cattle – cow/calf
A. Species
    1. Fescue: 3-6 acres/cow/calf
    2. Native warm season grasses: 6-8 acres/ cow/calf
B. Fertilization
    1. Fescue pastures: same as hay land
    2. Native warm season grasses: not fertilized
        - Burn 1/3 of land each year
C. Lime
    1. Fescue: soil test every 3 years
    2. Native warm season grasses: no lime is applied
D. Grazing systems
    1. Continuous: cattle on 12 months of the year
        - Feed hay December to April or May
        - Not too many good cattlemen continuously graze all 12 months
    2. Rotation grazing
        - 3-4 pastures - cattle circulate – based on season, moisture conditions and growth of grass
        - Cool season grasses: turn in when grass is 14” tall and move out at 3” grass height
        - Some rotate cows out at 5”-6” grass height
        - Native warm season grasses: rotate out at 6” grass height
    3. Patch-burn-graze
        - Burned area: 50% of time graze down
        - 2 years: 30% of time
        - 3 Years 20% of time
    4. Intensive Grazing – Little is done
        - Smaller operations of 40-60 acres in north part of watershed
        - 150-200 acre operations - Stockpile excess forage on ground; then strip graze this forage over the winter
E. Water Sources
    1. Creeks, Ponds (improved pond with water springs), Wells, Springs
F. Nutrient Management Plans
    1. Supplement nutrients; just large dairies
    2. Harrow pastures to break up and spread manure

Resource Concerns – Continued

Springfield –

A. Cool Season
- 4 acres/cow
- Most land is continuously grazed with some designated hay fields (these are hayed then grazed)

B. Rotation
- 2.5 acres/cow
- Rotate through 3-4 pastures (7 days), cut hay, then continue grazing in rotation and can use stockpiled forage

C. Intensive rotation
- 1 acre/cow -10 paddocks
- Rotate every third day
  * Supplement with waste mill product

D. Rotation
- Dry lot through the winter
- Turn into pasture in early April and November or December

E. Water
1. Ponds, Springs, Creeks, Wells (significant), Stream watering - significant

F. Nutrient management planning
1. SALT project – Polk County
2. EQIP contracts require nutrient management planning
3. Municipal sludge applied as de-watered sludge
3. Dairy farms are starting to plan

G. Irrigation
- Less and less irrigation

Resource Concerns – Continued

Conservation Practices

Arcola –

- Clean out old ponds and put in pipe to a freeze-proof water and fence off pond
- Terraces
- Grass waterways
- Intensive grazing provides for even-use - no trails
- No-till
- Fence out of woods
- Forest management is increasing - TSI
- Capping old wells - need to do more
- Crop rotation - leave residual to protect soil
- Pasture improvement
- Invasive species control
- Wildlife plots
- Conservation Reserve Program
- Stream buffers
- Buffers in cropland (CP-21)
- Field Boarders (CP-33)
- Prairie restoration; glades; savannah

Humansville –

- Inter-seed cool season grasses with legumes
- Burn native warm season grass pastures
- Pasture rotation
- Fence ponds
- Fence and limit access to creeks
- Terrace fields
- Crop rotation
- Field buffers; CP-33
- Grassed waterways
- Riparian buffers CP-22
- Minimum till; no-till
- Food plot - on small acreage ownerships
- Stream bank restoration
- Wetland restoration

Resource Concerns – Continued

Springfield –

- No-till
- Rotational grazing
- Stream buffers
- Animal waste system – being developed and applied
- Woody covers resulting from ice storms
- Fencing ponds and using alternative water
- Limited access or tanks off of wells
- Add legumes to pasture
- Timber Stand Improvement (TSI) in woodlands
- Windbreaks
- Savannah restoration; glade restoration
- Emphasis on quail habitat; Focus area near Bois de Arc
    - 90% cost share has generated interest
- Food plots
- Warm Season Grasses
- Past-prescribed burning was used
    * NRCS can no longer participate
- Grassed waterways and terraces on the west side of watershed
- Livestock
    1. Cattle: heavy concentration in the area
    2. Poultry: broilers
    3. Horses: heavy concentration in Greene, Polk and Lawrence Counties
    4. Goats (meat): increasing in numbers

Natural Resource Issues

Arcola –

- Rural Subdivisions – messy, unsightly
- On-site sewage disposal
- Rural land leaving agriculture
- Application of Springfield sewage sludge – surface application
- Small cities using creeks for sewage disposal
- Nitrates, phosphates, drugs, etc. in the water

* Developments are causing increased land prices and taxes

- Rural crime increasing
    - Meth, vandalism (Road-signs)
- Low taxes
- Trash, dead animals
- Trespass-hunters, ORVs
- Difficult for young farmers to make a living from farming full time
- Erosion from water release from Stockton Dam
- Many people leave a buffer along streams.

Resource Concerns – Continued

Humansville –

- Fish farms (aquaculture) are becoming more prevalent and targeted
    * Unfair regulations on impounded water discharge into creek; concern is that discharge water is polluted
    * Fair Play has an improperly installed lagoon system; MDNR is not forcing Fair Play to correct the problem
- Trespass
- Control of noxious weeds
    * MoDot - Sercia Lespedeza
    * Thistle, Mutiflora rose
- Public dumping of rubbish into streams; lack of enforcement of ordinances
- Public dumping of trash
- Increased taxes and land prices because of land being sold at high values for small plots for recreation and or hunting
- Drinking water supply

Springfield –

- Urban Sprawl from City of Willard
    * Storm-water runoff is polluting clear creek
    * Sewage goes into the Little Sac
- Erosion of landowner rights
    * Need a more participatory approach to addressing water quality
    * Need more agricultural people involved in natural resources decision making
    * Not all waste pollution is from agriculture
- Dams on streams lead to murky water- riparian rights
- Problem with water quality and quantity
- Learn how to utilize runoff
- Nutrient and pesticide management from urban areas
- On-site septic systems
    * Estimate that 60% in Green County are leaking
- Rural residential development
    * Septic systems
    * Increasing land prices
    * Young people cannot start farming
    * Concern over regulation
        - Manage by fear
- Trespassers
    - Pets, hunters, and Off Road Vehicles (ORVs)
- Road hunters (poachers)
- Mushroom hunters
- Indian artifact collectors
- Need a watershed district where management will be for water quality, but on an equitable basis

External 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 Sac 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. 47-48)	92,359	50	3
Forestland (p. 49-50)	383,481	25	10
Grassland (p. 51-52)	704,712	60	13
Urban (p. 53-54)	12,370	5	5

* 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	SAC RIVER - 10290106				LANDUSE ACRES	92,359		
LANDUSE TYPE	CROPLAND				TYPICAL UNIT SIZE ACRES	50		
ASSESSMENT INFORMATION					ESTIMATED PARTICIPATION	3%		
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 Quantity – Inefficient Water Use on Nonirrigated Land	Water Quality – Harmful Levels of Pesticides in Surface Water
Baseline System				System Rating ->	4	2	2	2
Total Acreage at Baseline Level	**23,090**	**20,781**	**0**	**20,781**				
Conservation Crop Rotation (ac.) 328	23,090	20,781	0	20,781	4	1	2	2
Grassed Waterway (ac.) 412	1,154	1,039	0	1,039	0	4	0	2
Terrace (ft.) 600	3,001,668	2,701,501	0	2,701,501	5	2	3	3
Progressive System				System Rating ->	4	3	3	4
Total Acreage at Progressive Level	**46,180**	**46,180**	**2,309**	**48,488**				
Conservation Crop Rotation (ac.) 328	46,180	48,488	0	48,488	4	1	2	2
Grassed Waterway (ac.) 412	2,309	2,424	0	2,424	0	4	0	2
Nutrient Management (ac.) 590	46,180	46,180	2,309	48,488	0	0	0	0
Residue and Tillage Management, No-Till/Strip Till/Direct Seed (ac.) 329	46,180	46,180	2,309	48,488	5	1	4	5
Terrace (ft.) 600	6,003,335	6,303,502	0	6,303,502	5	2	3	3
Resource Management System (RMS)				System Rating ->	5	3	3	5
Total Acreage at RMS Level	**23,090**	**23,090**	**0**	**23,090**				
Conservation Crop Rotation (ac.) 328	23,090	23,090	0	23,090	4	1	2	2
Filter Strip (ac.) 393	924	924	0	924	3	0	0	3
Grassed Waterway (ac.) 412	1,154	1,154	0	1,154	0	4	0	2
Nutrient Management (ac.) 590	23,090	23,090	0	23,090	0	0	0	0
Pest Management (ac.) 595	23,090	23,090	0	23,090	0	0	1	5
Residue and Tillage Management, No-Till/Strip Till/Direct Seed (ac.) 329	23,090	23,090	0	23,090	5	1	4	5
Terrace (ft.) 600	3,001,668	3,001,668	0	3,001,668	5	2	3	3

WATERSHED NAME & CODE	SAC RIVER - 10290106	LANDUSE ACRES	92,359
LANDUSE TYPE	CROPLAND	TYPICAL UNIT SIZE ACRES	50
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	3%

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	**2308.975**							
Conservation Crop Rotation (ac.) 328	0	$0	$0	$0	$0	$0	$0	$0
Grassed Waterway (ac.) 412	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	2,309	$0	$87,764	$17,553	$95,751	$0	$29,255	$45,033
Residue and Tillage Management, No-Till/Strip Till/Direct Seed (ac.) 329	2,309	$0	$125,585	$25,117	$137,014	$0	$41,862	$64,440
Terrace (ft.) 600	0	$0	$0	$0	$0	$0	$0	$0
	Subtotal	**$0**	**$213,349**	**$42,670**	**$232,765**	**$0**	**$71,116**	**$109,473**
Resource Management System (RMS) Acres Treated	**0**							
Conservation Crop Rotation (ac.) 328	0	$0	$0	$0	$0	$0	$0	$0
Filter Strip (ac.) 393	0	$0	$0	$0	$0	$0	$0	$0
Grassed Waterway (ac.) 412	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	0	$0	$0	$0	$0	$0	$0	$0
Pest Management (ac.) 595	0	$0	$0	$0	$0	$0	$0	$0
Residue and Tillage Management, No-Till/Strip Till/Direct Seed (ac.) 329	0	$0	$0	$0	$0	$0	$0	$0
Terrace (ft.) 600	0	$0	$0	$0	$0	$0	$0	$0
	Subtotal	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**2308.975**	**$0**	**$213,349**	**$42,670**	**$232,765**	**$0**	**$71,116**	**$109,473**

WATERSHED NAME & CODE	SAC RIVER - 10290106				LANDUSE ACRES	383,481		
LANDUSE TYPE	FORESTLAND				TYPICAL UNIT SIZE ACRES	25		
ASSESSMENT INFORMATION					ESTIMATED PARTICIPATION	10%		
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	Plant Condition – Productivity, Health and Vigor	Fish and Wildlife – Inadequate Food	Fish and Wildlife – Inadequate Cover/Shelter
Baseline System			System Rating ->		1	3	1	1
Total Acreage at Baseline Level	**345,133**	**310,620**	**0**	**310,620**				
Forest Stand Improvement (ac.) 666	345,133	310,620	0	310,620	3	5	3	3
Progressive System			System Rating ->		3	4	3	3
Total Acreage at Progressive Level	**23,009**	**21,858**	**34,513**	**56,372**				
Brush Management (ac.) 314	3,451	3,279	5,177	8,456	3	3	3	3
Fence (ft.) 382	920,354	874,337	1,380,532	2,254,868	0	0	0	0
Forest Stand Improvement (ac.) 666	23,009	56,372	0	56,372	3	5	3	3
Use Exclusion (ac.) 472	21,858	20,765	32,788	53,553	2	4	3	3
Resource Management System (RMS)			System Rating ->		4	5	3	4
Total Acreage at RMS Level	**15,339**	**15,339**	**1,150**	**16,490**				
Brush Management (ac.) 314	1,534	1,649	0	1,649	3	3	3	3
Fence (ft.) 382	613,570	659,587	0	659,587	0	0	0	0
Forest Stand Improvement (ac.) 666	15,339	16,490	0	16,490	3	5	3	3
Tree/Shrub Establishment (ac.) 612	1,534	1,534	115	1,649	5	5	3	4
Tree/Shrub Site Preparation (ac.) 490	1,534	1,534	115	1,649	-1	5	0	0
Use Exclusion (ac.) 472	14,572	15,665	0	15,665	2	4	3	3

WATERSHED NAME & CODE	SAC RIVER - 10290106	LANDUSE ACRES	383,481
LANDUSE TYPE	FORESTLAND	TYPICAL UNIT SIZE ACRES	25
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	10%

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	**34513.29**							
Brush Management (ac.) 314	5,177	$229,574	$0	$45,915	$275,489	$229,574	$4,591	$248,915
Fence (ft.) 382	1,380,532	$1,007,788	$0	$201,558	$1,209,346	$1,007,788	$100,779	$1,432,305
Forest Stand Improvement (ac.) 666	0	$0	$0	$0	$0	$0	$0	$0
Use Exclusion (ac.) 472	32,788	$81,969	$0	$16,394	$98,363	$81,969	$4,918	$102,686
	Subtotal	**$1,319,331**	**$0**	**$263,866**	**$1,583,197**	**$1,319,331**	**$110,288**	**$1,783,906**
Resource Management System (RMS) Acres Treated	**1150.443**							
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	0	$0	$0	$0	$0	$0	$0	$0
Tree/Shrub Establishment (ac.) 612	115	$18,752	$0	$3,750	$22,503	$18,752	$0	$18,752
Tree/Shrub Site Preparation (ac.) 490	115	$0	$15,459	$3,092	$16,865	$0	$5,153	$7,932
Use Exclusion (ac.) 472	0	$0	$0	$0	$0	$0	$0	$0
	Subtotal	**$18,752**	**$15,459**	**$6,842**	**$39,368**	**$18,752**	**$5,153**	**$26,684**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**35663.733**	**$1,338,083**	**$15,459**	**$270,708**	**$1,622,565**	**$1,338,083**	**$115,441**	**$1,810,590**

WATERSHED NAME & CODE	SAC RIVER - 10290106				LANDUSE ACRES	704,712		
LANDUSE TYPE	GRASSLAND				TYPICAL UNIT SIZE ACRES	60		
ASSESSMENT INFORMATION PART 1					ESTIMATED PARTICIPATION	13%		
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	Plant Condition – Noxious and Invasive Plants	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage	Domestic Animals – Inadequate Stock Water
Baseline System			**System Rating ->**		**2**	**2**	**3**	**3**
Total Acreage at Baseline Level	**387,592**	**329,453**	**0**	**329,453**				
Fence (ft.) 382	38,759,160	32,945,286	0	32,945,286	0	0	0	0
Pasture and Hay Planting (ac.) 512	387,592	329,453	0	329,453	4	4	5	0
Pond (no.) 378	6,460	5,491	0	5,491	0	0	0	5
Progressive System			**System Rating ->**		**5**	**4**	**5**	**5**
Total Acreage at Progressive Level	**211,414**	**194,501**	**46,511**	**241,012**				
Brush Management (ac.) 314	31,712	29,175	6,977	36,152	3	4	4	0
Critical Area Planting (ac.) 342	10,571	9,725	2,326	12,051	5	4	1	0
Fence (ft.) 382	31,712,040	33,826,176	2,325,550	36,151,726	0	0	0	0
Forage Harvest Management (ac.) 511	211,414	194,501	46,511	241,012	3	4	4	0
Pasture and Hay Planting (ac.) 512	211,414	241,012	0	241,012	4	4	5	0
Pipeline (ft.) 516	7,047,120	6,483,350	1,550,366	8,033,717	0	0	0	5
Pond (no.) 378	3,524	4,017	0	4,017	0	0	0	5
Prescribed Grazing (ac.) 528	211,414	194,501	46,511	241,012	4	4	5	0
Watering Facility (no.) 614	3,524	3,242	775	4,017	2	0	3	5

WATERSHED NAME & CODE	SAC RIVER - 10290106				LANDUSE ACRES	704,712		
LANDUSE TYPE	GRASSLAND				TYPICAL UNIT SIZE ACRES	60		
ASSESSMENT INFORMATION PART 2					ESTIMATED PARTICIPATION	13%		
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	Plant Condition – Noxious and Invasive Plants	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage	Domestic Animals – Inadequate Stock Water
Resource Management System (RMS)				System Rating ->	5	5	5	5
Total Acreage at RMS Level	105,707	105,707	28,541	134,248				
Brush Management (ac.) 314	10,571	12,262	1,163	13,425	3	4	4	0
Critical Area Planting (ac.) 342	5,285	6,131	581	6,712	5	4	1	0
Fence (ft.) 382	19,379,580	23,079,318	1,532,749	24,612,067	0	0	0	0
Forage Harvest Management (ac.) 511	95,136	110,358	10,465	120,823	3	4	4	0
Heavy Use Area Protection (ac.) 561	5,285	5,285	1,427	6,712	3	4	0	0
Nutrient Management (ac.) 590	95,136	95,136	25,687	120,823	0	0	4	0
Pasture and Hay Planting (ac.) 512	95,136	120,823	0	120,823	4	4	5	0
Pest Management (ac.) 595	105,707	105,707	28,541	134,248	0	5	4	0
Pipeline (ft.) 516	4,668,717	5,232,487	696,784	5,929,271	0	0	0	5
Pond (no.) 378	1,762	2,237	0	2,237	0	0	0	5
Prescribed Grazing (ac.) 528	95,136	110,358	10,465	120,823	4	4	5	0
Riparian Forest Buffer (ac.) 391	10,571	10,571	2,854	13,425	2	4	0	0
Tree/Shrub Establishment (ac.) 612	10,571	10,571	2,854	13,425	5	4	2	0
Tree/Shrub Site Preparation (ac.) 490	10,571	10,571	2,854	13,425	-1	4	0	0
Use Exclusion (ac.) 472	10,571	10,571	2,854	13,425	2	4	4	1
Water Well (no.) 642	1,762	1,762	476	2,237	2	0	2	5
Watering Facility (no.) 614	1,762	2,044	194	2,237	2	0	3	5

WATERSHED NAME & CODE	SAC RIVER - 10290106	LANDUSE ACRES	704,712
LANDUSE TYPE	GRASSLAND	TYPICAL UNIT SIZE ACRES	60
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	13%

	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	**46510.992**							
Brush Management (ac.) 314	6,977	$309,379	$0	$61,876	$371,255	$309,379	$6,188	$335,444
Critical Area Planting (ac.) 342	2,326	$553,690	$0	$110,738	$664,428	$553,690	$11,074	$600,337
Fence (ft.) 382	2,325,550	$1,697,651	$0	$339,530	$2,037,181	$1,697,651	$169,765	$2,412,764
Forage Harvest Management (ac.) 511	46,511	$186,044	$0	$37,209	$223,253	$186,044	$55,813	$421,149
Pasture and Hay Planting (ac.) 512	0	$0	$0	$0	$0	$0	$0	$0
Pipeline (ft.) 516	1,550,366	$1,666,644	$0	$333,329	$1,999,973	$1,666,644	$0	$1,666,644
Pond (no.) 378	0	$0	$0	$0	$0	$0	$0	$0
Prescribed Grazing (ac.) 528	46,511	$204,648	$0	$40,930	$245,578	$204,648	$0	$204,648
Watering Facility (no.) 614	775	$352,077	$0	$70,415	$422,492	$352,077	$14,083	$411,400
	Subtotal	**$4,970,134**	**$0**	**$994,027**	**$5,964,160**	**$4,970,134**	**$256,923**	**$6,052,386**
Resource Management System (RMS) Acres Treated	**28540.836**							
Brush Management (ac.) 314	1,163	$51,563	$0	$10,313	$61,876	$51,563	$1,031	$55,907
Critical Area Planting (ac.) 342	581	$138,423	$0	$27,685	$166,107	$138,423	$2,768	$150,084
Fence (ft.) 382	1,532,749	$1,118,906	$0	$223,781	$1,342,688	$1,118,906	$111,891	$1,590,231
Forage Harvest Management (ac.) 511	10,465	$41,860	$0	$8,372	$50,232	$41,860	$12,558	$94,759
Heavy Use Area Protection (ac.) 561	1,427	$37,262,630	$0	$7,452,526	$44,715,156	$37,262,630	$3,726,263	$52,959,005
Nutrient Management (ac.) 590	25,687	$0	$976,353	$195,271	$1,065,206	$0	$325,451	$500,984
Pasture and Hay Planting (ac.) 512	0	$0	$0	$0	$0	$0	$0	$0
Pest Management (ac.) 595	28,541	$0	$1,827,184	$365,437	$1,993,465	$0	$609,061	$937,560
Pipeline (ft.) 516	696,784	$749,043	$0	$149,809	$898,851	$749,043	$0	$749,043
Pond (no.) 378	0	$0	$0	$0	$0	$0	$0	$0
Prescribed Grazing (ac.) 528	10,465	$46,046	$0	$9,209	$55,255	$46,046	$0	$46,046
Riparian Forest Buffer (ac.) 391	2,854	$465,216	$0	$93,043	$558,259	$465,216	$9,304	$504,409
Tree/Shrub Establishment (ac.) 612	2,854	$465,216	$0	$93,043	$558,259	$465,216	$0	$465,216
Tree/Shrub Site Preparation (ac.) 490	2,854	$0	$383,503	$76,701	$418,404	$0	$127,834	$196,782
Use Exclusion (ac.) 472	2,854	$7,135	$0	$1,427	$8,562	$7,135	$428	$8,939
Water Well (no.) 642	476	$711,533	$0	$142,307	$853,839	$711,533	$28,461	$831,422
Watering Facility (no.) 614	194	$88,019	$0	$17,604	$105,623	$88,019	$3,521	$102,850
	Subtotal	**$41,145,589**	**$3,187,041**	**$8,866,526**	**$52,851,781**	**$41,145,589**	**$4,958,573**	**$59,193,235**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**75051.828**	**$46,115,723**	**$3,187,041**	**$9,860,553**	**$58,815,942**	**$46,115,723**	**$5,215,496**	**$65,245,621**

WATERSHED NAME & CODE	SAC RIVER - 10290106				LANDUSE ACRES	12,370		
LANDUSE TYPE	HIGH AND LOW INTENSITY URBAN				TYPICAL UNIT SIZE ACRES	5		
ASSESSMENT INFORMATION					ESTIMATED PARTICIPATION	5%		
CONSERVATION SYSTEMS BY TREATMENT LEVELS	CURRENT CONDITIONS	FUTURE CONDITIONS			RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Road, Roadsides and Construction Sites	Soil Condition – Compaction	Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water	Water Quality – Harmful Levels of Pathogens in Surface Water
Baseline System			System Rating ->		3	1	2	0
Total Acreage at Baseline Level	**11,133**	**10,576**	**0**	**10,576**				
Critical Area Planting (ac.) 342	557	529	0	529	5	3	4	1
Progressive System			System Rating ->		3	1	2	0
Total Acreage at Progressive Level	**619**	**588**	**557**	**1,144**				
Critical Area Planting (ac.) 342	31	57	0	57	5	3	4	1
Diversion (ft.) 362	61,850	58,758	55,665	114,423	2	0	2	1
Resource Management System (RMS)			System Rating ->		4	2	3	2
Total Acreage at RMS Level	**619**	**619**	**31**	**649**				
Critical Area Planting (ac.) 342	31	32	0	32	5	3	4	1
Diversion (ft.) 362	61,850	64,943	0	64,943	2	0	2	1
Mulching (ac.) 484	93	93	5	97	4	2	2	1
Tree/Shrub Establishment (ac.) 612	31	31	2	32	2	2	4	3
Tree/Shrub Site Preparation (ac.) 490	31	31	2	32	0	-1	-1	0

WATERSHED NAME & CODE	**SAC RIVER - 10290106**	**LANDUSE ACRES**	**12,370**
LANDUSE TYPE	**HIGH AND LOW INTENSITY URBAN**	**TYPICAL UNIT SIZE ACRES**	**5**
CONSERVATION INVESTMENT INFORMATION		**ESTIMATED PARTICIPATION**	**5%**

	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	**556.65**							
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Diversion (ft.) 362	55,665	$47,872	$0	$9,574	$57,446	$47,872	$1,915	$55,938
	Subtotal	**$47,872**	**$0**	**$9,574**	**$57,446**	**$47,872**	**$1,915**	**$55,938**
Resource Management System (RMS) Acres Treated	**30.925**							
Critical Area Planting (ac.) 342	0	$0	$0	$0	$0	$0	$0	$0
Diversion (ft.) 362	0	$0	$0	$0	$0	$0	$0	$0
Mulching (ac.) 484	5	$0	$1,392	$278	$1,518	$0	$464	$714
Tree/Shrub Establishment (ac.) 612	2	$252	$0	$50	$302	$252	$0	$252
Tree/Shrub Site Preparation (ac.) 490	2	$0	$208	$42	$227	$0	$69	$107
	Subtotal	**$252**	**$1,599**	**$370**	**$2,047**	**$252**	**$533**	**$1,073**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**587.575**	**$48,124**	**$1,599**	**$9,945**	**$59,494**	**$48,124**	**$2,448**	**$57,011**

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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Base Layer Map

Digital Elevation Model of Missouri. Map Layer. Center for Applied Research and Environmental Systems (CARES), 2005.
Public Land Survey. Map Layer. CARES, 2005.
Hydrologic Unit Code (HUC). Map Layer. Natural Resources Conservation Service (NRCS), 2006.
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Railroads. Map Layer. Federal Railroad Administration, 2003.
Political Boundaries. Map Layer. U.S. Census Bureau, 2001.
Public Lands. Map Layer. Missouri Resource Assessment Partnership (MoRAP), 2003.

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Relief Map:

Digital Elevation Model of Missouri. Map Layer. CARES, 2005.
Hillshade Relief Map of Missouri. Map Layer. CARES, 2005.

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Karst Features Map:

Springs, Sink Areas, and Losing/Gaining Streams. Map Layer. Missouri Department of Natural Resources (MoDNR), 2006.
Data Downloaded from: *http://www.msdis.missouri.edu/datasearch/ThemeList.jsp*
Sinkholes. Map Layer. CARES from various sources, 2006.

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Geologic Features Map:

Missouri Bedrock Geology. Map Layer. MoDNR, division of Geology and Land Survey-Geological Survey Program, 2006.
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Common Resource Area Map / Descriptions:

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Annual Precipitation Map:

Annual Precipitation. Map Layer. PRISM Group at Oregon State University, 2006.

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Land Ownership Map:

Public Lands. Map Layer. MoRAP, 2003.

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Land Slope Map:

Land Slope. Map layer. CARES, 2005.
Created from the CARES 10 Meter DEM.

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Land Use / Land Cover Map:

2005 Land Use Land Cover. Map Layer. MoRAP, 2005.

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Land Use / Land Cover Pie Chart:

2005 Land Use Land Cover. Database. MoRAP, 2005.

Land Use / Land Cover Graph:

2005 Land Use Land Cover. Database. MoRAP, 2005.
Data was collected by using Public Land (MoRaP, 2003) to clip Land Use / Land Cover. This gave both public and private land areas that could be queried by type.

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Land Capability Class Graph:

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Served by Missouri Cooperative Soil Survey at: *http://www.soilsurvey.org*
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Descriptions downloaded from *http://soils.usda.gov/technical/handbook/contents/part622.html*

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Riparian Corridor Map:

Riparian Corridor. Map Layer. NRCS.

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Highly Erodible Lands Map:

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Data queried from NRCS Soil data being served by the Missouri Cooperative Soil Survey at *http://www.soilsurvey.org*

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Prime Farmlands Map:

Soils GIS Data. Map Layer. NRCS.
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Census Data by Block Map:

2000 U.S. Census Tiger Lines. Map Layer. U.S. Census Bureau, 2001.
2000 U.S. Census Data. Database. U.S. Census Bureau, 2001.
Data queried from SF1-A databases.

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Census Data by Block Maps:

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Age Demographics Pie Chart:

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Income Sources Graph:

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Employment Figures Map:

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Confined Animal Feeding Operation Map:

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Facility Setback Graph:

Required Setbacks for Missouri. Database. MoDNR.
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Facility Additional Setback Information:

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Solid Waste and Wastewater Facilities Map:

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Hazardous Waste Generators. Map Layer. MoDNR, 2007.
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Surface Water Graph:

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Endangered and Threatened Species Graph:

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303(d) Listed Streams and Water Map:

Missouri 2002 303(d) Listed Waters. Map Layer. MoDNR, 2002.
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