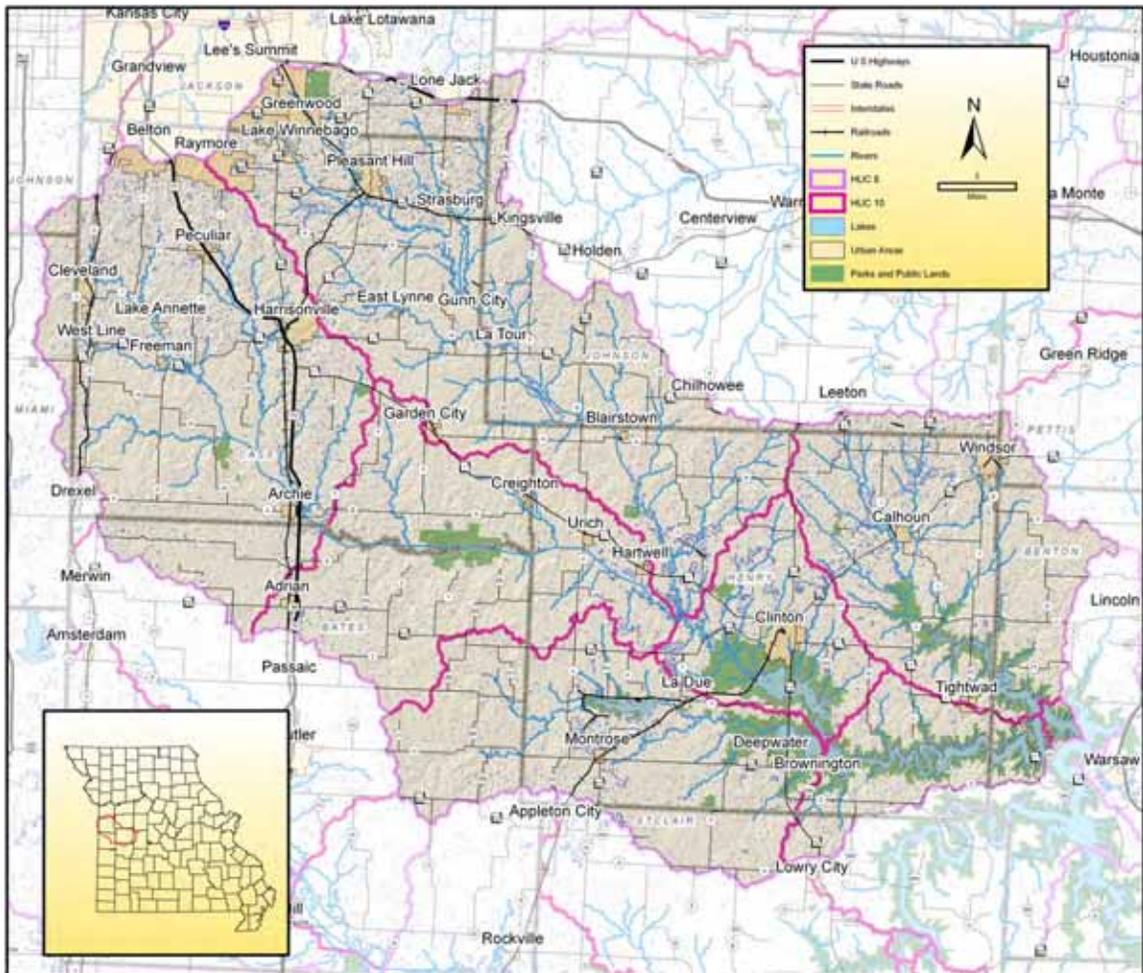


South Grand River – 10290108

8 – Digit Hydrologic Unit Profile and Resource Assessment Matrix



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This Project was supported by the United States Department of Agriculture Natural Resources Conservation Service through the Cooperative Conservation Partnership Initiative, the Missouri Agricultural Experiment Station, and the University of Missouri Extension.

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Summary

The South Grand Watershed (Hydrologic Unit 10290108) is a 2,060 square mile watershed in western Missouri (1.5% of the watershed is in Kansas). While the lower part of the basin is predominately rural, the upper part is rapidly undergoing urban development as the Kansas City metropolitan area expands southward. The overall topography is somewhat rolling, although a substantial portion is level. Agricultural operations are both crop- and livestock-based with many small ownerships. The area contains the greatest concentration of horses within the state. A significant amount of wetland area is in the watershed, and it supports fishing and waterfowl hunting areas. The watershed provides a substantial amount of the drainage for Harry S Truman Reservoir which is partially located within the watershed. The watershed is predominately private land, with only 6.8 percent in public holding.

The watershed contains three Common Resource Areas (CRAs) – Scarped Ozark Plains, Cherokee Plains, and Osage River Hills. The Scarped Ozark Plains and the Cherokee Plains are the major CRAs in the watershed. Cropland comprises only 29.4 percent of the land cover, while grassland is 41.6 percent, and deciduous forest is 13.3 percent. Highly erodible land is some 32.4 percent of the watershed, followed by 42.4 percent of potentially highly erodible land; 48.7 percent is identified as prime farmland. Only 8 Confined Animal Feeding Operations are permitted in the watershed 4 are swine operations and 4 are poultry operations. These are located across the central part of the watershed. There are a total of 9 separate streams and rivers listed as 303(d) waters. The largest is a 49 mile stretch of Big Creek running northwest from the South Grand River to a confluence just south of the town of Pleasant Hill and the Harry S Truman Reservoir.

Local stakeholder meetings held at Clinton and Harrisonville in March and May of 2007, respectively, identified corn, wheat and soybeans as the primary crops. Fescue is the predominate grass grown for pasture and grazing. Some warm season grasses have been established on Conservation Reserve Program (CRP) lands. Cow-calf management is the primary livestock operation. Most grazing is continuous, although some rotational grazing takes place. Various conservation practices were mentioned, with some relating to crop production and some 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	57,747	46,197		
Progressive	269,484	264,672	549,215	320,962
Resource Mgmt.	57,747	74,108	40,862,371	22,202,676
Total		25,024	41,411,585	22,523,637
Forestland				
Baseline	193,614	183,934		
Progressive	19,361	23,234	3,710,265	3,287,015
Resource Mgmt.	2,151	6,024	1,282,667	1,157,579
Total		11,617	4,992,932	4,444,594
Grassland				
Baseline	190,659	162,060		
Progressive	217,896	215,173	1,799,776	1,824,282
Resource Mgmt.	136,185	156,613	7,266,559	5,890,368
Total		39,494	9,066,335	7,714,651
Urban				
Baseline	16,993	15,294		
Progressive	1,699	2,889	2,011,068	2,025,772
Resource Mgmt.	189	563	586,923	565,750
Total		1,733	2,597,991	2,591,522

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:

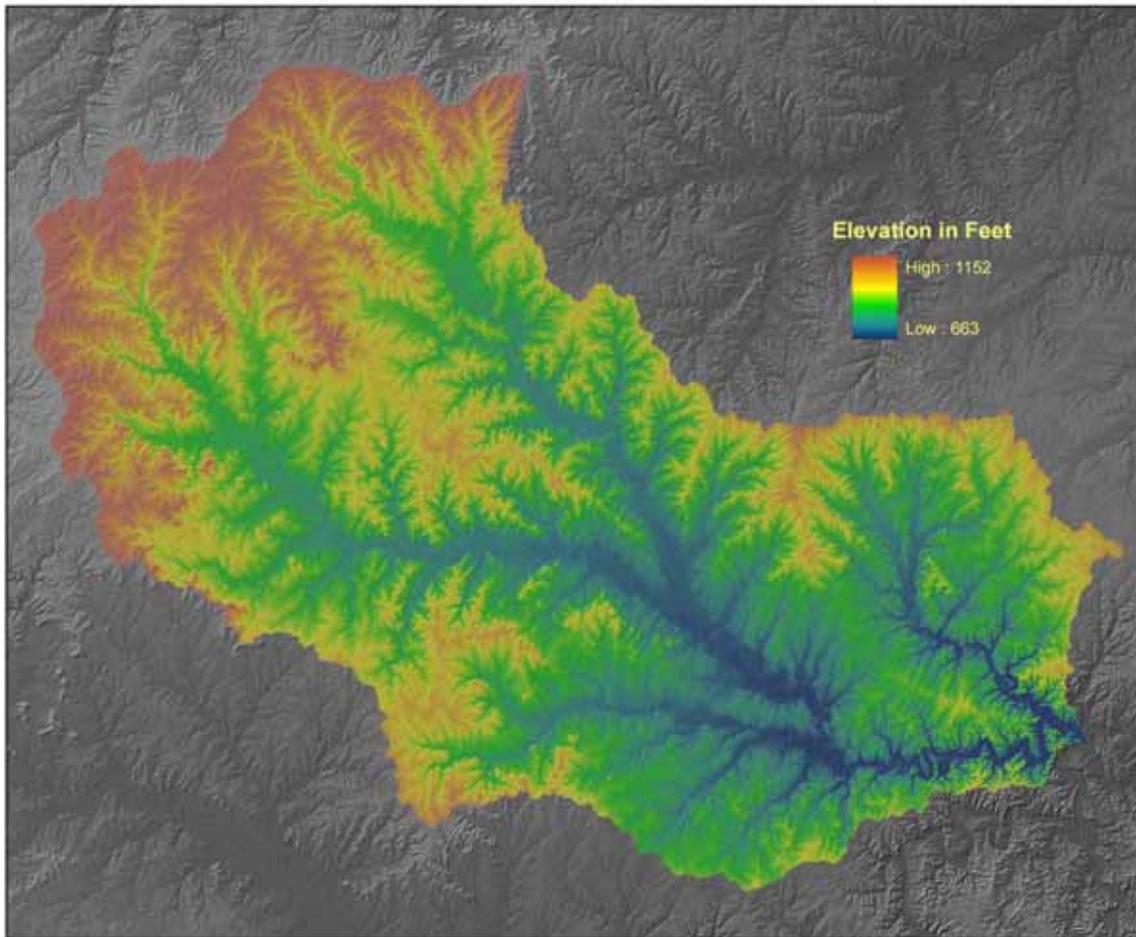
- Identifying the various factors which impede the watershed from providing a safe and reliable supply of water and related products to the users.
- Stating a set of measurable objectives for removing or resolving the impediments to water quality.
- Identifying a set of strategies and practices and strategies 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 South Grand 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 South Grand Watershed (Hydrologic Unit – 10290108), a 2,060 square mile watershed in west Missouri (1.5% of the watershed is in Kansas), was selected for its mix of agricultural activities, provision of recreational and wildlife activities, and provision of public drinking water for residential development. While the lower portion of the basin remains rural, the upper portion is rapidly undergoing urban development as the Kansas City metropolitan area expands southward. The South Grand Basin is a major contributor to the Harry S Truman Reservoir, and includes nearly one-half of the lake area.

The hydrologic unit supports 13 public drinking water lakes and river intakes supplying many towns as well as a number of rural water supply districts. The watershed includes significant wetland areas, and supports fishing and waterfowl hunting areas. Agriculture operations are both crop- and livestock-based with many small-acreage ownerships. The area contains the highest concentration of horses within the state. Historically, coal strip mining was located within the watershed (a major coal burning power facility remains in operation) and 33 Minuteman missile silos were situated throughout. Concerns include eight 303(d)-listed impaired water bodies, moderate loss of wetland areas, water pollution



South Grand River - 10290108

8 – Digit Hydrologic Unit Profile and Resource Assessment Matrix

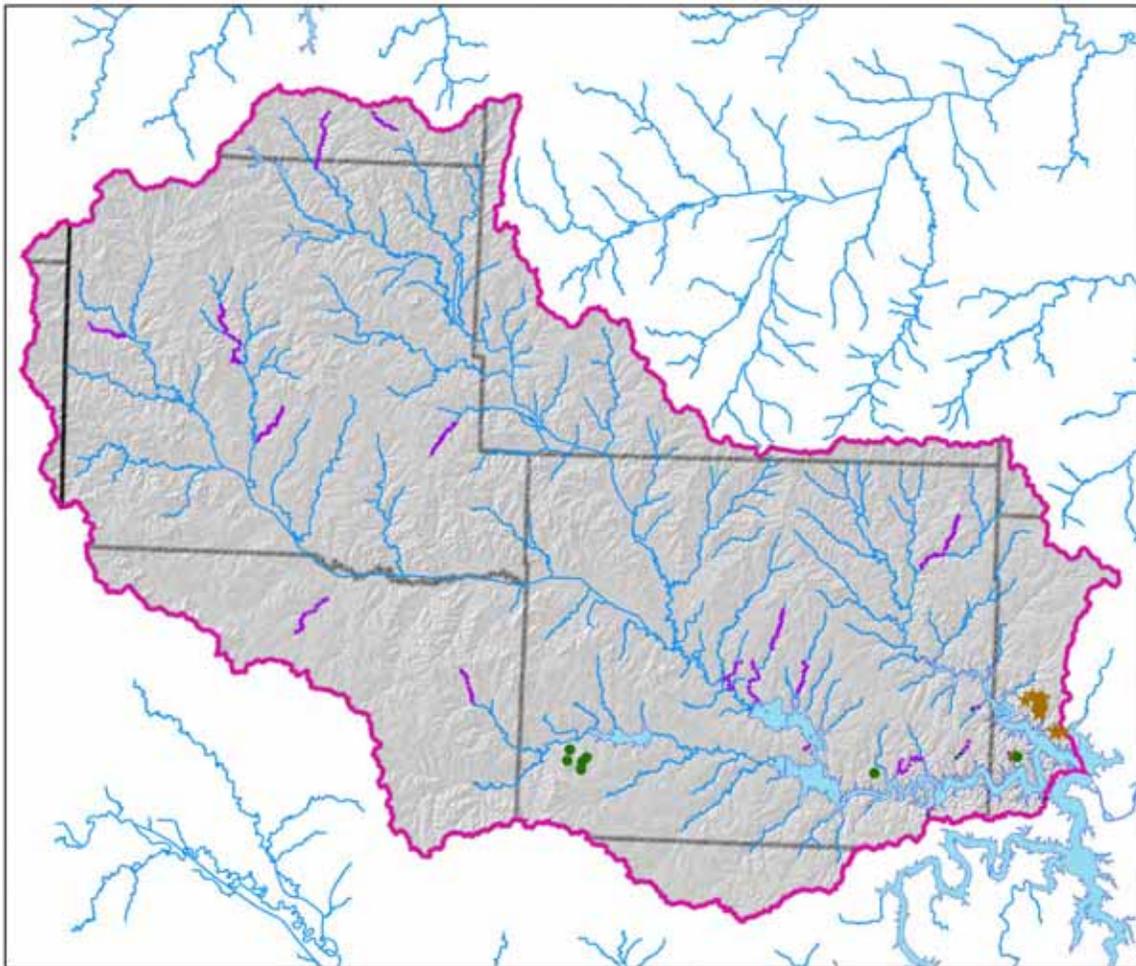


Relief Map – Continued

from sulphates and low pH levels, significant channelization and a growing human population.

The South Grand River Watershed is located in the western plains region of the state. The topography is somewhat rolling, although a substantial portion is relatively level.

Karst Features



For the South Grand River sub-basin, there are a total of 24 gaining streams and 4 losing streams. There are also 20 sinkholes and 2 sink areas. There are 7 total springs, with none having been either named or measured.

Karst Features

- Springs
- ★ Sinkholes
- Sink Areas
- Rivers / Streams / Lakes
- ▭ County Boundaries
- ▭ State Boundaries

Losing / Gaining Streams

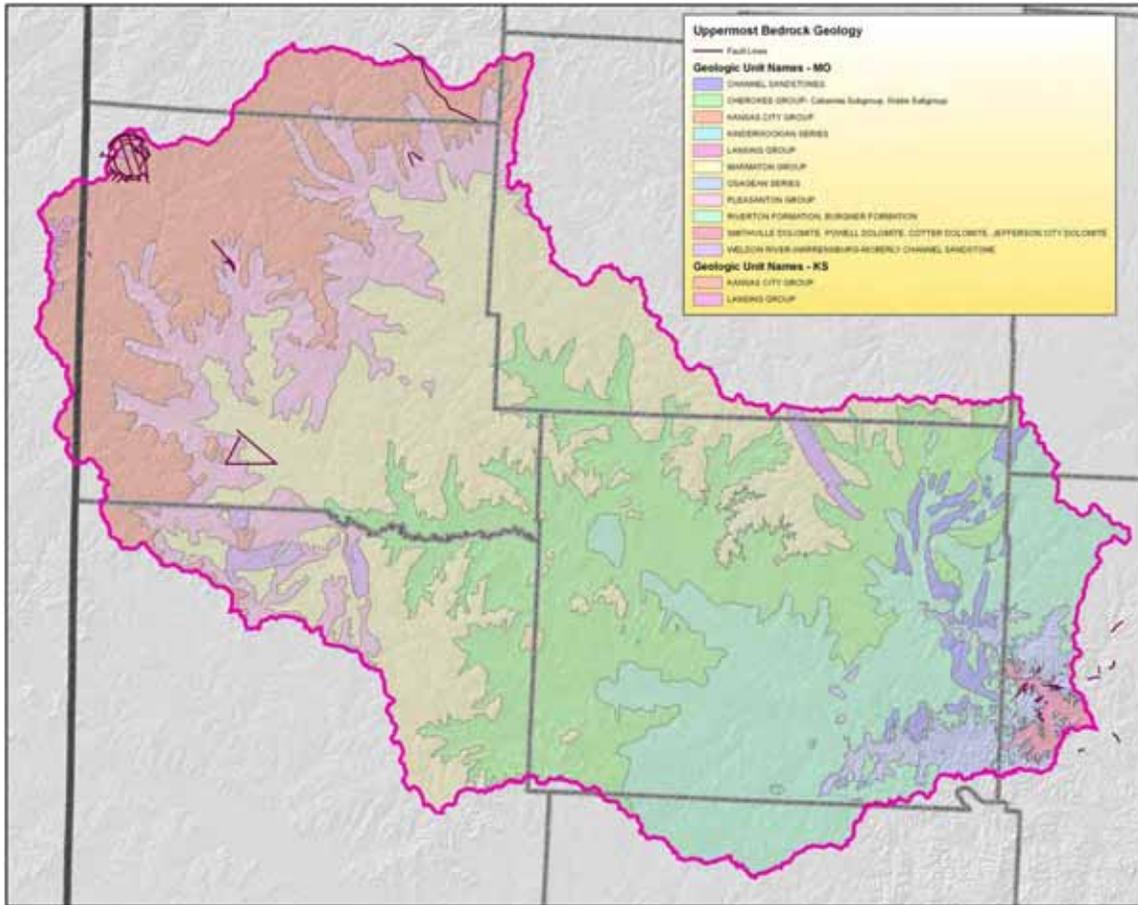
- Gaining
- Losing

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.

Geologic Features



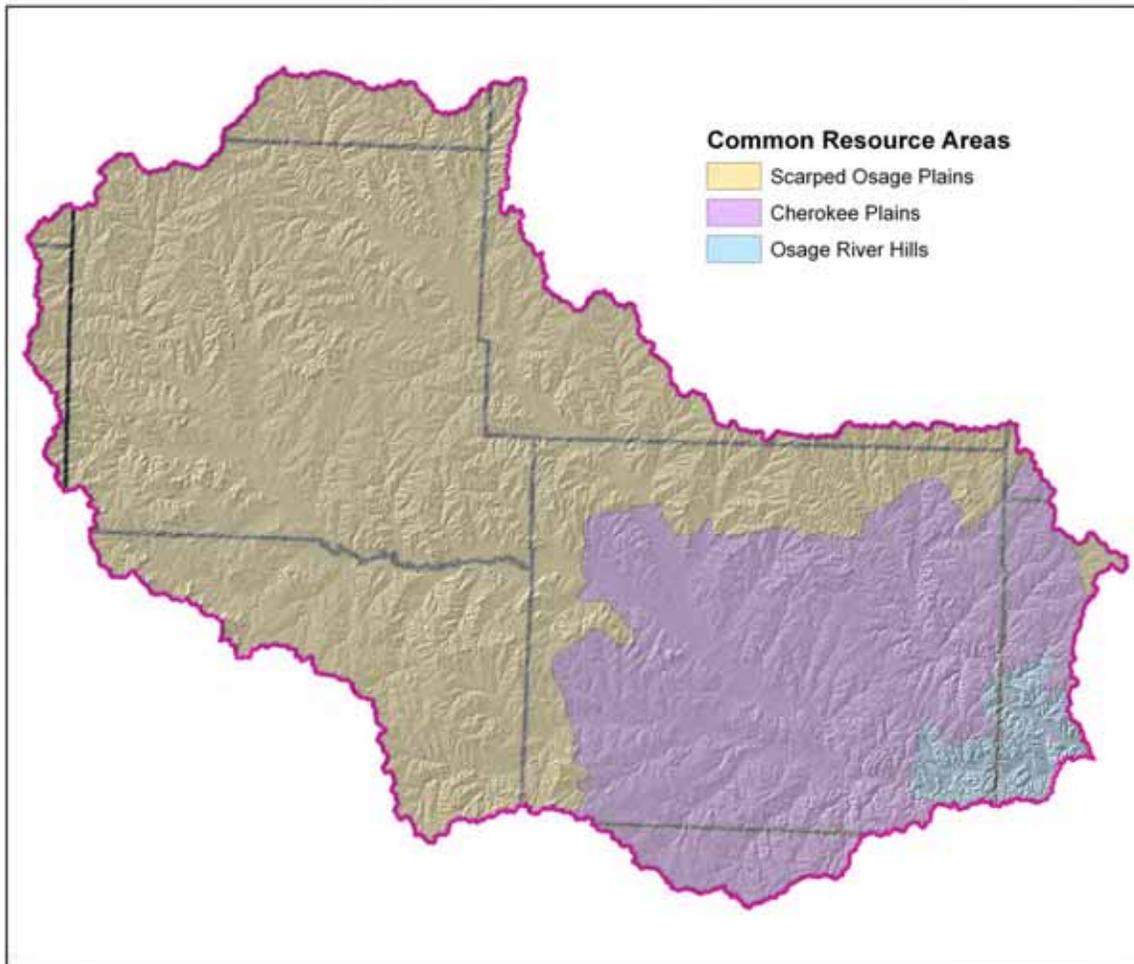
The geology of a watershed shows bedrock formations (or parent materials) which will produce soils that will in turn influence water quality, biological activity, and aquatic life in a stream. Different types of bedrock also control how channels develop.

For this sub-basin, bedrock types run from Smithville Dolomite, Powell Dolomite, Cotter Dolomite, and Jefferson City Dolomite in the bed of Harry S Truman Reservoir, to Marmaton Group, Pleasanton Group, and Kansas City Group in the upper reaches of the Lower Grand River Watershed. There is some minor impact from surface fault lines near Harry S Truman Reservoir, and more substantial impact near Belton in Cass County.

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
Channel Sandstones	sandstone;
Cherokee Group	shale; sandstone; siltstone, clay, limestone, coal
Kansas City Group	limestone; shale; sandstone, coal
Landsing Group	shale; limestone; sandstone
Osagean Series	limestone; chert; dolostone (dolomite), shale
Marmaton Group	limestone; shale; sandstone, clay, coal
Kinderhookian Series	limestone; siltstone; shale, sandstone
Pleasanton Group	shale; sandstone; coal
Weldon River - Warrensburg - Moberly Channel Sandstone	sandstone
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**

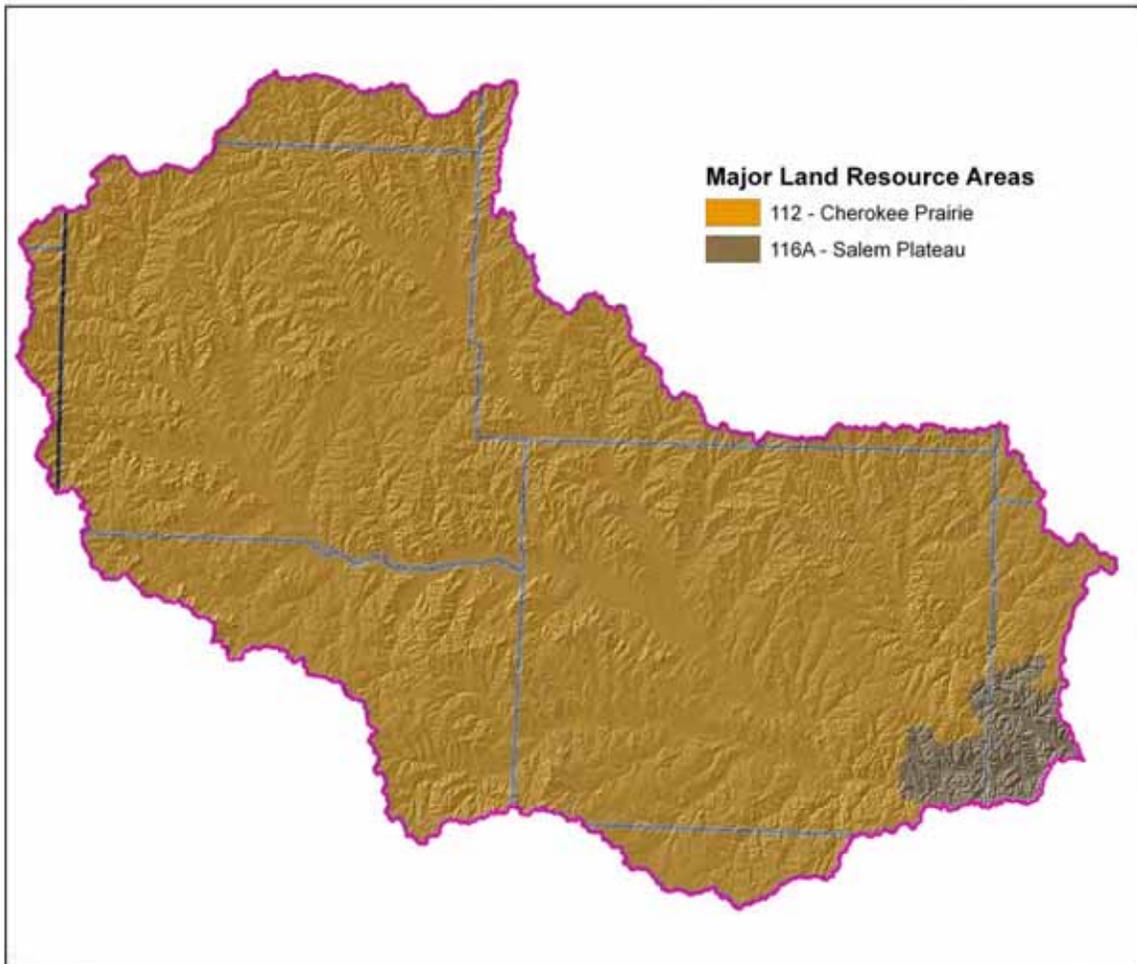
The South Grand River Watershed is comprised of three Common Resource Areas (CRAs), described as:

Scarped Osage Plains – A smooth plain interrupted by low, ragged escarpments trending southwest-northeast in which thin-bedded Pennsylvanian limestone bedrock is regularly exposed. Local relief reaches 150 feet in the escarpment zones but elsewhere averages less than 100 feet. Valley bottoms are exceptionally broad for the size of the streams. Most of the land is in pasture and cropland.

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.

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 (MLRA) Descriptions

The South Grand River Watershed is located in two MLRAs as described below:

112 – Cherokee Prairies

Land use: Nearly all this area is in farms, and about 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. Approximately 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 that in Missouri and in Oklahoma.

Major Land Resource Area – Continued

Elevation and topography: Elevation ranges from 100 to 400m. The gently sloping to rolling dissected plains is 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 is 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 ranges from 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.

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.

Major Land Resource Area – Continued

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. Local relief is in meters to tens of meters.

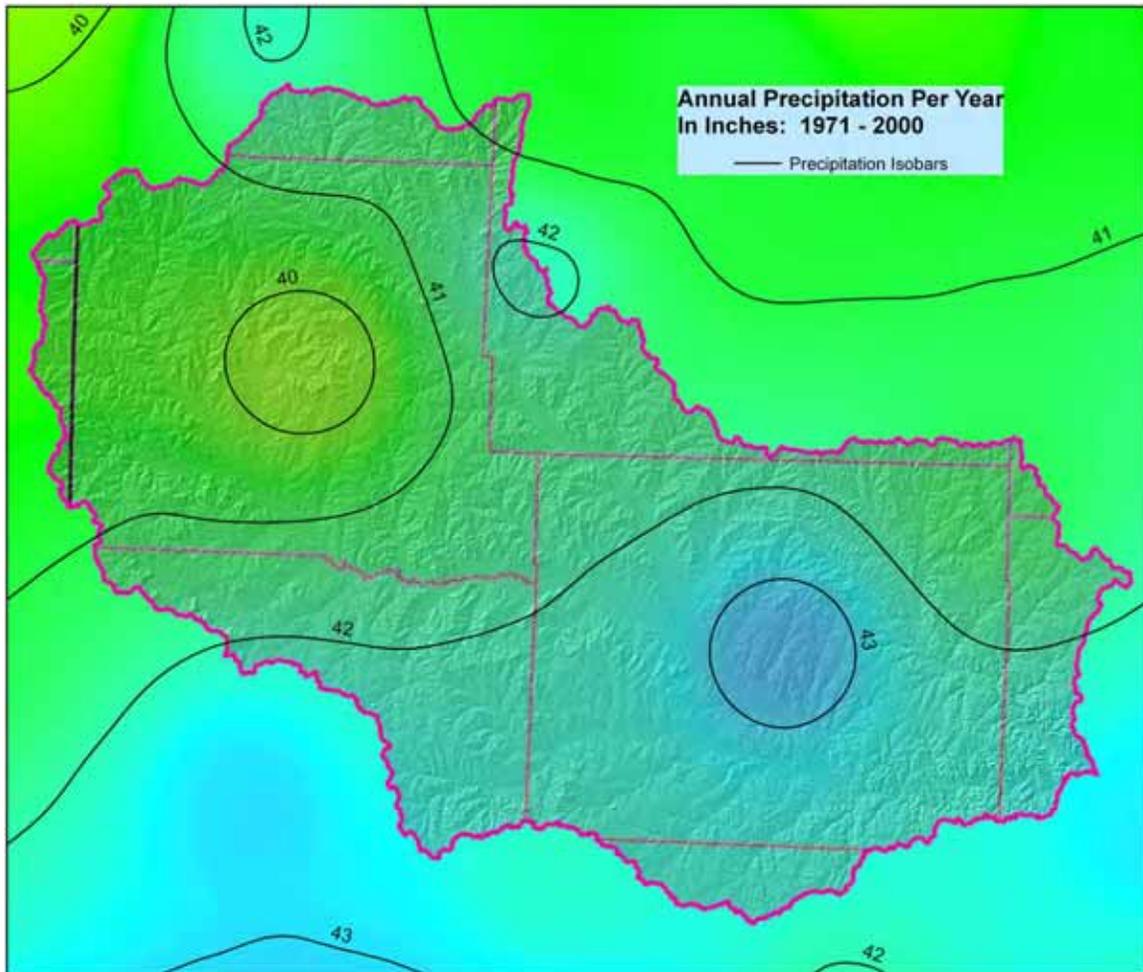
Climate: Average annual precipitation ranges from 1,025 to 1,225 mm. Maximum precipitation is in spring and early in summer, and the minimum is in midsummer. Average annual temperature ranges from 13° to 16°C with an average freeze-free period of 180 to 200 days.

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 Elsay 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.

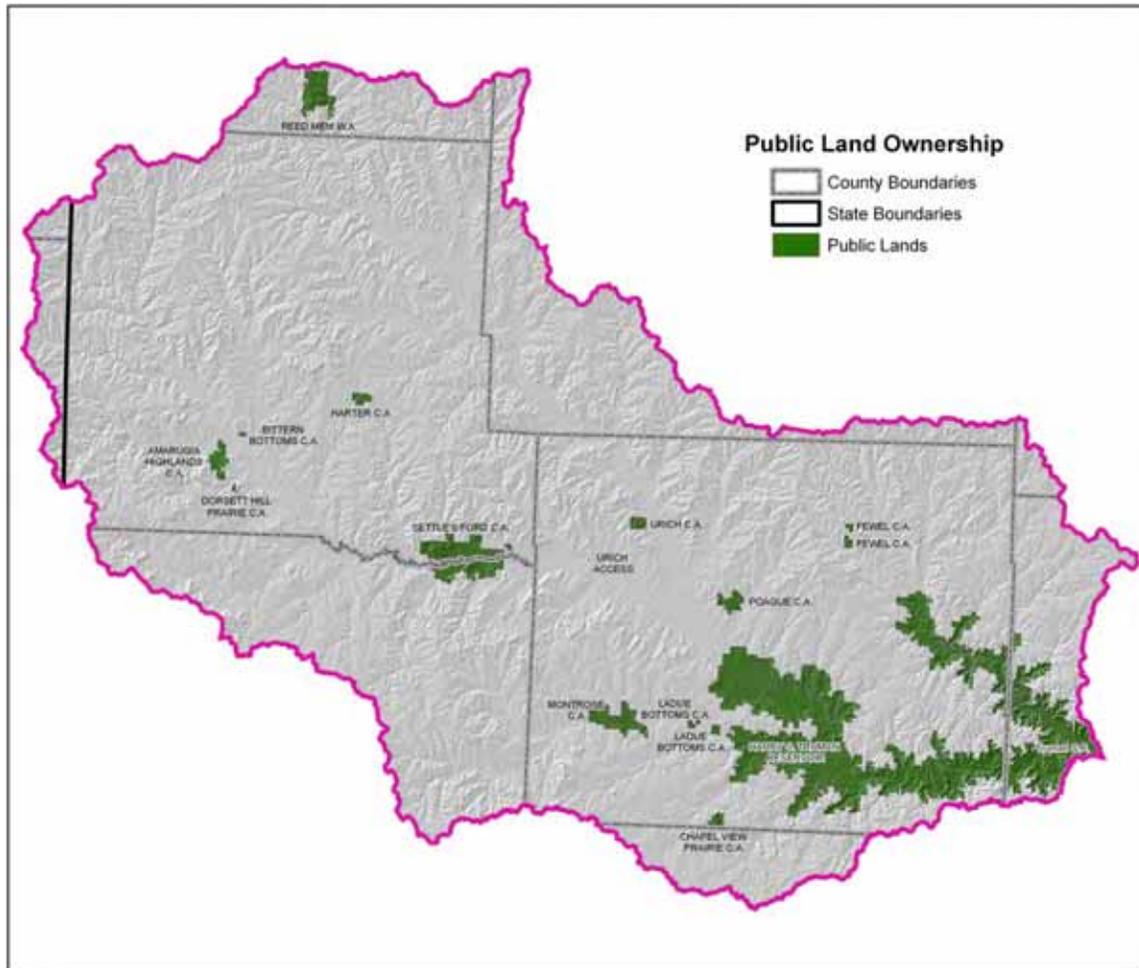
Potential natural vegetation: This area supports oak-hickory and oak-hickory-pine forests. Oak-hickory-pine forests are more dominant in the east. Glades, openings having bedrock outcrops or that are shallow to bedrock, support a more herbaceous vegetation consisting primarily of Indiangrass, little 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 South Grand area is from less than 40 inches per year near the center of Cass County to more than 43 inches per year near the center of St. Clair County.

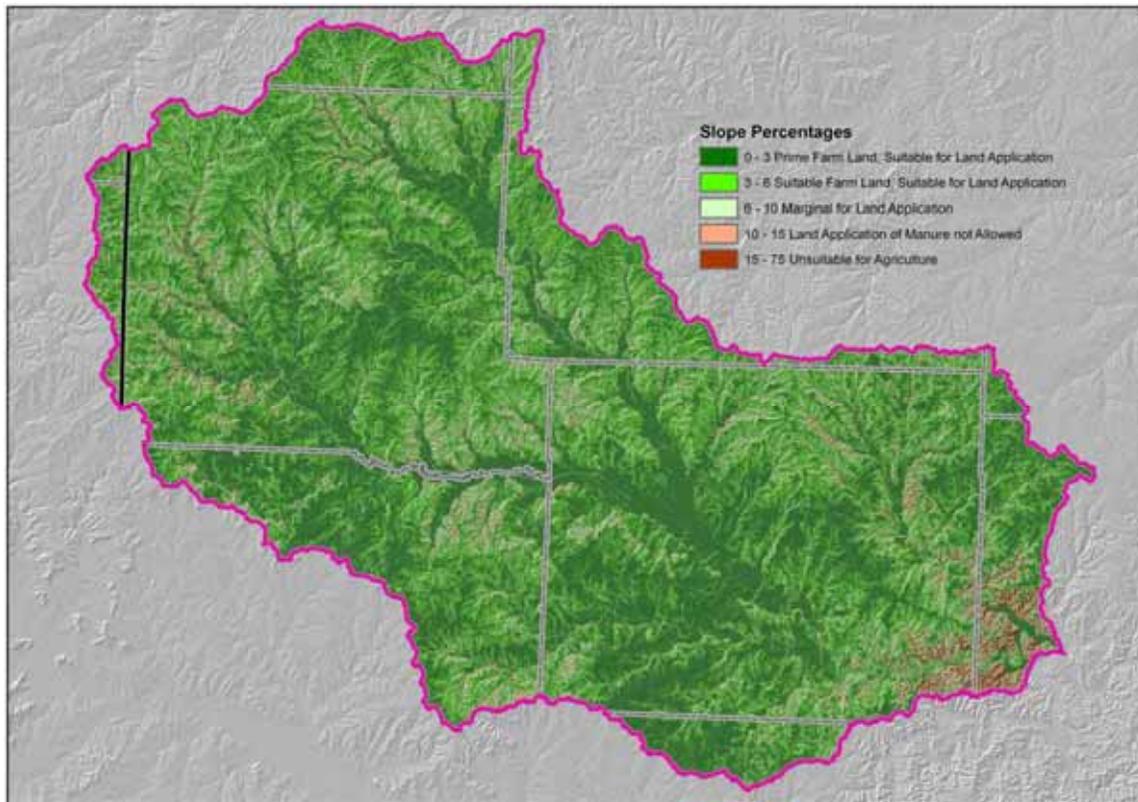
Land Ownership



Of the 1,309,266 acres that comprise the South Grand River sub-basin, only 89,020 acres (or 6.8%) are public holdings. The remaining 1,220,246 acres (or 93.2%) are owned by private landowners.

The largest public land areas in this watershed are: Harry S Truman Reservoir – 71,465 acres; Settle’s Ford Conservation Area – 6,546 acres; Reed Memorial Wildlife Area – 2,621 acres; Montrose Conservation Area – 2,443 acres; Truman State Park – 1,310 acres; and Amarugia Highlands Conservation Area – 1,039 acres.

Land Slope

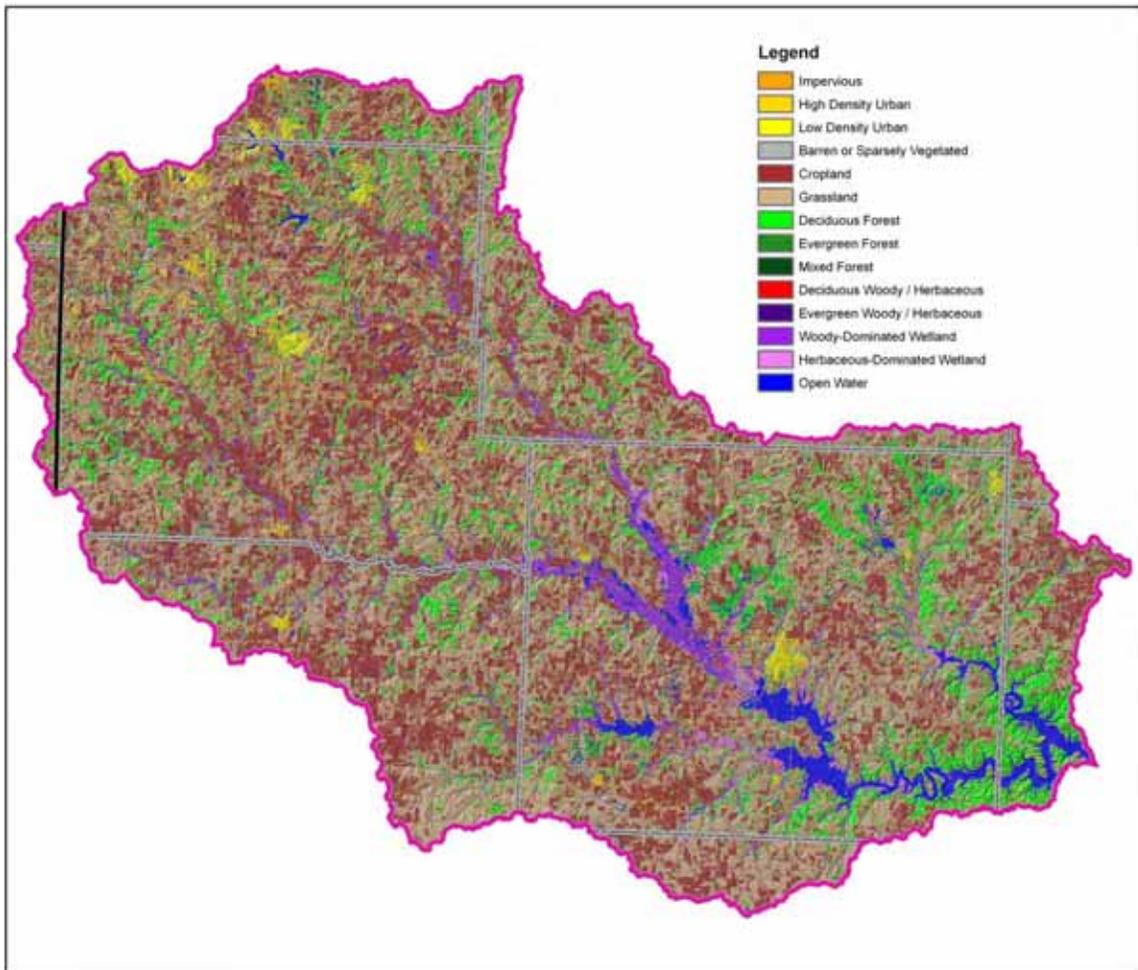


The majority of this sub-basin consists of large continuous plains that do not offer a lot of dramatic slopes, and is ideally suited for agriculture. The only large areas unsuitable for farming occur in the steeper slopes located near the town of Tightwad and Harry S Truman Reservoir. There are other local areas occurring on the steep gullies that surround rivers and streams.

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.

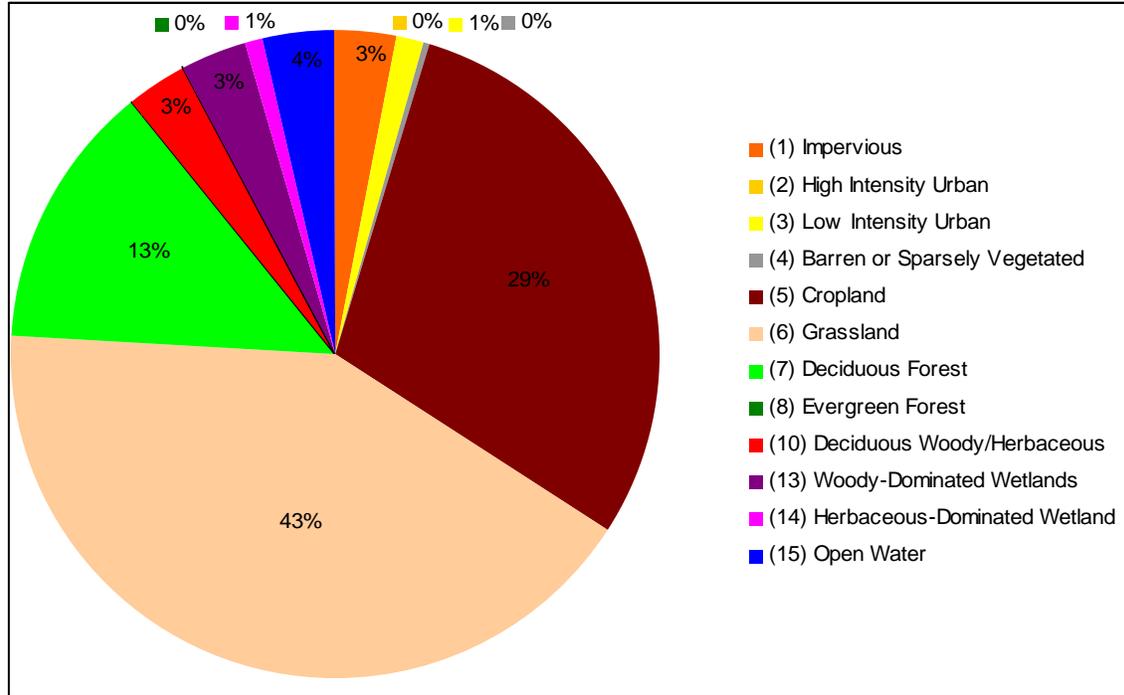
Land Use / Land Cover



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		PRIVATE		TRIBAL		TOTALS	
	Acres	%	Acres	%	Acres	%	Acres	%
(1) Impervious	874.3	0.98%	39747.3	3.26%	0	0.00%	40621.6	3.10%
(2) High Intensity Urban	2.3	0.00%	879.1	0.07%	0	0.00%	881.4	0.07%
(3) Low Intensity Urban	143.3	0.16%	17856	1.46%	0	0.00%	17999.3	1.37%
(4) Barren or Sparsely Vegetated	645.2	0.72%	1724.2	0.14%	0	0.00%	2369.4	0.18%
(5) Cropland	5954.5	6.69%	379202.6	31.07%	0	0.00%	385157.1	29.41%
(6) Grassland	18139.8	20.38%	526598.6	43.15%	0	0.00%	544738.4	41.60%
(7) Deciduous Forest	20732.1	23.29%	153948.8	12.61%	0	0.00%	174680.9	13.34%
(8) Evergreen Forest	1126.3	1.27%	931.5	0.08%	0	0.00%	2057.8	0.16%
(9) Mixed Forest	0.7	0.00%	0	0.00%	0	0.00%	0.7	0.00%
(10) Deciduous Woody/Herbaceous	3620.6	4.07%	34749.9	2.85%	0	0.00%	38370.5	2.93%
(11) Evergreen Woody/Herbaceous	0	0.00%	15.8	0.00%	0	0.00%	15.8	0.00%
(13) Woody-Dominated Wetlands	6410.4	7.20%	38507.7	3.16%	0	0.00%	44918.1	3.43%
(14) Herbaceous-Dominated Wetland	5807.2	6.52%	5774.2	0.47%	0	0.00%	11581.4	0.88%
(15) Open Water	25554.6	28.71%	20483.7	1.68%	0	0.00%	46038.3	3.52%
TOTALS	89011.3	6.80%	1220419.4	93.20%	0		1309430.7	
% OF TOTAL								

Nearly 30 percent of the watershed is in cropland; another 41 percent is in grassland; and 13 percent is in deciduous forest.

Land Cover / Land Use – Continued

LAND CAPABILITY CLASS		Acres	Percent
~Based on Cropland and Pastureland only ~Uses Non-Public Lands only	I	57.5	0.01%
	II	463272.7	51.73%
	III	316733	35.37%
	IV	64244.9	7.17%
	V	3877.6	0.43%
	VI	38301.7	4.28%
	VII	9034.1	1.01%
	VIII	65.7	0.01%
Total Acres Croplands and Pasturelands		895587.2	

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.

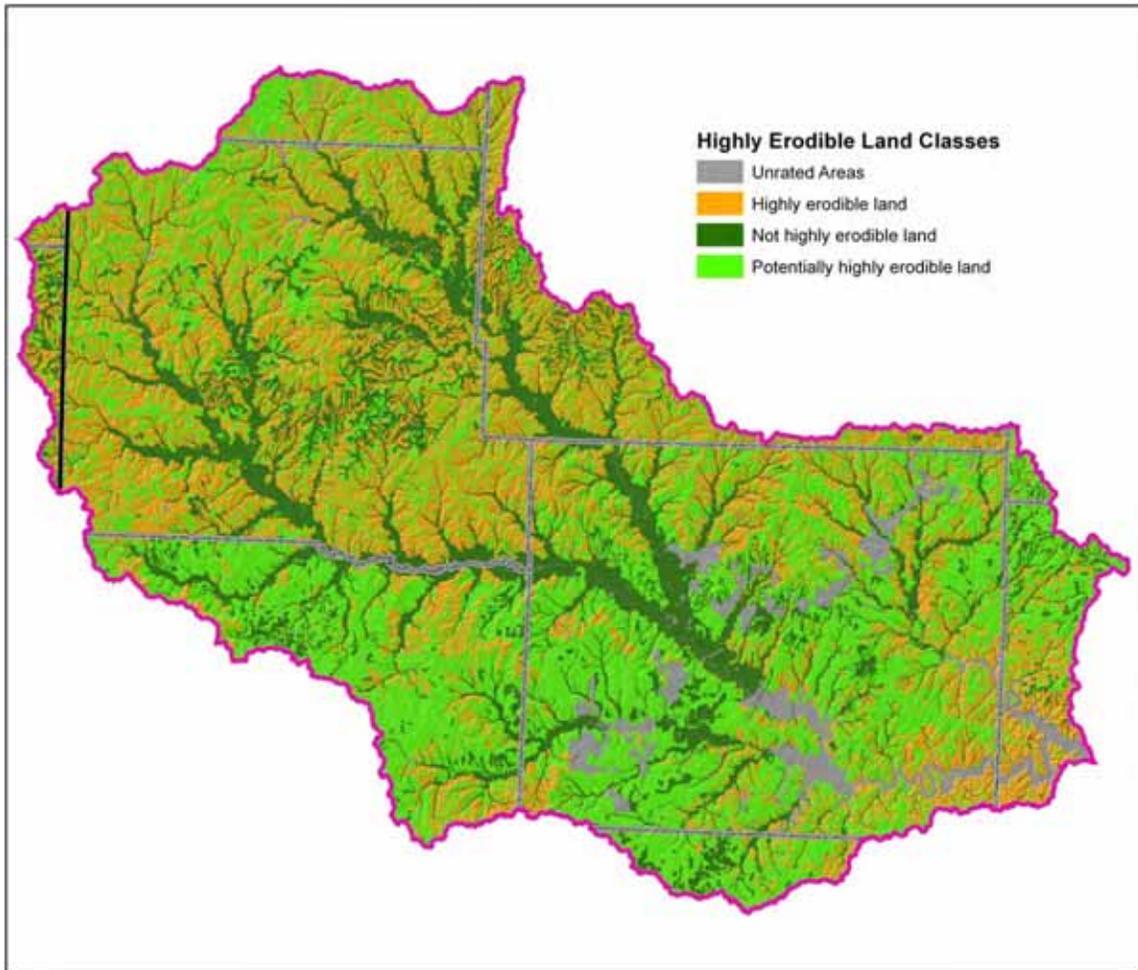
Riparian Corridor – Continued

Riparian Corridor Lands		TOTALS	
		Acres	%
	*Crop OR unclassified OR Public Land	11467	17.65%
	Urban	1122	1.73%
	Cropland	10399	16.01%
	Rangeland	166	0.26%
	Forestland	30851	47.50%
	Water	4181	6.44%
	Mined Land	154	0.24%
	Barren Land	2	0.00%
	Other Agriculture Lands	6612	10.18%
TOTALS		64954	

* 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

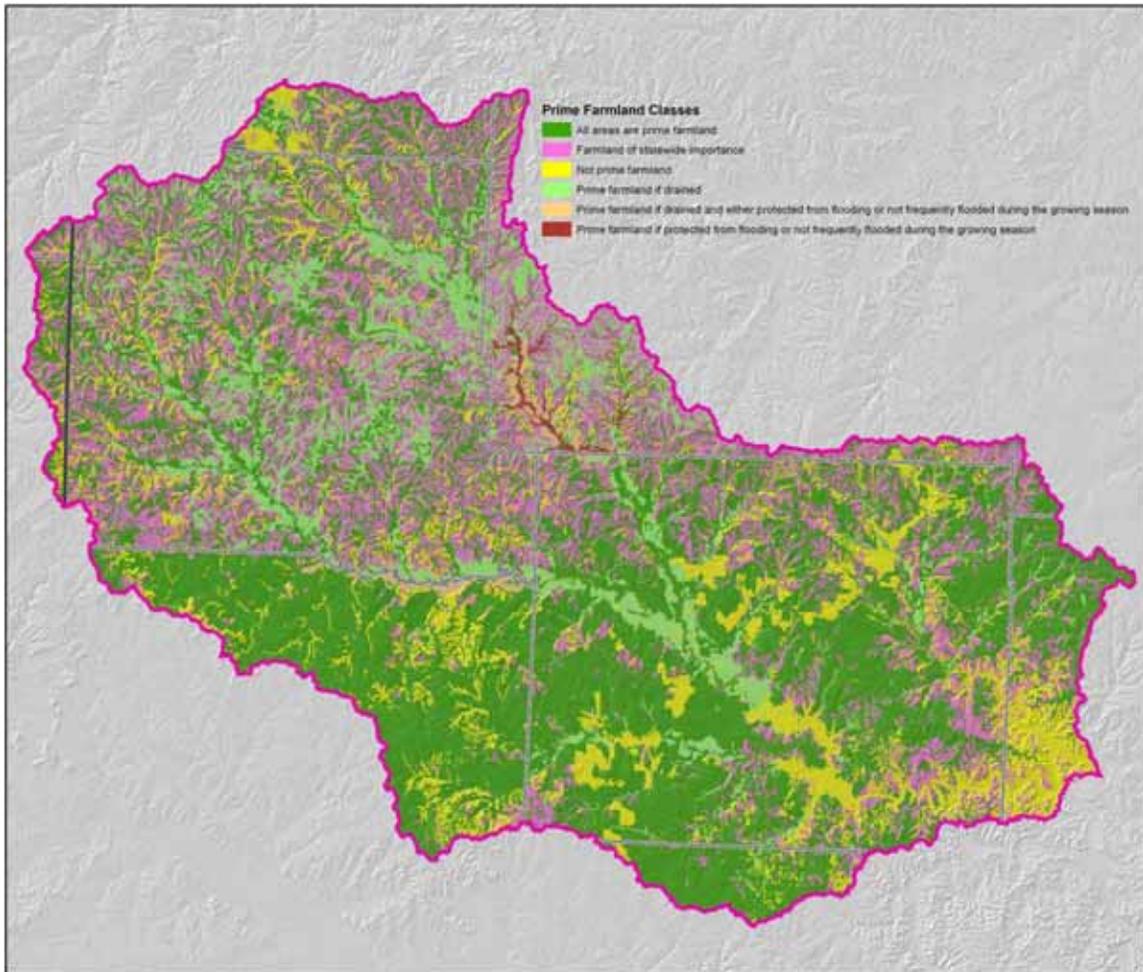


Erosion is defined as the wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Roughly 75% of the lands in the South Grand River sub-basin are defined as either Highly Erodible or Potentially Highly Erodible.

HIGHLY ERODIBLE LANDS		
	Acres	Percent of Total
Unrated Areas	55200	4.22%
Highly Erodible Land	424732	32.44%
Not Highly Erodible Land	273765	20.91%
Potentially Highly Erodible Land	555569	42.43%
TOTAL	1309266	

Prime Farmland



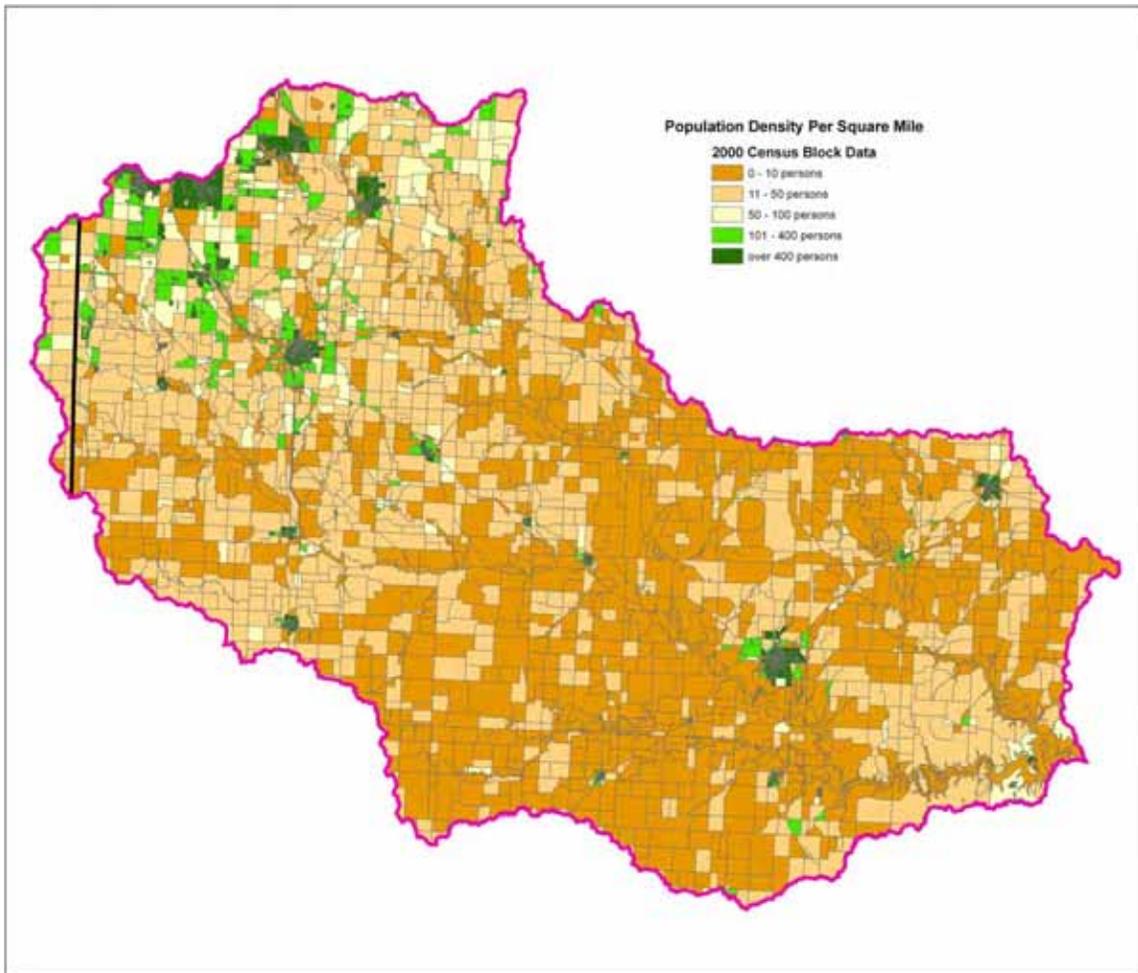
Prime Farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses.

Prime Farmland – Continued

PRIME FARMLANDS		Acres	Percent of Total
All Areas are Prime Farmland		637206	48.67%
Farmland of Statewide Importance		327639	25.02%
Not Prime Farmland		180133	13.76%
Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season		8638	0.66%
Prime Farmland if Drained		151238	11.55%
Prime Farmland if Protected from flooding, or not frequently flooded during the growing season		4411	0.34%
TOTAL		1309265	

Approximately three-fourths of the farmland in the watershed is classified as Prime Farmland or Farmland of Statewide Importance; almost 14% is classified as Not Prime Farmland. Another 12 percent would be considered prime if it were drained or otherwise protected.

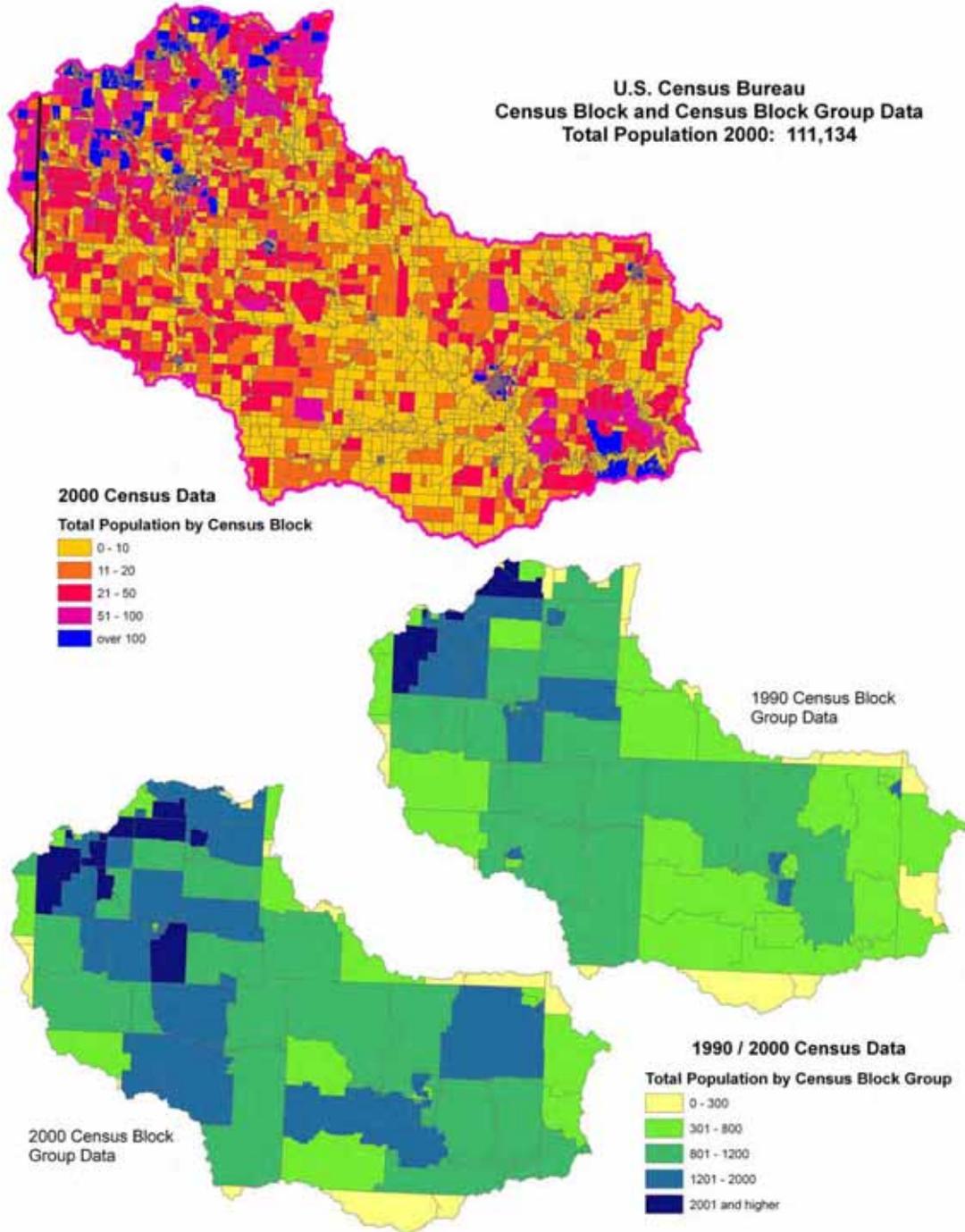
Census Data



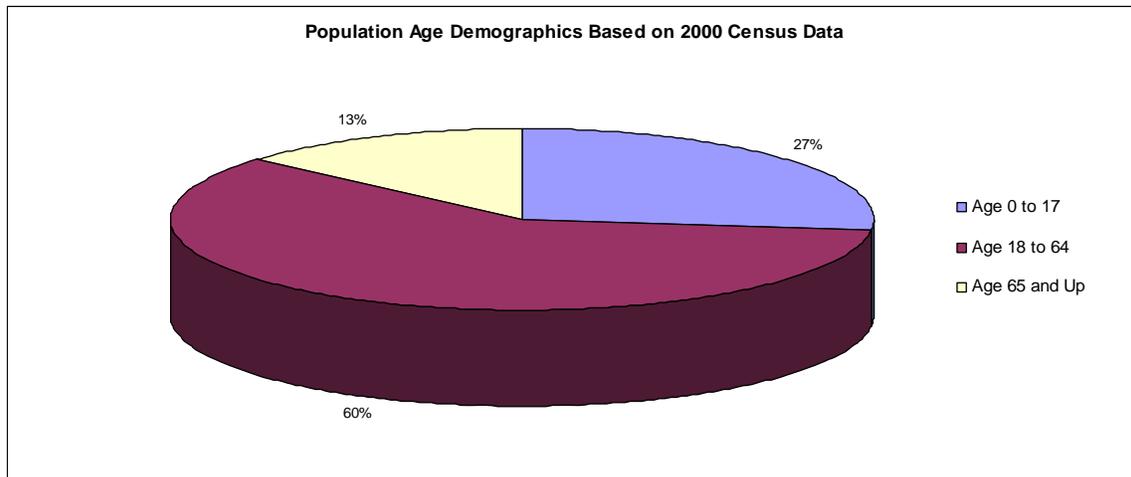
This map is based on 2000 U.S. Census Block data. It distributes the population evenly over the entire area of a block.

As expected, the higher density areas appear where urban areas are located. In this case, the highest population per square mile occurs in two separate areas. The first is located where the town of Clinton sits. The second is near the northwest corner of the sub-section where Kansas City has a very heavy influence on population. The least dense areas are on the southern and north eastern edges of the watershed in Bates, St. Clair, Benton, and Johnson Counties in Missouri, and southern Miami County in Kansas.

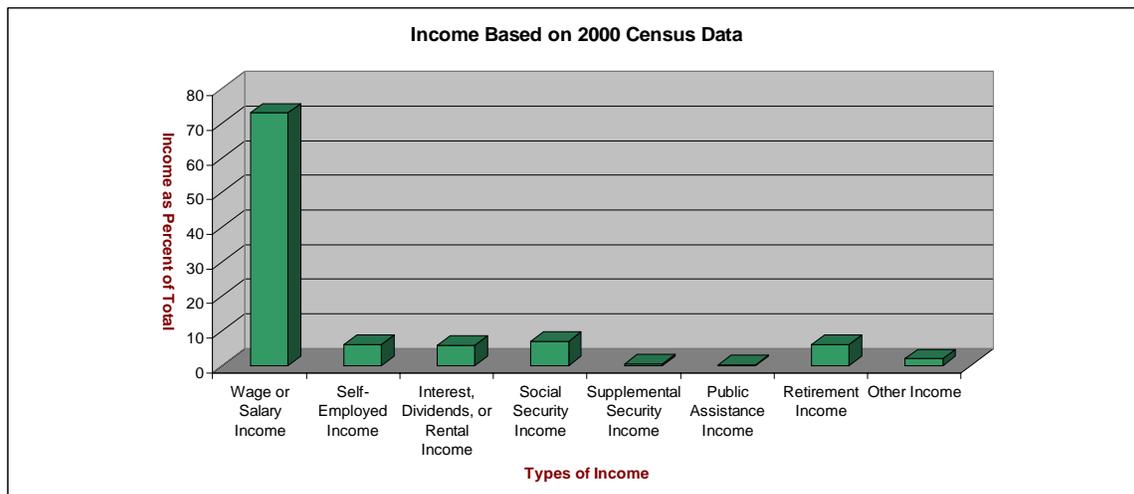
Census Data – Continued



Census Data – Continued



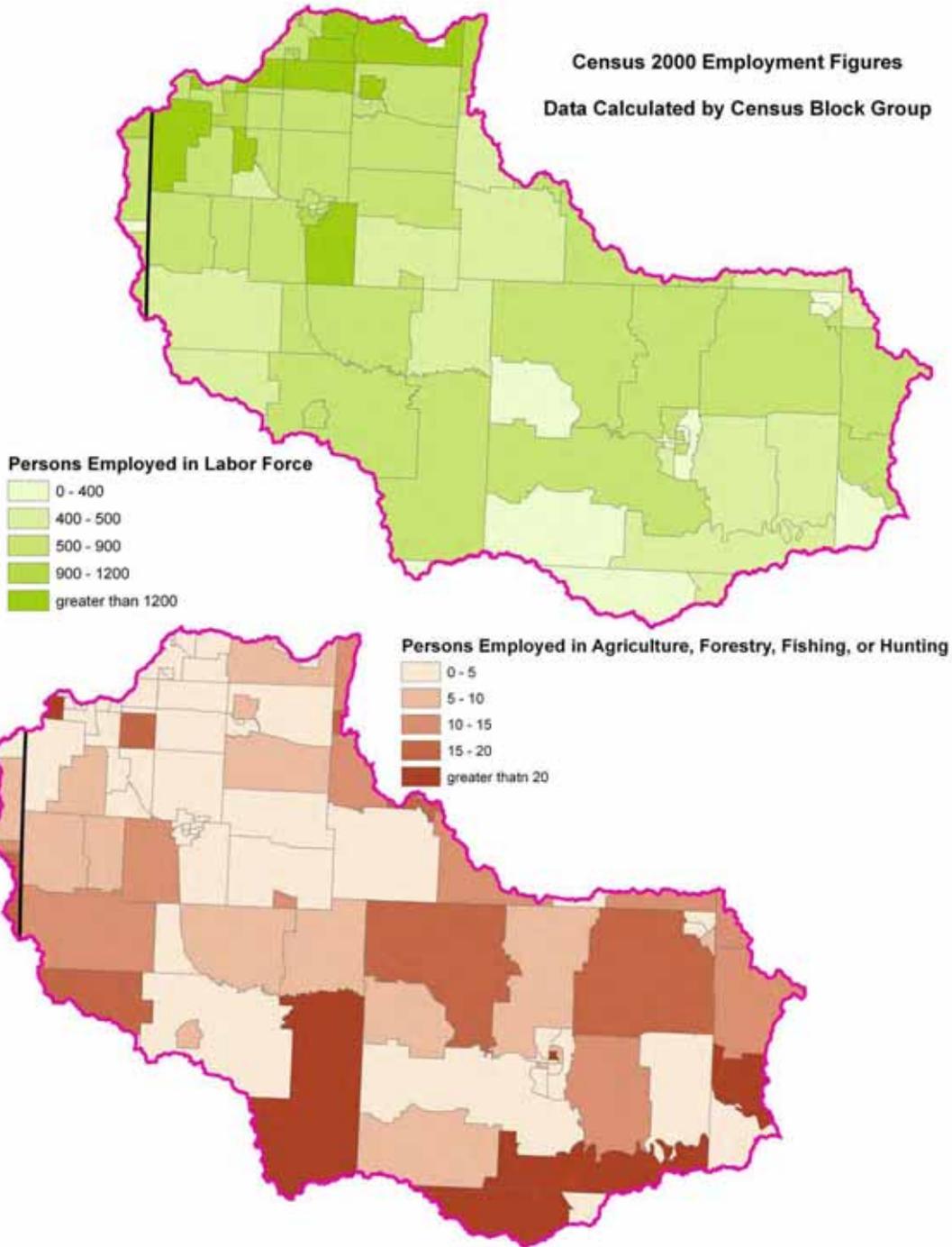
According to the Census Bureau, well over half of the population in the watershed falls between the ages of 18 and 65. Additionally, most of the income earned in this watershed comes from wages or salaries.



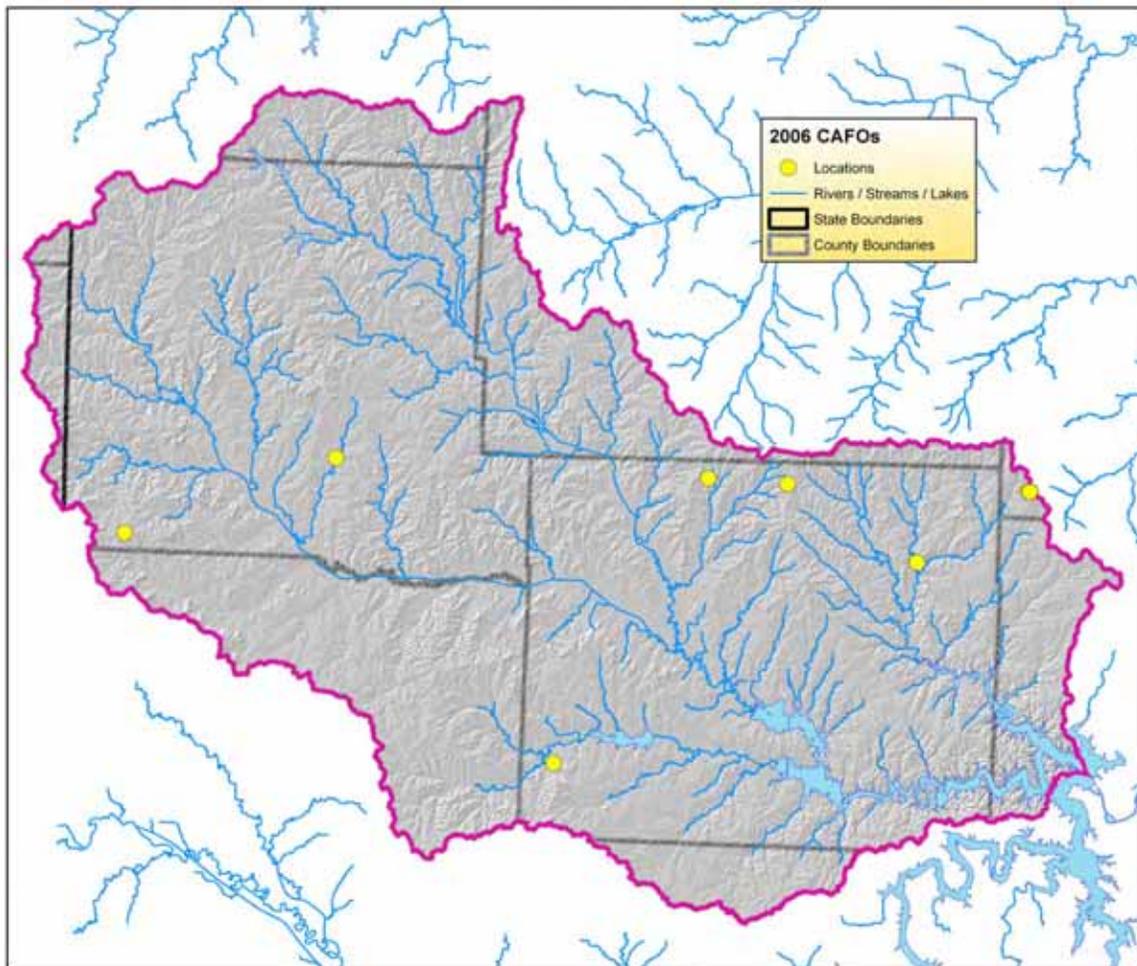
Agriculture income is not separated from other types of income in this graph. Farmers who own and work their own farms or ranches are included as Self-Employed. Farm hands and others who do not work their own land, and are paid employees are included as Wage and Salary Income.

Census Data – Continued

Census 2000 Employment Figures
Data Calculated by Census Block Group



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.

There are eight permitted CAFOs in the watershed. While they are distributed throughout the watershed, most are located relatively near streams.

Confined Animal Feeding Operations - Continued

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		4	4,171
Swine		4	8,974
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

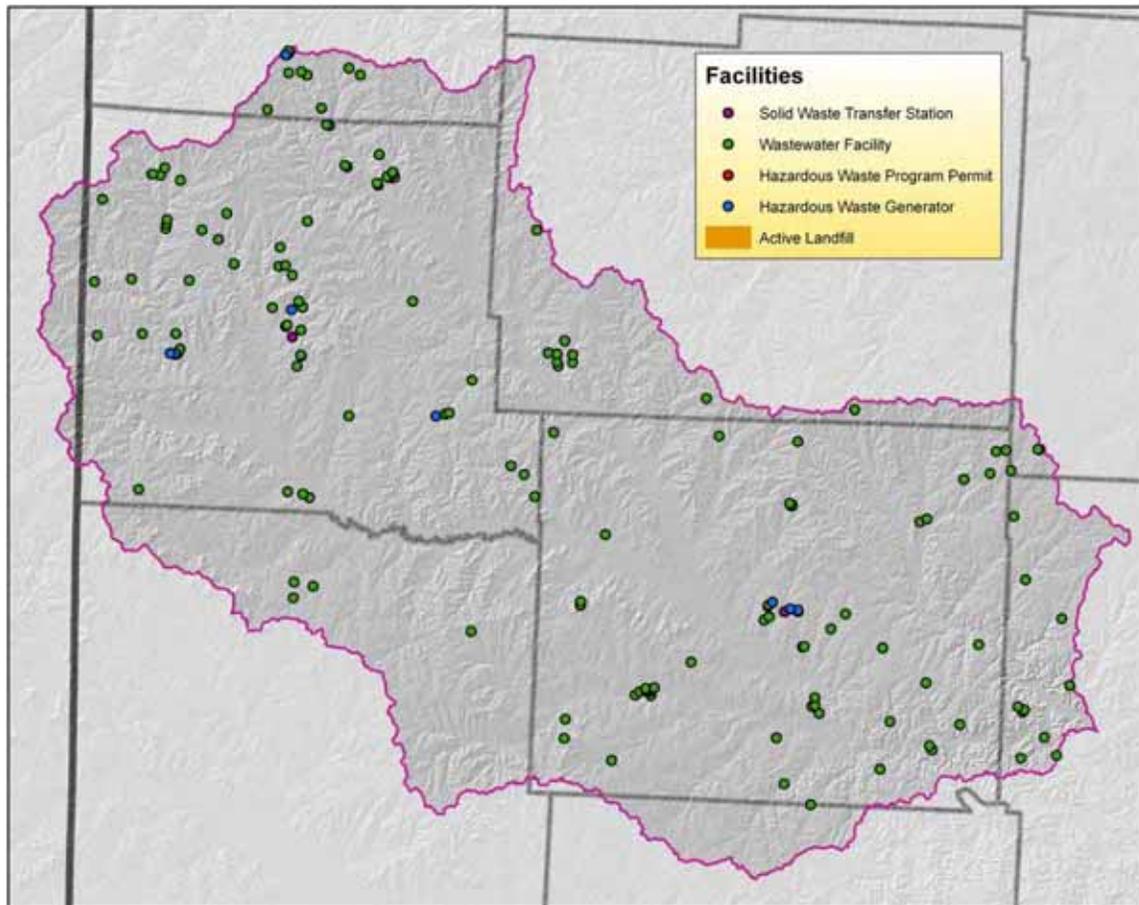
Confined Animal Feeding Operations - Continued

Additional Setbacks:

Of the ten counties that contribute area to the Lower Osage River sub-basin, only Henry and Pettis Counties have additional restrictions as imposed by County Health Ordinances.

Facility Setback:			
Feature	Facility Size	Requirement	Regulating Authority
Dwelling (Non-Owned)	1000 AU or more	3000 feet	Henry County
Well	All	100 feet (poultry litter) 300 feet (other)	State of Missouri
WARNING: No lagoons shall be located on an elevation less than 742 feet. The entire evaluation area is above 742 feet elevation.			Henry County
Feature	Facility Size	Requirement	Regulating Authority
Dwelling (Non-Owned) ¹	300 to 1100 AU	1000 feet	Pettis County
	1101 to 1650 AU	1320 feet	
	1651 to 2000 AU	2640 feet	
	2001 AU or more	3960 feet	
Other CAFOs ²	All	1320 to 5280 feet	Pettis County
Populated Area ³	2001 AU or more	10560 feet	Pettis County
Well	All	100 feet (poultry litter) 300 feet (other)	State of Missouri
¹ Increases 1320 feet per 500 AU in excess above 2000 AU. ² County restrictions have different classifications for CAFOs than state standards. You will need to read the county legislation for specifications and size classifications. ³ Increases 1320 feet per 500 AU in excess above 2000 AU. Populated Area defined as an area having at least 10 occupied dwellings within one square mile.			

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.

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

Active Landfills: permitted active landfills in Missouri.

Solid Waste and Wastewater Facilities – Continued

Permitted Facilities		
	Facility Type	Total
	Hazardous Waste Generators	8
	Hazardous Waste Program Permits	1
	Wastewater Facilities	162
	Solid Waste Transfer Stations	2
	Active Landfills	2

Drinking Water

Ground Water (Public Wells)	
*Missouri Data Only	
Total population served by public wells	5108
Community population served by wells	4361
Non-community, non-transient population (schools, factories)	75
Non-community, transient population (campgrounds, state parks)	672
Total wells	1280
Public wells	27
Community wells	9
Non-community, non-transient population	1
Non-community, transient	13
Private wells	1253

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

Surface Water (Reservoir Used for Public Drinking)	
*Missouri Data Only	
Total population served by surface water	43172
Community population served by surface water	43172
Non-community, non-transient population (schools, factories)	0
Non-community, transient population (campgrounds, state parks)	0
Total number of intakes	11

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

Resource Concerns

Endangered and Threatened Species

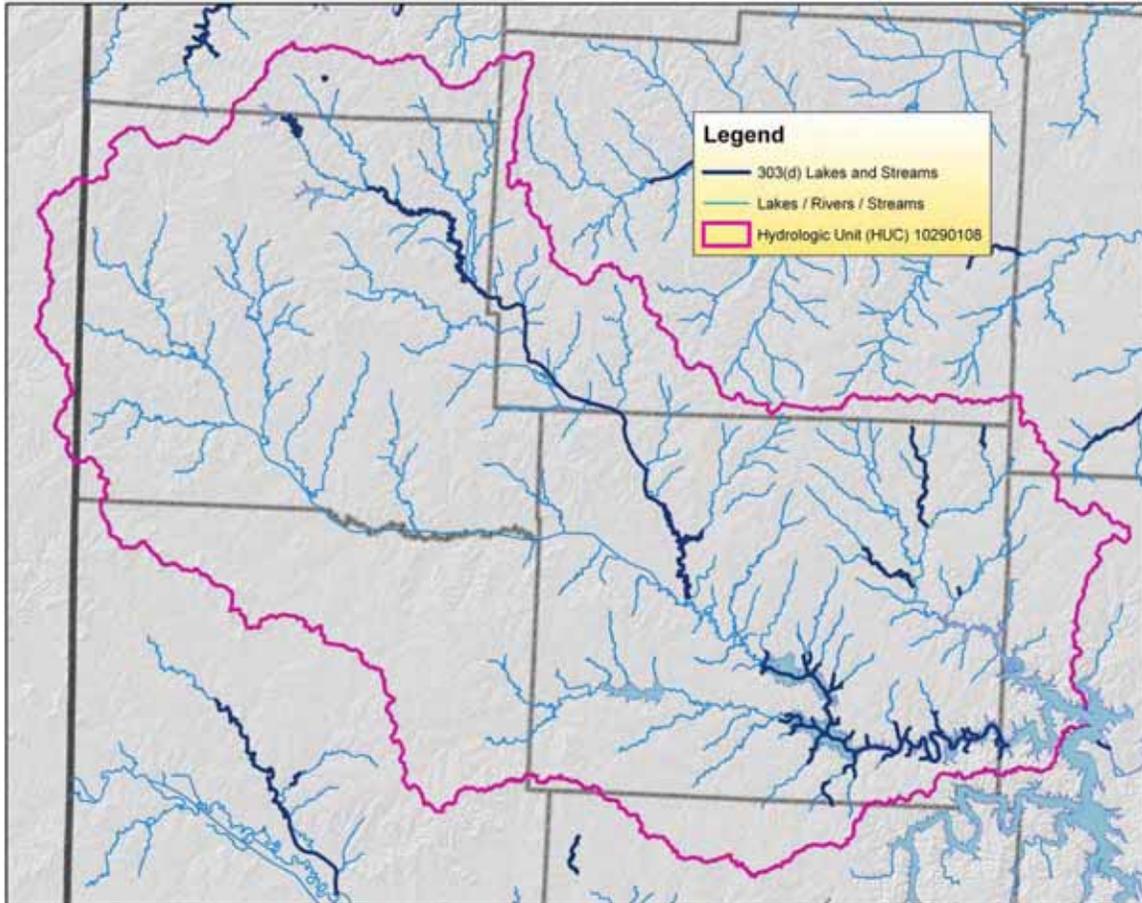
THREATENED AND ENDANGERED SPECIES LISTED FEDERALLY AND BY STATE		
State or Federally listed	Species	Endangered Status
State	Redbelly Snake - <i>reptile</i>	Threatened
State	Smooth Earth Snake - <i>reptile</i>	Threatened
State	Broadhead Skink - <i>reptile</i>	Threatened
State / Federal	Mead's Milkweed - <i>plant</i>	State - Endangered / Federal - Threatened
State / Federal	Gray Bat - <i>Mammal</i>	State - Endangered / Federal - Endangered
State	Barn Owl - <i>bird</i>	Endangered
State	Northern Harrier - <i>bird</i>	Endangered
State	Greater Prairie Chicken - <i>Bird</i>	Endangered
State / Federal	Bald Eagle - <i>bird</i>	State - Endangered / Federal - Threatened
State	Black-tailed Jackrabbit - <i>mammal</i>	Endangered
State / Federal	Geocarpon - <i>plant</i>	State - Endangered / Federal - Threatened
<p style="text-align: center;"> <i>Listed by U.S. Fish and Wildlife</i> <i>Listed by Missouri Department of Conservation</i> <i>Listed by Kansas Department of Wildlife and Parks</i> </p>		

Stream Flow Data

STREAM FLOW DATA	USGS 06921760 South Grand River near Clinton, MO as recorded 1992-2006	Total Avg. Yield	1,139 CFS
		May - Sept. Yield	1,280 CFS

Resource Concerns – Continued

303(d) Listed Lakes and Streams



The South Grand River sub-basin has a total of nine separate streams and rivers, and three separate lakes listed as 303(d) waters. The largest of these are a 49 mile stretch of Big Creek running northwest from the South Grand River to a confluence just south of the town of Pleasant Hill, and the Harry S Truman Reservoir.

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	871	100%
	303(d) Listed Streams	69.3	7.96%
303(d) Listed Streams and Lakes			
	Barkers Creek Tributary	0.3	miles
	Big Creek	49	miles
	Big Otter Creek	1	miles
	Big Otter Creek Tributary	1	miles
	East Fork Tebo Creek	1	miles
	Honey Creek	3	miles
	Middle Fork Tebo Creek	5.5	miles
	Middle Fork Tebo Creek Tributary	1.5	miles
	West Fork Tebo Creek	7	miles
	Bluestem Lake	15	acres
	Harry S Truman Lake	10000	acres
	Winnebago Lake	350	acres

Resource Concerns – Continued

Local Stakeholder Meetings

Meetings with local stakeholders were held at two locations – Clinton and Harrisonville – within the South Grand 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 – South Grand Watershed

Initial Meeting			Invitees*	Second Meeting		
Date	Location	Attendees		Date	Location	Attendees
1 - 24	Clinton	13	44	3 – 27	Clinton	14
1 - 25	Harrisonville	12	46	5 – 1	Harrisonville	23

* 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 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 of 2008 within the 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, due to an unusually wet spring, these meetings were subsequently cancelled.

Resource Concerns – Continued**Cropping Practices**Clinton –

- A. Main crops: Corn, Wheat, Soybeans
 - Wheat is grown the least; double cropping - lespedeza or clover
 - Recent years - continuous corn; economics is the driving force – ethanol production
- B. Fertilizer
 - Mostly commercial and some manure
 - Forages – landowner applied; other crops are fertilized by the supplier
 - Soil testing – has been done for less than 20 years
 - Lime broadcast at the rate of 2-3 tons every 4-5 years
- C. Herbicides
 1. Soybeans: RoundUp is contact applied
 2. Corn-grass: soil applied herbicide
 - Because of resistance to weeds - going to split applications of herbicides
 3. Wheat: not worried in past; now, winter annuals and onions are a problem
 4. Soybeans followed by corn: generally not inoculated; fungicides are used when necessary
 5. Plant some Bt corn
- D. Tillage
 1. Soybeans: not a high percentage
 2. Wheat: not a high percentage
 3. Corn: less than 10% no-till; most is conservation tilled (minimum till)
 4. Minor crops: sunflowers/milo/alfalfa
 5. New farm practices: irrigation-pivots
- E. Conservation Reserve Program (CRP)
 1. CP33-buffer acres: amount is increasing
 2. Lot of CRP was on highly erosive and/or on lower productive soils
 3. New signups require warm season grasses while earlier signups permitted cool season grasses
 4. CRP land that is coming out of the program is going to crops
 5. Higher grain prices may bring back some land in production

Resource Concerns – ContinuedHarrisonville –

- A. Main crops: Wheat, corn, and soybeans
- B. Rotations
 - 1. Corn, soybeans
 - 2. Corn, soybeans, soybeans
 - 3. Corn price dictates: corn, corn, soybeans, wheat 4th year (soybeans are double-cropped)
 - 4. Very little other grains grown in this part of the watershed
 - 5. Milo is replacing popcorn
 - 6. Double-crop soybeans after wheat
- C. Yields
 - 1. Corn: county average - 125bu/acre; range - 90-150 bu/ac
 - 2. Soybeans: county average - 35 bu/acre; range 20-60 bu/ac 25 bu/ac - double crop, 40+ bu/ac - single crop
 - 3. Wheat: county average 50 bu/acre; range 30-70 bu/ac
 - 4. Popcorn: 1000 acres (entire county)
 - 5. Milo: 1000 acres (entire county); county average 70-80 bu/ac range 50-90 bu/ac
- D. Tillage Practices
 - 1. Conventional till: 0
 - 2. Conservation till: 70-75%
 - 3. No-till: 25-30%
- E. Fertilization – Irrigation – 2,000 acres (manure is applied on crops)
 - 1. Corn: preplanting anhydrous – 150-75-75; at planting – P-K
 - Applied mostly single pass with side dressing
 - 2. Soybeans: use carryover from corn
 - 3. Wheat: Spring application of N (100-0-0) – top dress, sometimes split application - P-K in the fall, 0-50-70
- F. Lime
 - 3-5 year intervals
 - 2-4 tons per acre
- G. Soil test
 - 1. Every four years
 - 2. Some farmers test every other year
 - Rental land, price of fertilizer dictate application
- H. Herbicides – used by everyone
 - 1. Corn: lots of choices; atrazine – 1.5 – 2.0 lbs/ac
 - 2. Soybeans: 90% RoundUp ready
 - 3. Wheat: little herbicides used on wheat; sometimes spray for broadleaf
- I. Seed treatment
 - 1. Corn: Poncho
 - 2. Beans: very low percent are inoculated
 - 3. Fungicides: are applied to bean seeds

Resource Concerns – Continued**Pastures/Hay**Clinton –

A. Forages

1. Fescue: predominant
2. Lespedeza and red clover are inter-seeded
3. Seed production: fertilized for seed production

B Fertilizer

1. Rotational grazing: fertilizer and lime are required
2. Fescue: hayed once/year; yield is 1.5-2.0 tons /acre; fall graze

Harrisonville –

A. Species

1. Fescue: 90%
2. Brome hay only
3. Orchard grass hay only
4. Red clover inter-seeded
5. Lespedeza inter-seeded
6. Alfalfa
7. Sudan
8. Warm season grasses, primarily on CRP lands

B. Fertilization: P-K in fall; N in spring

1. Fescue: 55-20-30 lbs. per acre
2. Brome: 60-20-30 lbs. per acre
3. Orchard grass: 55-20-30 lbs per acre
4. Alfalfa: 0-70-140 lbs. per acre is applied after the first cutting
5. Hog manure: some is applied; sometimes it is tested for nutrient content – Less than 1,000 acres

C. Yields

1. Fescue: 3 tons/acre; county average - 2 tons per acre
2. Orchard grass: slightly less than for fescue
3. Brome: 3 tons/acre on better ground and is fertilized more heavily
4. Alfalfa: 5 tons/acre, four cuttings

D. Lime

1. Applied by soil test every 4-5 years

Resource Concerns – Continued**Grazing**Clinton –

- A. Management: primarily cow-calf
 - 1. 3+/- acres per cow or year round grazing - cow-calf
 - Supplement hay from December through March
 - 2. Protein licks/tub licks
 - 3. Paddock grazing-non-existent
 - 4. Warm season grass grazing: less than 5%
 - Most warm season grass is in CRP or seed production

Harrisonville –

- A. Management: Primarily cattle - lots of small horse lots (number 1 horse county) - more goats are coming in
- B. Forages
 - 1. Fescue: continuous 80%, 3 acre/cow on good pasture
 - 2. Timber: quite a lot less 10 acres/cow
 - 3. Feed hay in the winter
 - 4. Intensive rotation grazing: high intensity, short duration
 - Less than 5,000 acres
- C. Rotation: 20-25%
 - 1. Move every few weeks, among several pastures
 - 2. Feed late November early December through March or mid April
- D. Water
 - 1. Few improved ponds
 - 2. Rural water
 - 3. Creeks, wells
 - 4. Few springs
- E. Nutrient management planning
 - 1. Crops
 - Hay - pasture
 - Livestock pasture
- F. Confinement operations
 - 1. Hogs: 4
 - 2. Dairies: 6

Conservation PracticesClinton –

- Terraces with grass waterways
- Contour grass strips
- Highly erodible lands require conservation plan; crop rotation and tillage to leave residue
- Field borders
- CP33 buffers
- Food plots (small landowners, sports clubs and MDC)

Resource Concerns – Continued**Harrisonville** –

- Terraces
- No-till
- Waterways
- Conservation Reserve Program
- Tile drains
- Buffers/field borders
- Filter strips
- Conservation tillage
- Crop rotation
- Residue management
- Wildlife food plots
- Cover strips
- Edge feathering
- Grazing systems
- Grade stabilization structures
- Crop land being converted to pasture and hay land
- Fence cattle out of ponds and waterways
- Alternative watering sources
- Inter-seed legumes in fescue pasture
- Well decommissioning 1-2 per year
- Elimination of noxious weed and woody invaders in pastures
- Nutrient management/ waste utilization
- Pest management

Natural Resource Issues**Clinton** –

- Parcels of land converted to recreational/ private gun clubs
- Second bottom lands
- Small parcels
 - Urban development/sprawl
- Increased runoff
- On-site household waste management
- Ground water quality/quantity
- Abandoned wells?
- Stream bank erosion
- Channelization - down cutting
- Increased wildlife damage for landowners
- Trespassing problems/ adjacent to Corps of Engineers and MDC
- 4-wheeler/ORV issues
- Resident geese population - water quality issue
- Lake water quality-fecal bacteria/sediment/nutrients/solid waste
- Old car tires