United States Department of Agriculture
Natural Resources Conservation Service

North Fabius River

HUC # 07110002

R A P I D W A T E R S H E D A S S E S S M E N T

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Lower Missouri - Crooked River Watershed

HUC #10300101

A rapid watershed assessment (RWA) evaluates resource conditions and needs on an 8-digit hydrologic unit (HU) basis. The assessment identifies the primary resource concerns for the watershed being profiled and provides estimate as to where conservation investments would best address the concerns of landowners, conservation districts, stakeholders, and others. The RWA provides information on which to base decisions about conservation priorities, allocation of resources, and funding for implementation.

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Introduction[1]

The North Fabius River sub-basin extends across portions of nine counties in southeastern Iowa and northeastern Missouri, covering approximately 940 square miles. Centered on the North Fabius and Middle Fabius Rivers, this long, narrow drainage area extends southeastward from southeast Appanoose County, Iowa and outlets near the Mississippi River in northeastern Marion County, Missouri. The topography is dominated by a very distinct series of parallel ridges and valleys, cut by the postglacial stream network, that run the length of the sub-basin. Within this ridge and valley setting, there are substantial changes in the sub-basin's physiography as one moves from the rolling uplands encompassing the headwaters of the North Fabius and Middle Fabius Rivers to the steeper relief of the dissected valleys approaching the Mississippi River.

The prevailing land uses and covers throughout the sub-basin are rural and agricultural with only 3 percent of the land area dedicated to developed uses. Thirty-five percent of the sub-basin's land area is used for cultivated crops, with the largest acreages planted to soybeans, followed by corn for grain, wheat for grain and grain sorghum. Pastureland, the sub-basin's second largest land use, covers 24 percent of the land area. The third largest land cover/use acreage is forestland at 15 percent. Non-cultivated cropland, primarily hay land, is fourth at 11 percent and forage is the sub-basin's third largest crop. Conservation Reserve Program (CRP) land is the fifth largest land cover/use, taking 10 percent of the sub-basin's land area.

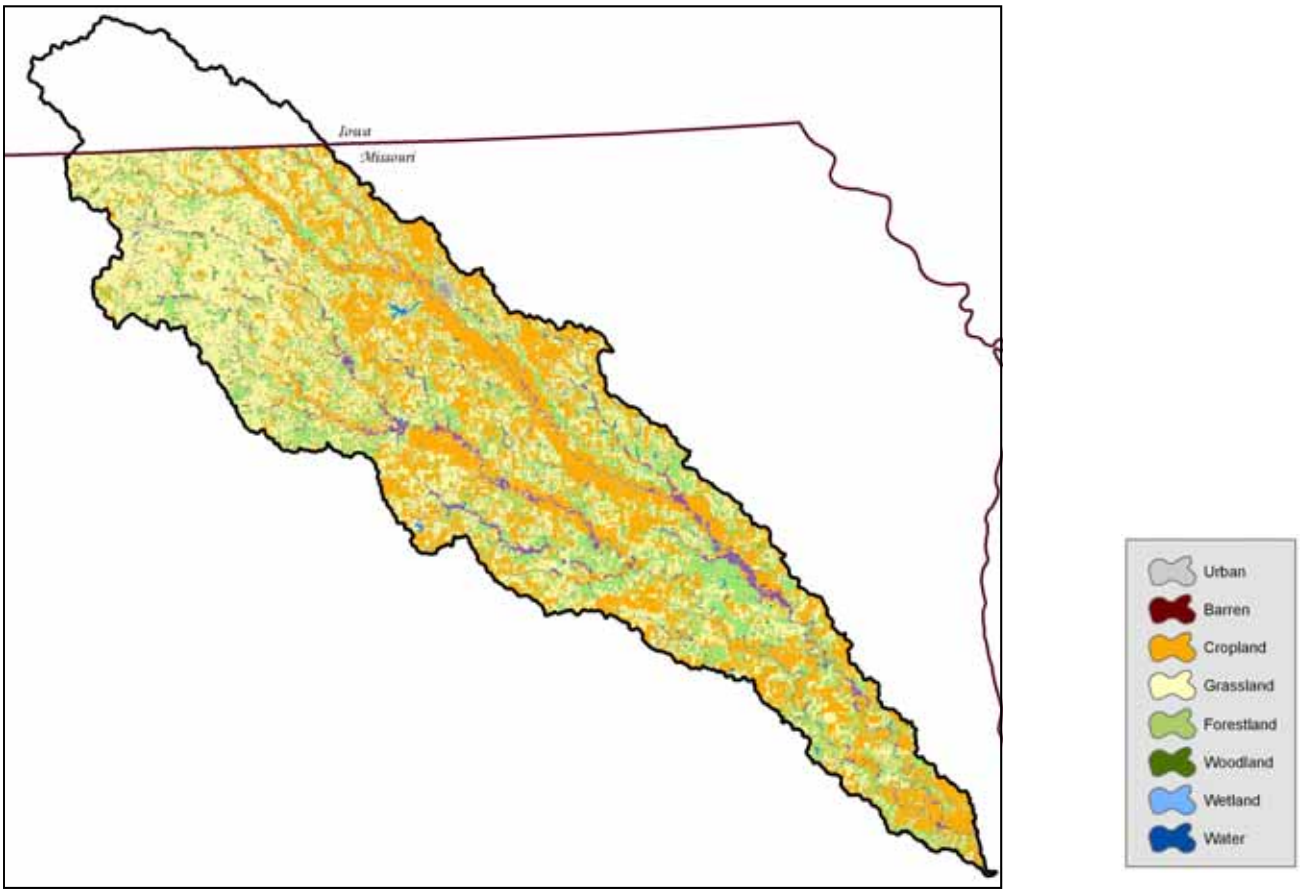
The upper third of the sub-basin, concentrated in Appanoose (Iowa), Davis, Schuyler, and the western edge of Scotland County consists of broad ridges separating a subparallel stream network trending northwest to southeast. With local relief averaging around 100 feet, the stream valleys are gently sloping and slightly dissected. Thick deposits of glacial till, with a thin cap of loess, cover alternating layers of Pennsylvanian age limestone, sandstone and shale bedrock. Pre-settlement vegetation consisted of prairie grasses on the broad interfluves grading into oak savannas and woodlands on the valley sides. Today, 10 percent of the area is cultivated cropland, concentrated in the wider stream bottoms. Forty-three percent of the landscape is cool-season pasture, 21 percent is hayland and 14 percent is dedicated to CRP. Forest land covers 9 percent of the area and 3 percent is developed uses.

The parallel ridge and valley topography continues into the middle section of the sub-basin covering about two-thirds of Scotland County and the northeast corner of Knox County. Local relief drops to less than 50 feet on average as the broad interfluves flatten to form a more gently rolling surface in loess covered glacial till. Like the upper reaches of the sub-basin, the pre-settlement tall grass prairies have given way to predominantly agricultural land uses. Forty-two percent of the land is cultivated cropland, accounting for over half of the sub-basin's cultivated acreage. Twenty-six percent is pastureland and hayland; fourteen percent is enrolled in CRP; and 2 percent is developed land.

The lower third of the sub-basin is located in Clark, Lewis and Marion Counties. The southeast trending broad divides give way to steeper valleys with local relief between 100 – 150 feet as the sub-basin narrows to its confluence with the South Fabius and Fabius Rivers. The glacial till thins on the lower slopes, exposing Mississippian age limestone along the valley sides and streambeds. The pre-settlement tall grass prairies have been replaced with cool-season pastures and hayland that cover about 18 percent of the area. Cultivated cropland in the river bottoms and on the moderately sloped uplands accounts for 52 percent of this portion of the sub-basin. Twenty-three percent of the area is forested and 3 percent is developed.

Physical Description

A. Land Use/ Land Cover and Percent of Sub-Basin in Each County



Land Use/ Land Cover NRI[2]	Urban	Cultivated cropland	Conservation Reserve Program	Non-cultivated cropland	Pastureland	Forest land	Minor land cover/uses	Water	Federal land cover/use not recorded
1982 Acres, % of Area	14,000 3%	281,100 51%	0 0%	26,400 5%	155,700 28%	57,500 10%	8,500 2%	4,700 1%	500 0%
1987 Acres, % of Area	14,100 3%	259,800 47%	39,800 7%	17,200 3%	132,300 24%	75,100 14%	4,900 1%	5,100 1%	500 0%
1992 Acres, % of Area	14,300 3%	215,800 39%	55,000 10%	34,400 6%	138,100 25%	80,700 15%	4,800 1%	5,700 1%	0 0%
1997 Acres, % of Area	14,500 3%	204,700 37%	27,700 11%	54,400 10%	120,500 22%	86,400 16%	4,800 1%	5,800 1%	0 0%
Total Gain or Loss from 1982 to 1997 Acres, % of Area	**100** **0%**	**(76,400)** **-14%**	**57,700** **11%**	**28,000** **5%**	**(35,200)** **-6%**	**28,900** **5%**	**(3,700)** **-1%**	**1,100** **0%**	**(500)** **0%**

B. Grassland

	Hayland (acres)			Pastureland a(cres)			Other Farmland (acres
Year	Grass	Legume	Legume-Grass	Grass	Legume	Grass-Forbes-Legume Mix	CRP
1997	39,500	0	19,800	59,300	1,400	62,300	57,700

C. Crop History

	Close Grown Crops (acres)			Row Crops (acres)				General (acres)	
Year	Oats	Wheat	All Other	Corn	Sorghum	Soybeans	Double Cropped	Cultivated	Non-Cultivated
1982	2,900	34,600	0	104,900	1,900	104,700	5,900	281,100	26,400
1987	3,800	10,400	0	86,700	0	128,000	1,200	259,800	17,200
1992	0	17,400	0	66,900	600	117,000	0	215,800	34,400
1997	0	8,000	0	78,100	5,500	103,800	3,500	204,700	54,400

D. Public Land

About 11,367 acres, or 2.2% of the sub-basin, are in public ownership (Missouri Department of Conservation). These public lands include four conservation areas and oneriver access. The region falls well below the state average of 6.7% public ownership but is typical of sub-basins that are not in the Ozark Highlands.

E. Soil Capability

Land Capability[2]

Land Capability is a classification system used to identify the erosion potential of farmland. For over forty years the USDA has used land capability classification as a planning tool in laying out conservation measures and practices to farm without serious deterioration from erosion or other causes. The current system includes eight classes of land designated by Roman numerals I thru VIII. The first four classes are arable land--suitable for cropland--in which the limitations and the need for conservation measures and management increase from I thru IV. The remaining four classes, V thru VIII, are not to be used for cropland, but may have uses for pasture, range, woodland, grazing, wildlife, recreation, and esthetic purposes.

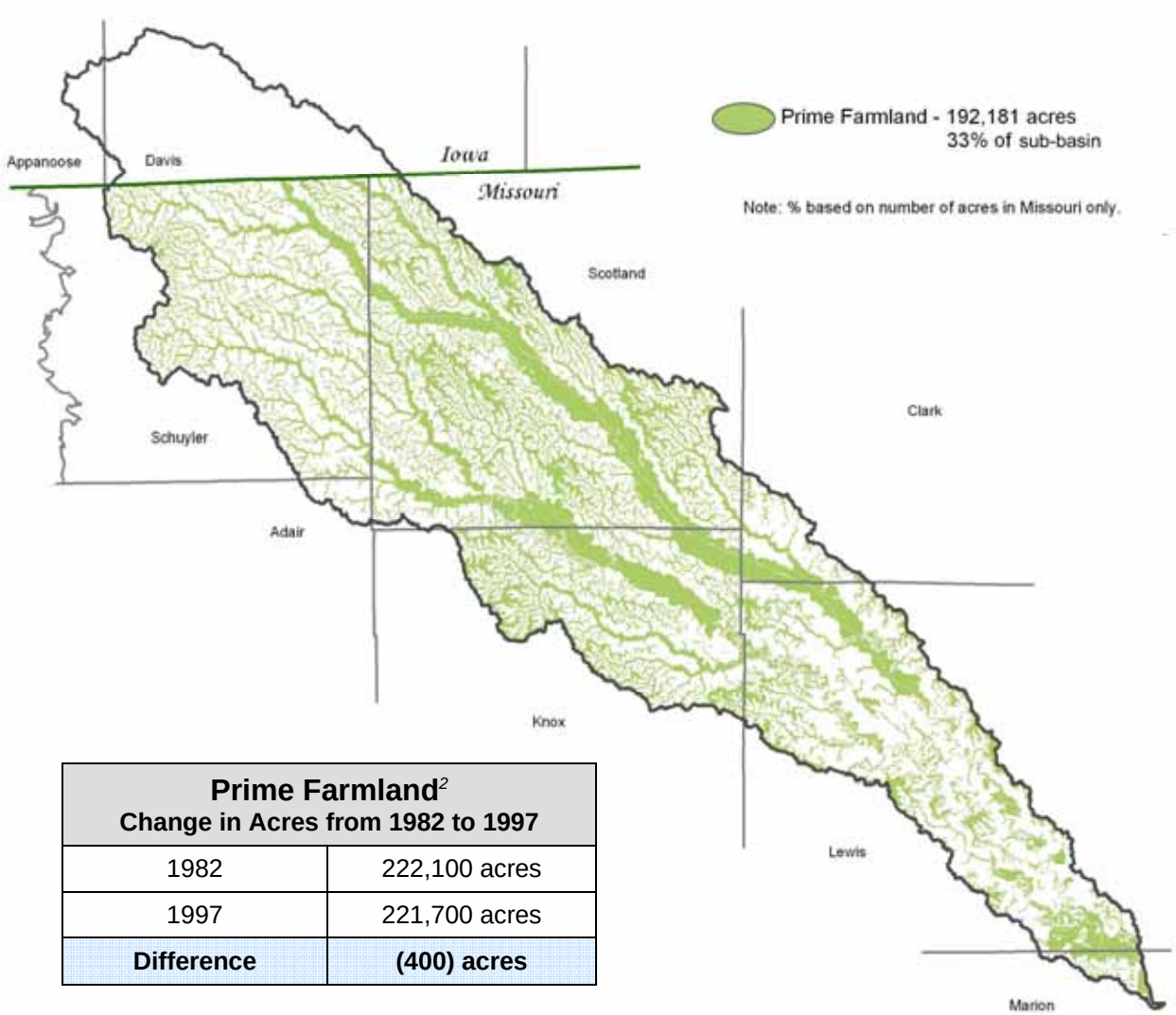
Figure 3

Land Capability Class	Cultivated cropland (acres, % of area)	Non-cultivated cropland (acres, % of area)	Pastureland (acres, % of area)
I - slight limitations	-	-	-
II - moderate limitations	138,000, 567%	14,600, 27%	21,800, 18%
III - severe limitations	49,000, 24%	23,600, 43%	19,600, 16%
IV - very severe limitations	10,700, 5%	5,500, 10%	22,300, 19%
V - no erosion hazard, but other limitations	-	-	-
VI - severe limitations, unsuited for cultivation, limited to pasture, range, forest	7,000, 3%	4,900, 9%	25,600, 21%
VII - very severe limitations, unsuited for cultivation, limited to grazing, forest, wildlife	-	-	-
VIII - misc. areas have limitations, limited to recreation, wildlife and water supply	-	-	-
Total	**204,700 acres**	**54,400 acres**	**120,500 acres**

Prime Farmland[4]

Prime Farmland is 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. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Prime Farmland in the North Fabius River Sub-basin [5]



Prime Farmland[2] **Change in Acres from 1982 to 1997**	
1982	222,100 acres
1997	221,700 acres
Difference	**(400) acres**

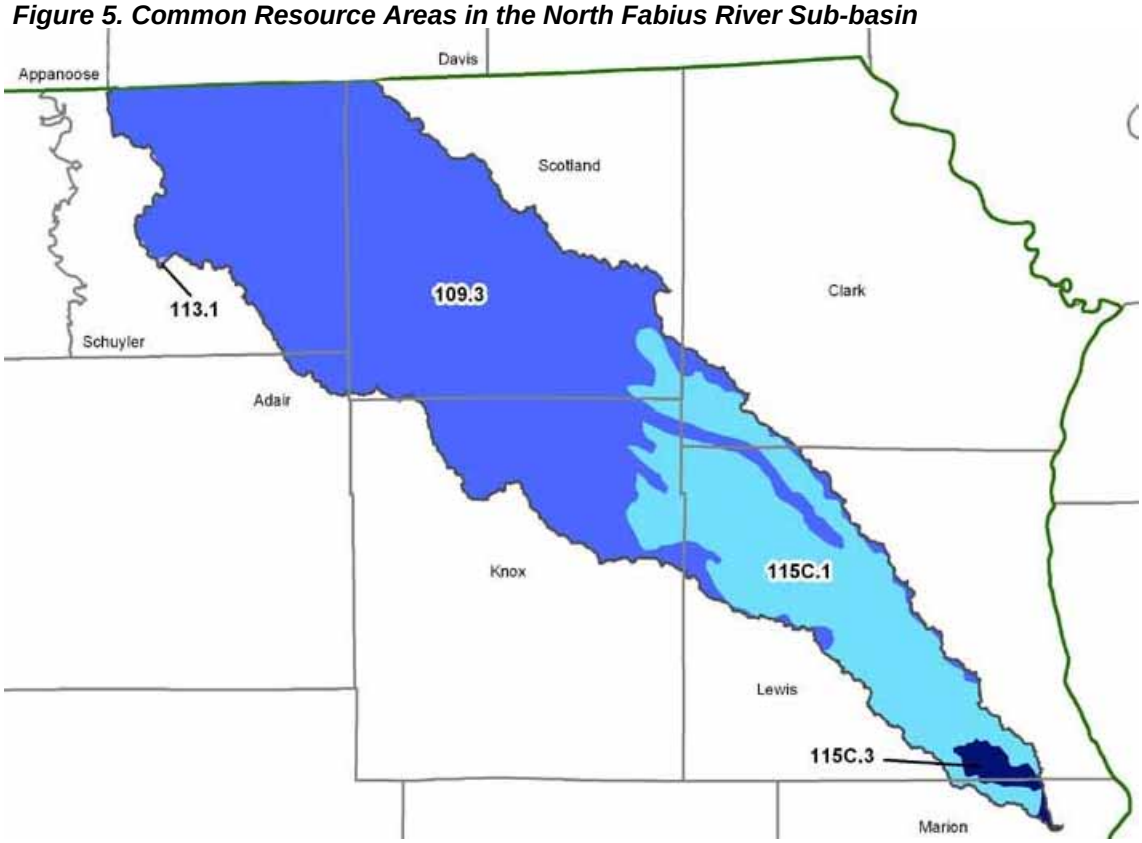
F. Common Resource Areas[6]

NRCS has divided the Nation into ecological type land regions called Major Land Resource Areas (MLRA). MLRAs are defined by their agricultural potential and soils capabilities and provide a spatial framework for addressing national and regional agricultural issues. A Common Resource Area (CRA) is a geographic and ecologic subdivision of an MLRA within which there are similar resource concerns and treatment requirements.

Each Missouri CRA is a grouping of Land Type Associations (LTA) taken directly from the state's ecological classification system (ECS). Missouri's LTAs are primarily differentiated on the basis of local climate, landforms and topography, geologic parent materials, soil types and potential vegetation.

The North Fabius River sub-basin occupies portions of MLRA 109, MLRA 113 and MLRA 115.

Figure 5. Common Resource Areas in the North Fabius River Sub-basin



109.3 – Fox-Wyaconda River Dissected Till Plain

The Fox-Wyaconda River Dissected Till Plain CRA is a gently sloping to steep area that consists of a slightly dissected till plain. Although relief is usually less than 150 feet, little of the flat till plain surface remains. Native vegetation was a mix of prairie grasses and deciduous trees. Most of this area is a mix of cropland and pasture. Corn, soybeans and forage crops are the most common crops. Resource concerns are water erosion, nutrient management and pasture management.

113.1 – Clay Pan Till Plains

The Clay Pan Till Plains CRA is nearly level and gently sloping, well-developed claypan soils on a flat glacial till plain. Light to moderately dark colored, poorly drained and somewhat poorly drained soils formed primarily in loess. Loess thickness generally ranges from greater than 6 feet in the western part to about 3 feet in the eastern part. The low clay surface soil changes abruptly to the high clay subsoil. The area is intensively cropped with row crops and small grain. Sodium affected soils are throughout the area and occur in an intricate pattern with soils not affected by sodium. The more sloping areas adjacent to the streams are more commonly used for pasture or remain in woodland. Postglacial stream erosion has made little progress and most of the surface is flat or gently rolling with local relief less than 100 feet. Bedrock exposures are rare.

115C.1 – Central Mississippi Valley Wooded Slopes

The Central Mississippi Valley Wooded Slopes CRA consists of the Mississippi and lower Illinois River valleys and adjacent slopes. Low areas consist of the nearly level flood plains and terraces. The Corps of Engineers maintains a levee along the Mississippi River. Adjacent uplands consist of loess hills with moderately steep to very steep side slopes and narrow to moderately wide gently sloping to moderately sloping ridgetops. Low areas are composed of poorly drained to well drained

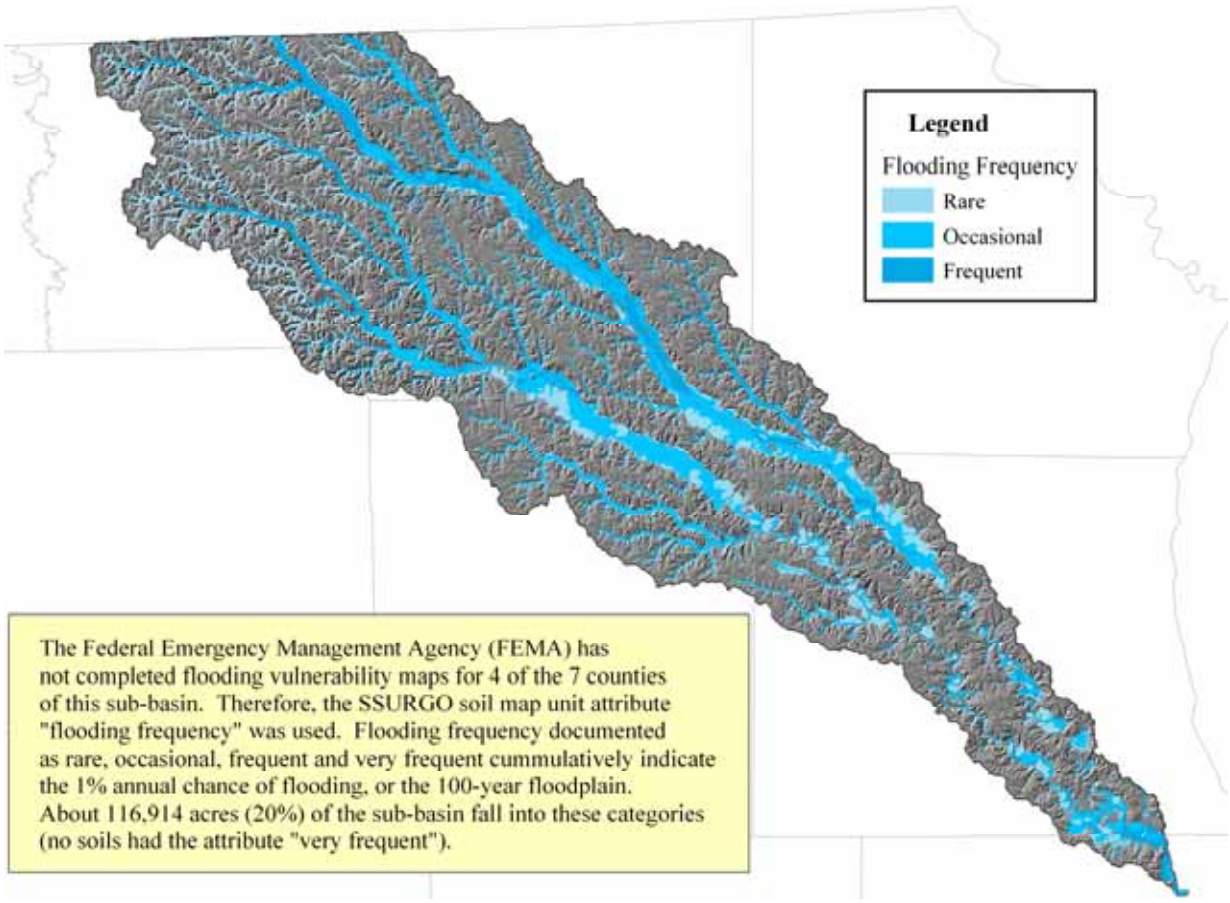
silty, clayey and loamy alluvial and outwash deposits. Corn and soybeans are the major crops. Upland areas consist of well drained to somewhat poorly drained light colored soils. Hardwood forest dominate the upland side slopes. Livestock and grain farming are dominant in the less sloping upland areas. Urban growth is evident in the area around the Quad Cities.

115C.3 – Mississippi River Alluvial Plains

The Mississippi River Alluvial Plains CRA consists of the alluvial plain and channel of the Mississippi River. The alluvial plain has very deep loamy and clayey soils of variable drainage capacity. Many islands are timbered. The main bottoms are artificially drained and in cropland, but some oxbow wetlands remain.

G. Streams

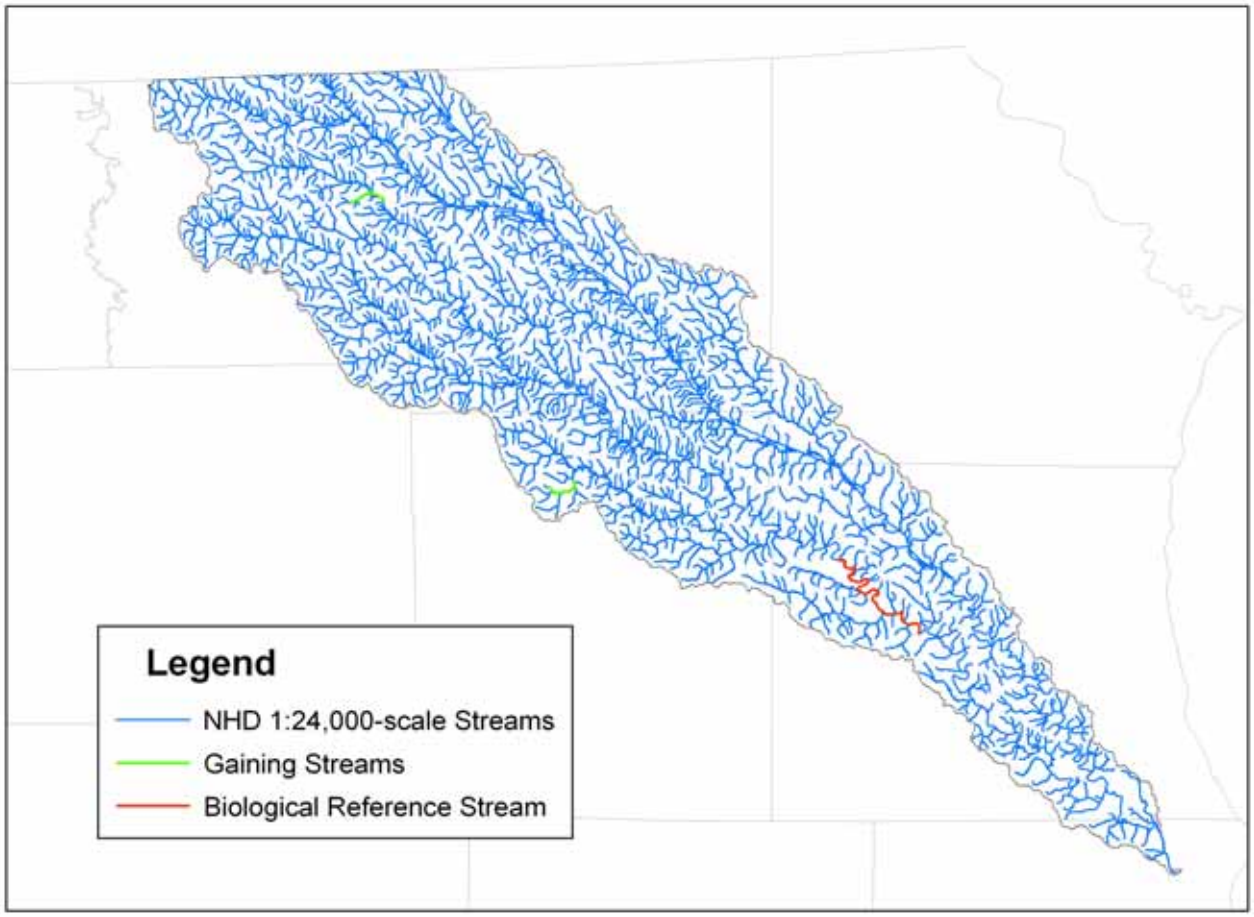
Floodplains[7]



The Federal Emergency Management Agency (FEMA) has not completed flooding vulnerability maps for 4 of the 7 counties of this sub-basin. Therefore, the SSURGO soil map unit attribute "flooding frequency" was used. Flooding frequency documented as rare, occasional, frequent and very frequent cummulatively indicate the 1% annual chance of flooding, or the 100-year floodplain. About 116,914 acres (20%) of the sub-basin fall into these categories (no soils had the attribute "very frequent").

National Hydrography Dataset (NHD) with Gaining Streams and Biological Reference Streams [8]

High-resolution (1:24,000-scale) streams from the National Hydrography Dataset total 2,047 miles of intermittent and perennial streams in this sub-basin. About 6 miles of streams are considered gaining streams and there are no designated losing streams. Stream segments are classified 'gaining' or 'losing' by the Missouri Department of Natural Resources (MoDNR), Division of Geology and Land Survey (DGLS). The classification depicts sections of streams which are either losing water flow to the subsurface or gaining water flow from the subsurface, based on change in flow rate over a set distance. MoDNR also designates biological reference streams for watersheds. Biological reference streams are segments of streams that represent the best stream conditions to support aquatic life for a given area. An 11-mile stretch of the Middle Fabius River is the biological reference stream in this sub-basin.



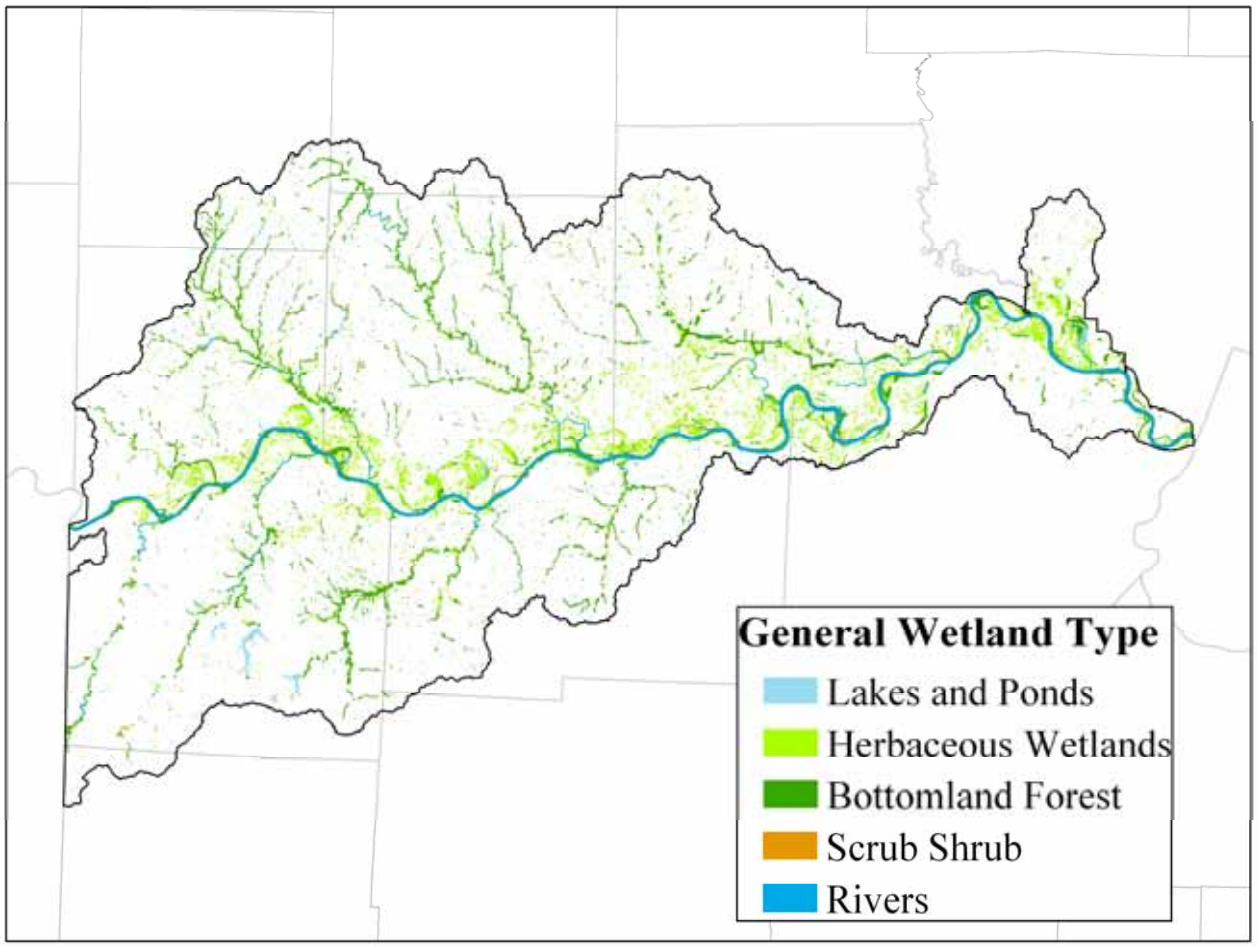
H. Wetlands[9]

Wetlands consist of land surface areas that are flooded or saturated by surface or ground water often enough to support plant and animal lifeforms that are adapted for life in wet environments.

The National Wetland Inventory delineated wetlands from early 1980s aerial photography and classified the wetlands using a wetland classification scheme developed by Cowardin, et al. The inventory identifies 20,902 acres of various wetland types within the North Fabius River Sub-basin.

General Wetland Type	Acres	Percent of Sub-basin
Lakes and Ponds	4,017	0.8%
Herbaceous Wetlands	2,385	0.5%
Bottomland Forests	12,034	2.3%
Scrub Shrub	449	.09%
Rivers	2,017	.4%
Total	**20,902 acres**	**4.1%**

Figure 8



I. Relief Map[10,11]

This shaded relief map of the sub-basin depicts elevation above sea level and generalized relief across the sub-basin. The shaded relief and elevation values are derived from digital elevation models generated from United States Geological Survey 7.5 minute elevation contours. In the rolling uplands that form the headwaters of the North Fabius River, local relief averages around 100 feet. As one moves southeastward into the middle reaches of the North Fabius River, the elevations drop and local relief across the flat to gently rolling hills and shallow valleys is typically less than 50 feet. The moderately dissected valleys and broad divides covering the lower portion of the sub-basin push the average local relief to greater than 100 feet.

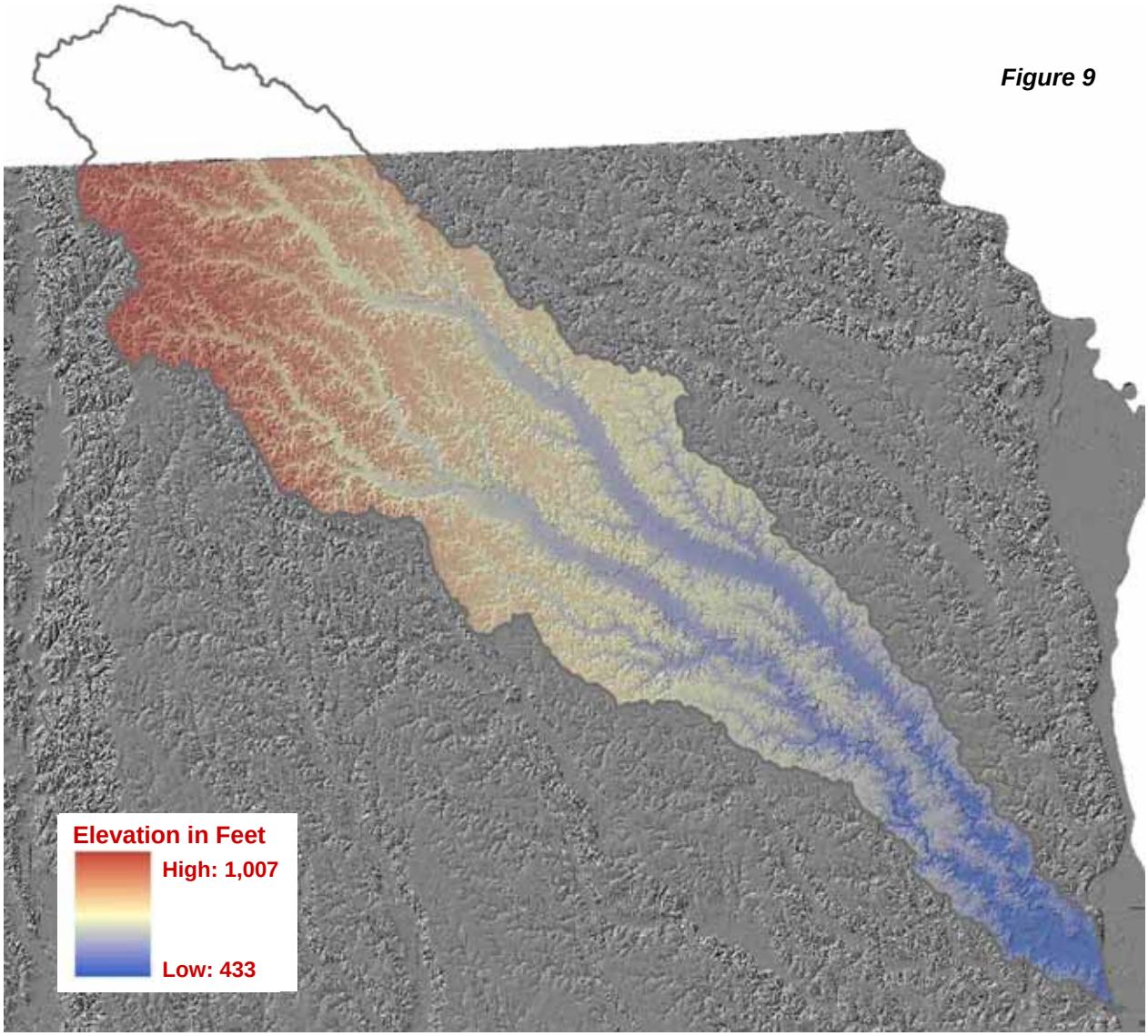
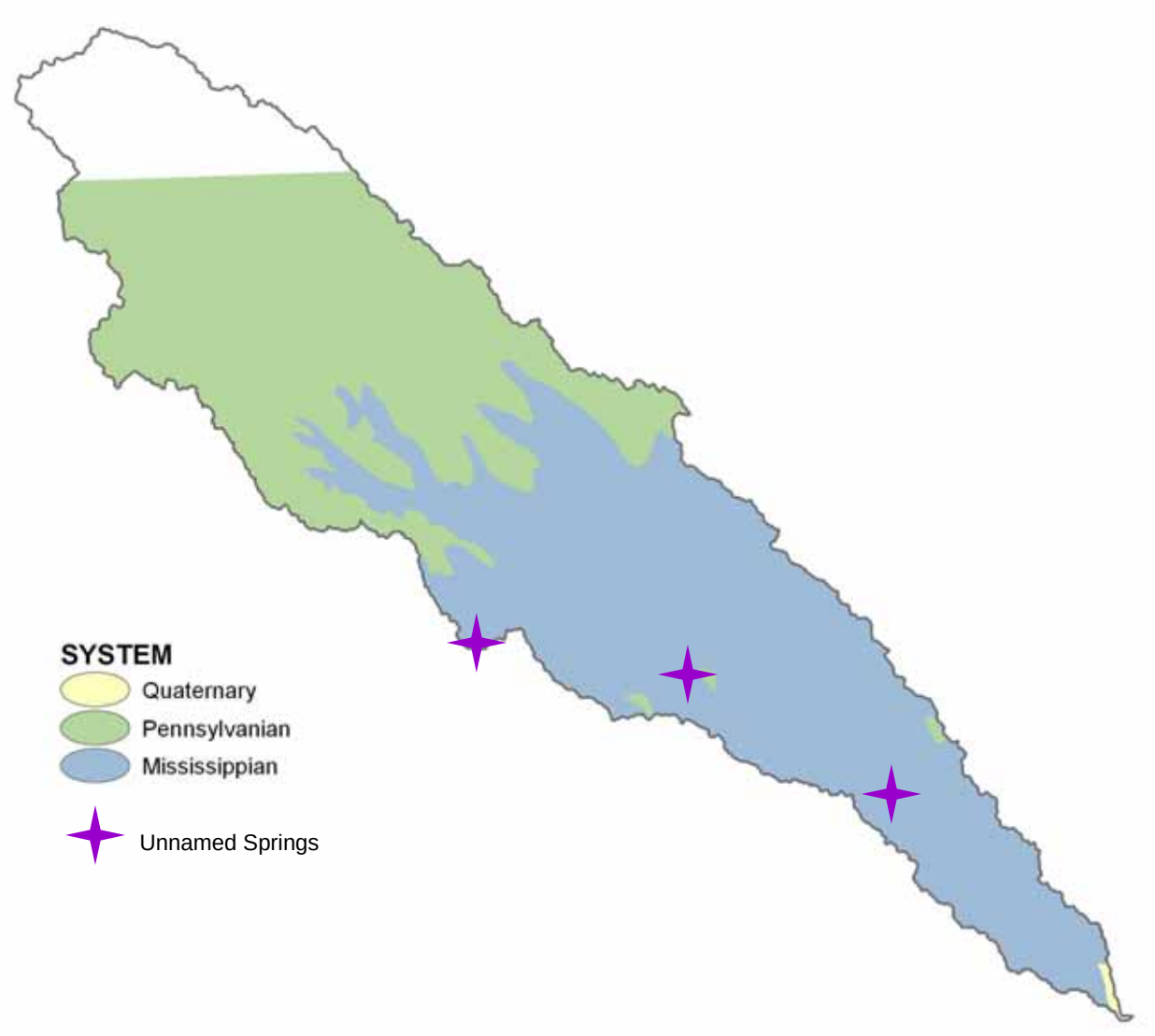


Figure 9

J. Geology[12,13]

Geology Map

This bedrock geology map is derived from the Geologic Map of Missouri. Like the North Fabius River sub-basin's elevation and relief, bedrock geology changes substantially from northwest to southeast. The upper half of the drainage area consists of Pennsylvanian sedimentaries (limestones, shales, sandstones and siltstones) under glacial till with few exposures. The lower half of the sub-basin is underlain by Mississippian carbonates, primarily limestone, under a much thinner cover of glacial till with significant exposure in streambeds, valley sides and stream bluffs.



Karst features[14]

Karst topography is generally formed over carbonate bedrock such as limestone and dolomite by dissolving or solution. It is often characterized by sinkholes, caves, underground drainage, and losing streams. This sub-basin is not considered a karst region. Three unnamed springs are located in the sub-basin, with unmeasured flow. No sinkholes or caves are documented in the area. As noted in Section G, no losing streams are documented.

Resource Concerns

Resource concerns are issues related to the natural environment. Natural resources include soil, water, air, plants, animals, and humans. Missouri Natural Resources Conservation Service identified resource concerns that affect the North Fabius River Watershed.

Figure 11

Natural Resource	Concern 1	Concern 2	Concern3
Air	Objectionable Odors		
Animals (Domestic)	Stress & Mortality		
Plants	Threatened & Endangered Species	Noxious & Invasive Plants	Plant Damage (from wind erosion)
Soil (Quality)	Sheet & Rill Erosion to "T"		
Water (Quality)	Harmful Levels of Pathogens (livestock source)	Excessive Nutrients and Organics in Surface Water	
Water (Quantity)	Inefficient water use on irrigated lands		

Soil Erosion

- Streambank, streambed, and classical gully erosion occurs on pasture/grassland, cropland, forestland, and urban areas. However, due to a lack of reliable data at the sub-basin level, the degree and amount of soil loss from these sources is not known.
- Classical gully erosion occurs on pasture/grassland, cropland, forestland, and urban areas. No sub-basin level data are available to determine the degree and extent.
- Ephemeral gully erosion is occurring primarily on cropland eroding at levels above the tolerable limit ("T"). No sub-basin level data are available to determine the degree and extent.
- An estimated 27 percent (207,144 acres) of all cropland is eroding at levels above "T".
- The estimated USLE soil loss on highly erodible, cultivated cropland (eroding above "T") is 13.2 tons/acre/year.
- Erosion and runoff is occurring from construction sites primarily found in and near urban areas.

Sedimentation

- Excessive sedimentation can reduce the useful life of ponds, lakes, reservoirs, and wetlands and can increase the severity and frequency of flooding by reducing the water carrying capacity of streams and rivers.

Prime Farmland

- The majority of the prime farmland (16,500 acres) lost between 1982 and 1997 is believed to be in the western one-third of the sub-basin where growth of the metropolitan Kansas City area is interacting with surrounding agricultural areas. Refer to the Population Interaction Zones for Agriculture (PIZA) map on page ???

Soil Quality

- Excessive soil erosion is a primary contributor to soil quality degradation. This limits the productivity and sustainability of the soil resource.

Water Quality

- Highly erodible and cultivated croplands with USLE soil losses above tolerable limits ("T") are a primary non-point source of sediment, nitrogen, and phosphorus pollutants that enter the stream system.
- Twelve waterbodies within the sub-basin appear on the 303(d) list and are not meeting water quality standards. Pollutants listed include chlordane, mercury, ammonia, polychlorinated biphenyl (PCB), volatile suspended solids (VSS), biochemical oxygen demand (BOD), and fecal coliform. Refer to Water Quality section on page ???
- An estimated 260 leaking tanks have been identified within the sub-basin and are concentrated primarily in the Kansas City metropolitan area. Refer to Water Quality section on page ???

A. Soils

The upland soils on broad divides and ridge tops of this sub-basin formed in loess (wind blown sediments). The soils on side slopes formed in glacial till (materials deposited by glacial ice) . These upland soils are predominantly very deep and range from moderately well to somewhat poorly drained, depending upon gradient and shape of the slope, and have silt loam surface textures with silty clay subsoils.

The broad upland divide and ridge top soils formed under prairie vegetation and the steeper soils adjacent to the major stream valleys formed under savanna or forest vegetation.

The flood plains of the North Fabius River and its tributaries are narrow and inextensive. Soils in the floodplain settings are formed in alluvial sediments are very deep and generally have silty surface textures with silty clay loam subsoils.

B. Soil Erosion[15]

The objectives of this section are to profile cropland erosion rates and identify cropland areas within the North Fabius River sub-basin that would benefit the most from the application of conservation practices to limit sediment loss.

"**The production practices and inputs used by agriculture can result in a number of pollutants entering water resources, including sediment, nutrients, pathogens, pesticides and salts." (USDA-Economic Research Service).**

"Sediment is the largest contaminant of surface water in the United States by weight and volume (Koltun et al., 1997) and the second leading pollution problem in rivers and streams and third leading problem in lakes" (USEPA, 2002).

Sediment losses from water erosion on cropland, stream banks and streambeds and runoff from construction sites and developed land are an ongoing resource concern throughout the Lower Missouri-Crooked River sub-basin. Cultivated cropland is the primary nonpoint source of sediment loss in this heavily cropped sub-basin and accounts for 41% of the sub-basin's total surface area**.** In sub-basins like the North Fabius River throughout the Upper Midwest Region, the acres most in need of conservation treatment are primarily the result of sediment loss and nitrogen and phosphorus lost with waterborne sediment.

The consequences of excessive soil erosion are well known. Waterborne soil sediments are inextricably linked to degraded water quality through turbidity and loss of fertilizers and pesticides attached to soil particles. Suspended sediments degrade aquatic habitats, increase water treatment costs and marginalize water recreation. Sedimentation reduces the useful life of ponds, lakes and reservoirs; increases the probability and severity of flooding; and clogs drainage networks. Excessive soil erosion is a primary contributor to soil quality degradation, limiting the productivity and sustainability of the soil.

This assessment concentrates on sheet and rill erosion on cropland for which there is scientifically based soil erosion estimates for the entire sub-basin. This focus does not suggest that sedimentation related to urban storm water runoff, stream bank erosion or ephemeral gully erosion on cropland is not significant in volume or impact; only a lack of reliable data at the sub-basin level for these other sources of sediment. The erosion rate data has been extracted from the 1997 National Resources Inventory (NRI). Erosion rates and their relationship to "T" values are reported in tons/acre/year for cultivated crop-

land, non-cultivated cropland, corn and soybeans on highly erodible and non-highly erodible land. Also included are erosion rates and their relationship to “T” values for pastureland.

Universal Soil Loss Equation (USLE) Cropland Erosion Rates in Tons/Acre/Year[2]

USLE - This table reports estimated soil loss rates from the 1997 NRI based on the Universal Soil Loss Equation (USLE). USLE estimates average annual sheet and rill soil movement down a uniform slope using rainfall energy as the erosive force acting on the soil. Soil characteristics and slope for the fields in which the NRI sample points fall or those portions of the fields surrounding the points that would be considered in conservation planning are used in the NRI USLE calculations.

“T” FACTOR – This is the maximum rate of annual soil erosion that will still permit crop productivity to be sustained economically and indefinitely.

HEL – Highly erodible land (HEL) is land that has an erodiblity index (EI) value of 8 or more. The EI index provides a numerical expression of the potential for a soil to erode, considering the physical and chemical properties of the soil and climatic conditions where it occurs. The higher the index value, the greater the investment needed to maintain the sustainability of the soil if intensively cropped.

Figure 12

USLE Cropland Erosion Rates Tons/Acre/Year[2]

CROPLAND CATEGORY	CULTIVATED CROPLAND	NON-CULTIVATED CROPLAND
HIGHLY ERODIBLE LAND (HEL)		
HEL Eroding at or below "T"	2.06	0.55
HEL Eroding above "T"	13.28	0
All HEL	11.9	0.55
NON-HIGHLY ERODIBLE LAND (Non-HEL)		
Non-HEL Eroding at or below "T"	2.08	0.06
Non-HEL Eroding above "T"	5.3	0
All Non-HEL	3	0.06
ALL CROPLAND		
All Land Eroding at or below "T"	2.07	0.4
All Land Eroding above "T"	10.57	0
All Land	6.54	0.4

Cropland Erosion in Relationship to "T"[2]

This table reports acres and percentages of cultivated cropland, non-cultivated cropland and all cropland by HEL and "T" categories for the sub-basin.

Cultivated Cropland

CROPLAND CATEGORY	Total Acres	% of Cropland Category	% of all Cropland	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	9,600	12%	4%	2%
Highly Erodible Cropland above "T"	70,600	88%	27%	14%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**198,200**	**100%**	**26%**	**12%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	85,600	70%	33%	16%
Non-Highly Erodible Cropland above "T"	37,000	30%	14%	7%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**122,600**	**100%**	**47%**	**23%**
GRAND TOTALS	**202,800**	**100%**	**78%**	**39%**

Non-Cultivated Cropland

CROPLAND CATEGORY	Total Acres	% of Cropland Category	% of all Cropland	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	38,600	100%	15%	7%
Highly Erodible Cropland above "T"	0	0%	0%	0%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**38,600**	**100%**	**15%**	**7%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	15,800	100%	6%	3%
Non-Highly Erodible Cropland above "T"	0	0%	0%	0%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**15,800**	**100%**	**6%**	**3%**
GRAND TOTALS	**54,400**	**100%**	**21%**	**10%**

All Cropland

CROPLAND CATEGORY	Total Acres	% of Cropland Category	% of all Cropland	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	48,200	41%	19%	9%
Highly Erodible Cropland above "T"	70,600	59%	27%	14%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**118,800**	**100%**	**46%**	**23%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	101,400	73%	40%	19%
Non-Highly Erodible Cropland above "T"	37,000	27%	14%	7%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**138,400**	**100%**	**54%**	**26%**
GRAND TOTALS	**257.200**	**100%**	**100%**	**49%**

Corn and Soybean Erosion Profiles[2]

These tables report USLE rates and acres by HEL, "T" and conservation practices for corn and soybeans (tons/acre/year).

All Corn and Soybean Acres

	All Corn Acres	USLE - Corn Acres	All Soybean Acres	USLE - Soybean Acres
All Acres	78,100	6.46	103,800	6.95
All Contoured acres	14,800	6.4	9,700	4.04
All Contoured and Terraced Acres	10,100	6.98	7,100	2.02
All Contoured Acres, Not Terraced	4,700	5.14	2,600	24.9
All Non-Contoured Acres	63,300	6.48	94,100	7.25
All Non-Contoured and Terraced Acres	12,400	4.13	7,400	7.44
All Non-Contoured, Not Terraced Acres	50,900	7.05	86,700	7.23

HEL Corn and Soybean Acres

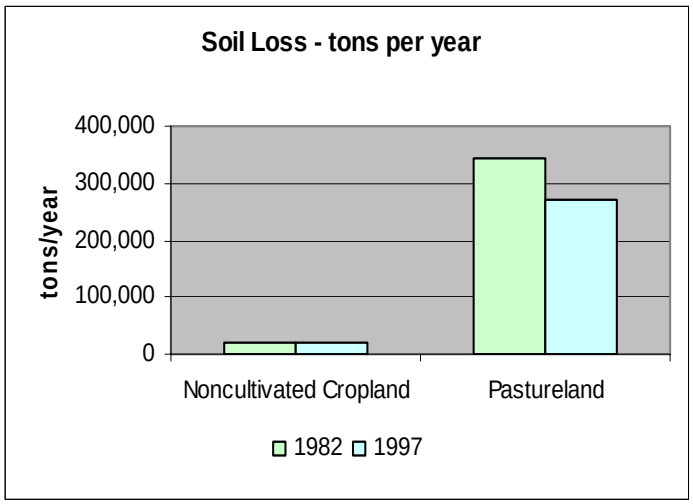
	All HEL Corn Acres	USLE - HEL Corn Acres	All HEL Soybean Acres	USLE - HEL Soybean Acres
All Acres	31,300	11.83	38,900	12.54
All Contoured acres	8,100	8.89	4,500	7.67
All Contoured and Terraced Acres	6,700	9.18	1,900	5.08
All Contoured Acres, Not Terraced	1,400	7.53	2,600	9.57
All Non-Contoured Acres	23,200	12.85	34,400	13.18
All Non-Contoured and Terraced Acres	4,700	7.95	4,200	8.77
All Non-Contoured, Not Terraced Acres	18,500	14.10	30,200	13.80

Pastureland Erosion

This table reports USLE rates and acres in relationship to "T" for pastureland (tons/acre/year).

	Pastureland Acres	USLE Rate
All Pastureland	120,500	2.24
Pastureland Eroding at or Below "T"	96,300	1.32
Pastureland Eroding Above "T"	24,200	5.94

USLE Soil Loss Rates (tons/year)[2]



Noncultivated Cropland

1982 20,900 tons per acre

1997 22,200 tons per acre

Pastureland

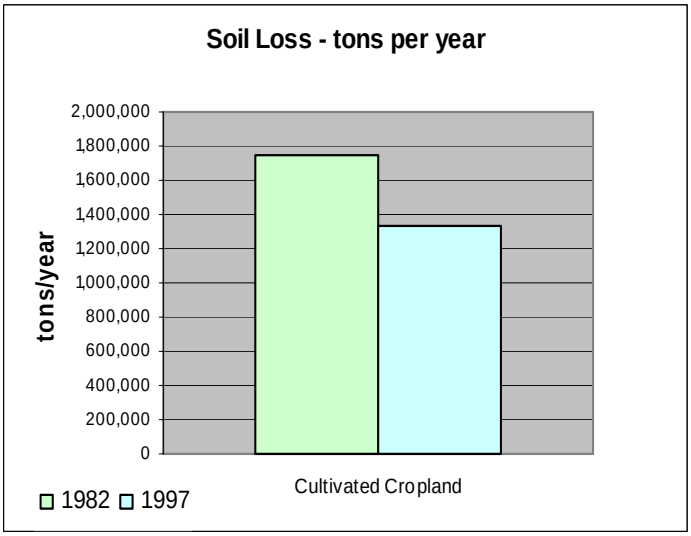
1982 345,300 tons per acre

1997 271,000 tons per acre

Cultivated Cropland

1982 1.75 million tons per acre

1997 1.3 million tons per acre

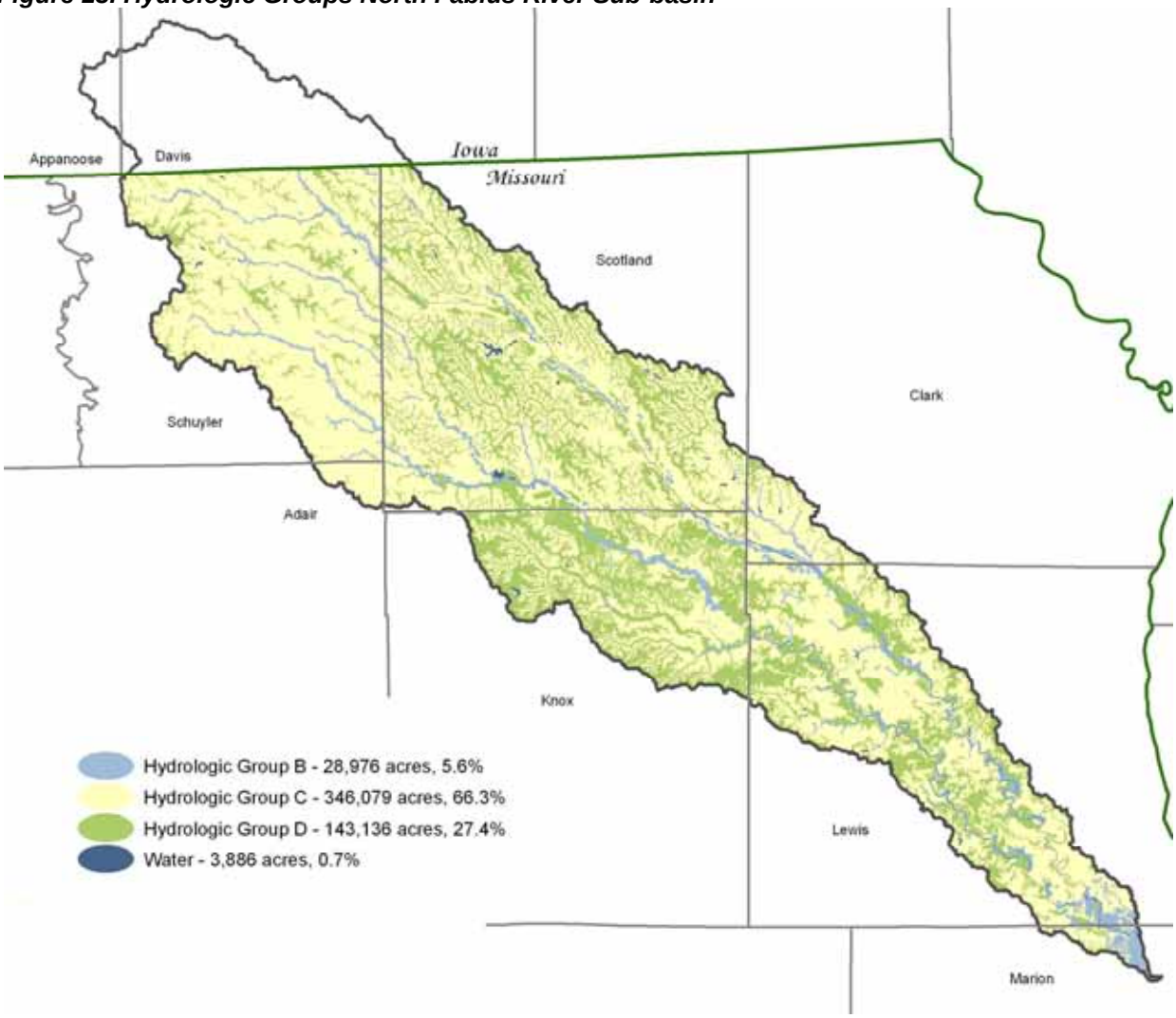


Hydrologic Soil Groups[5]

In addition to the sub-basin-wide NRI erosion estimates, a spatial assessment of erosion potential was implemented using SSURGO soils data and land cover. The acres most in need of conservation practices (acres with the highest potential for sediment loss, if cropped) have been targeted based on a major finding from model simulations of soil loss outcomes reported by the NRI-Conservation Effects Assessment Project (CEAP), (NRCS, 2006): ***Hydrologic soil group and soil texture account for a large part of the variability in the loss of sediment, nitrogen and phosphorus from field to field.*** Based on average per acre sediment loss rates by hydrologic soil groups and soil texture groups reported in the CEAP study, each hydrologic soil group was divided into three classes of sediment loss potential: (1) higher average, (2) moderate average and (3) lower average.

The amount of sediment loss from sheet and rill erosion is determined by the amount of precipitation, tillage practices, soil characteristics and the presence or absence of conservation practices and can vary considerably from field to field. A significant portion of this variability can be accounted for by hydrologic soil groups (HSG) and soil texture differences within the hydrologic groups. This map shows the spatial distribution of hydrologic soil groups A, B, C and D.

Figure 13. Hydrologic Groups North Fabius River Sub-basin



Sediment Loss Potential on Hydrologic Soil Group B (if used for cropland)

Acreages for this hydrologic soil group are typically high with a large number of cropland acres. Acres with the highest potential for sediment loss are defined by medium and fine soil texture groups. Soils with a medium average sediment loss potential are represented by moderately coarse and moderately fine textured soils. Coarse textured soils in hydrologic soil group B dominate the areas with the lowest average sediment loss rate potential. Average soil loss rates for all texture groups will tend to be at or below the average for the sub-basin.

Sediment Loss Potential on Hydrologic Soil Group C (if used for cropland)

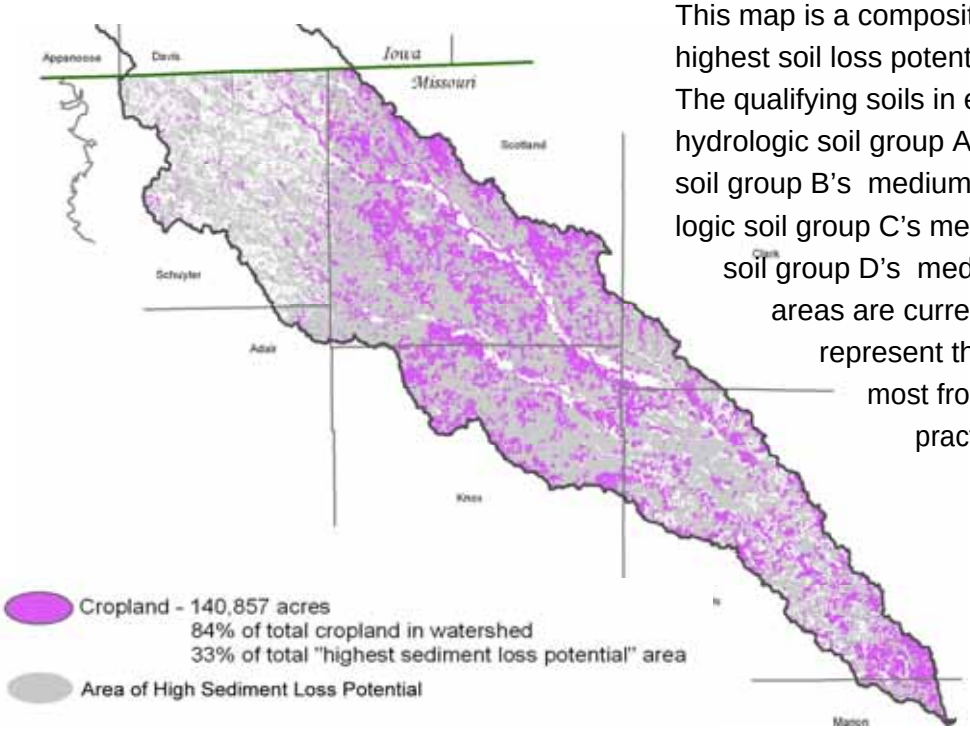
This is the largest hydrologic soil group in the sub-basin with a large cropland acreage. Higher average sediment loss rates are reflected in the medium texture soil group. The moderate average sediment loss rate category is made up of the coarse and moderately coarse and fine and moderately fine soil texture groups. Average soil loss rates for all the texture groups will tend to exceed the average for the sub-basin.

Sediment Loss Potential on Hydrologic Soil Group D (if used for cropland)

This is the second smallest hydrologic soil group in the sub-basin but it is dominated by cropland. The higher average sediment loss rates are on the medium textured soils and the moderate average sediment loss rates are produced by the fine and moderately fine soil texture groups. The coarse and moderately coarse soil texture groups generate the lower average sediment loss rates.

Acres of Cultivated Cropland on

Each hydrologic soil group was divided into three classes of sediment loss potential based on texture groups: (1) higher average, (2) moderate average and (3) lower average. This rating was linked to a SSURGO soils data set to produce maps of high, medium and low soil loss potential for each hydrologic group.



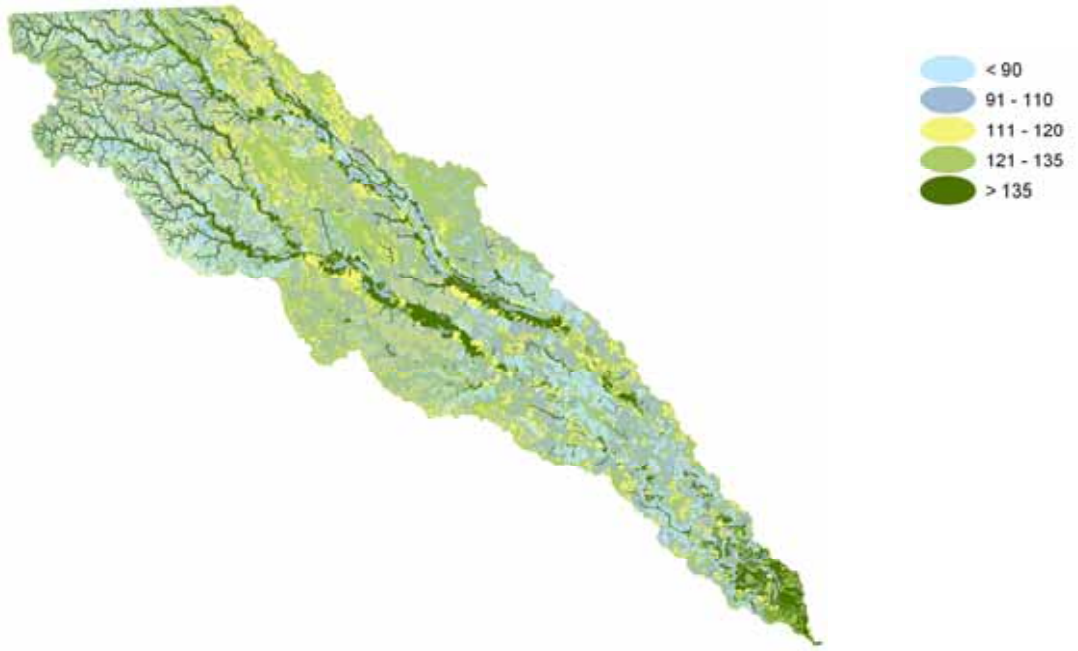
This map is a composite of the acres that have the highest soil loss potential in each hydrologic soil group. The qualifying soils in each hydrologic soil group are: hydrologic soil group A – no qualifying soils; hydrologic soil group B's medium and fine textured soils; hydrologic soil group C's medium textured soils; hydrologic soil group D's medium textured soils. The purple areas are currently under cultivation and represent the acres that could benefit the most from the application of conservation practices, if not already implemented.

Soil Productivity[5]

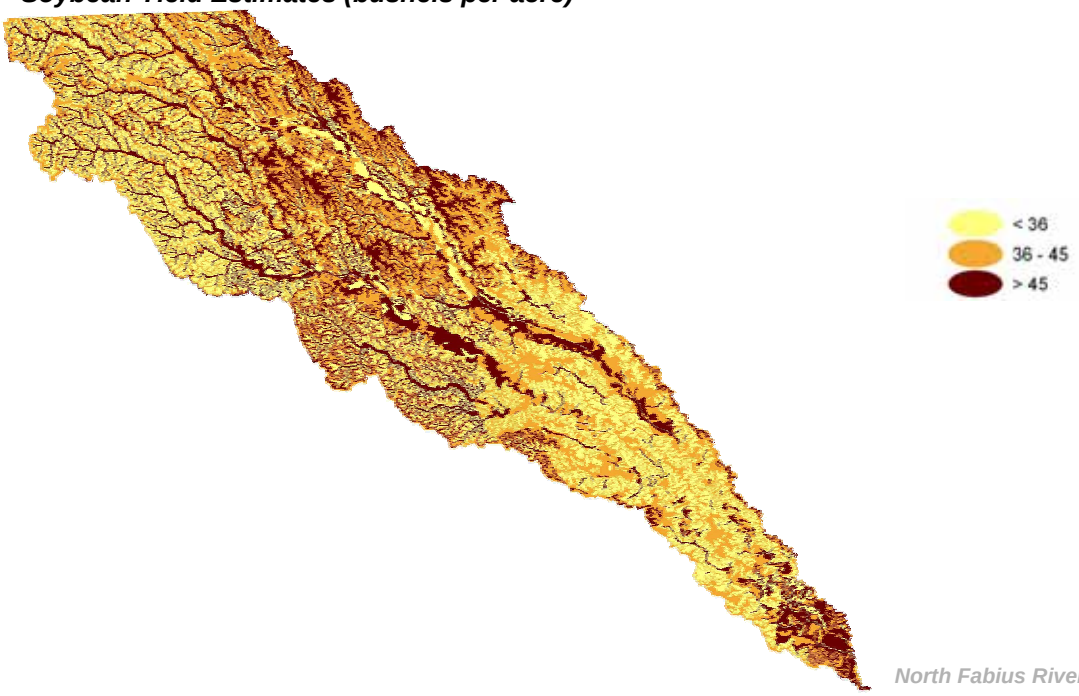
Yield estimates were developed using Missouri's Productivity Index (PI). The PI is a method developed by soil scientists that "automatically" evaluates specific soil properties directly related to plant growth. The soil properties used are a record of many years of soil survey data stored in USDA's National Soils Information System (NASIS) . The properties include: nutrient- supplying power (Organic matter, cation exchange capacity and pH), root penetration (depth to barriers, retarding layers, etc.), wetness effects (depth to seasonal high water table), available water capacity, surface restrictions (rocks, clayey, etc.), flooding restrictions (frequency), phase restrictions (gullied, channeled), slope restrictions and climate.

Figure 14

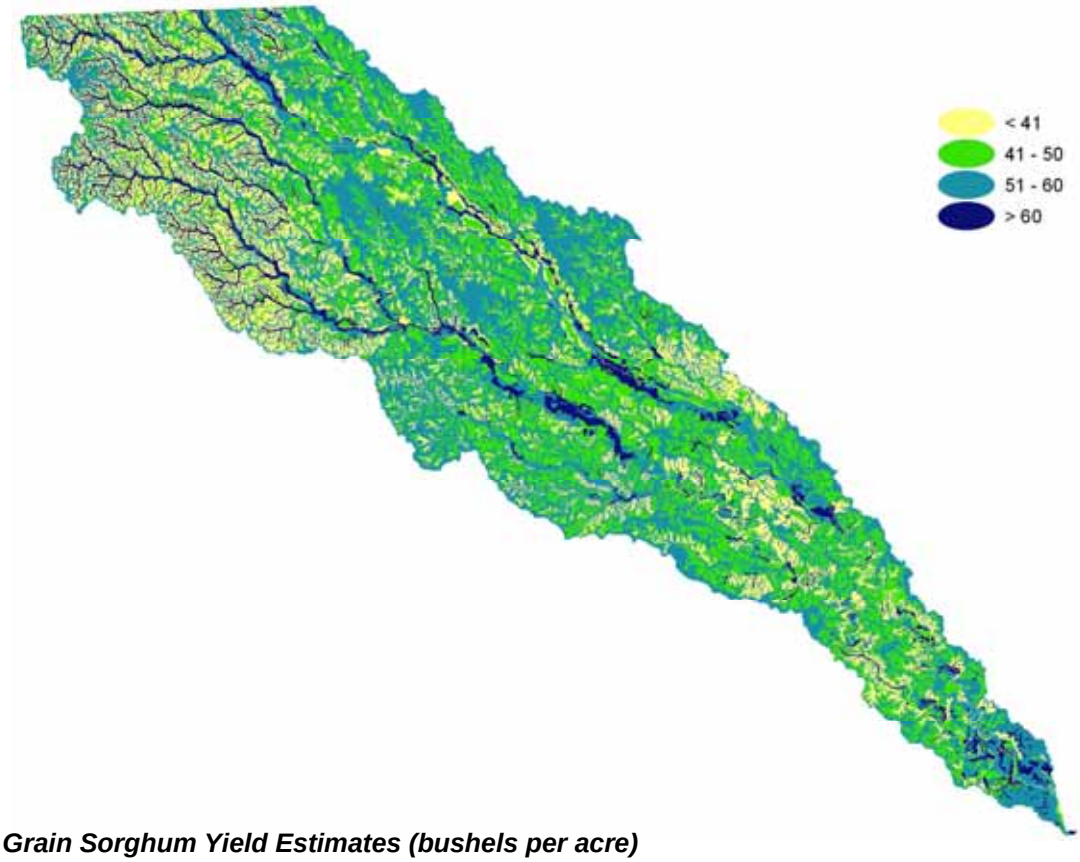
Corn Yield Estimates (bushels per acre)



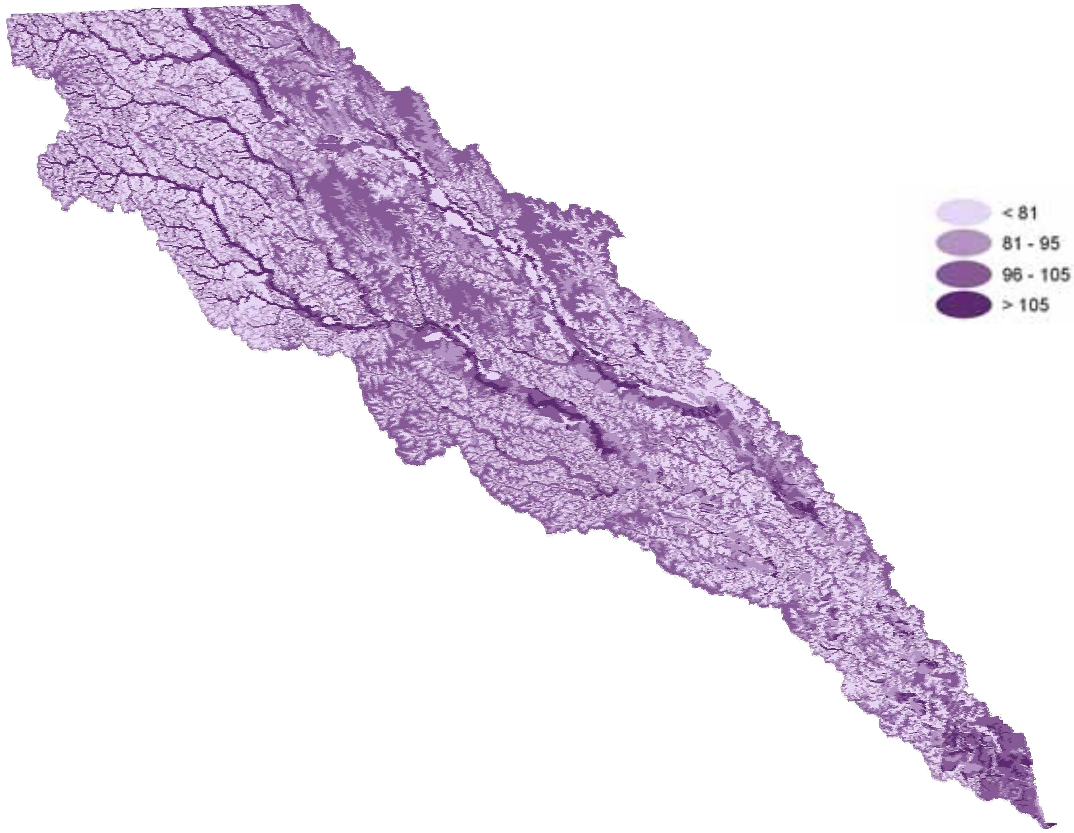
Soybean Yield Estimates (bushels per acre)



Wheat Yield Estimates (bushels per acre)



Grain Sorghum Yield Estimates (bushels per acre)



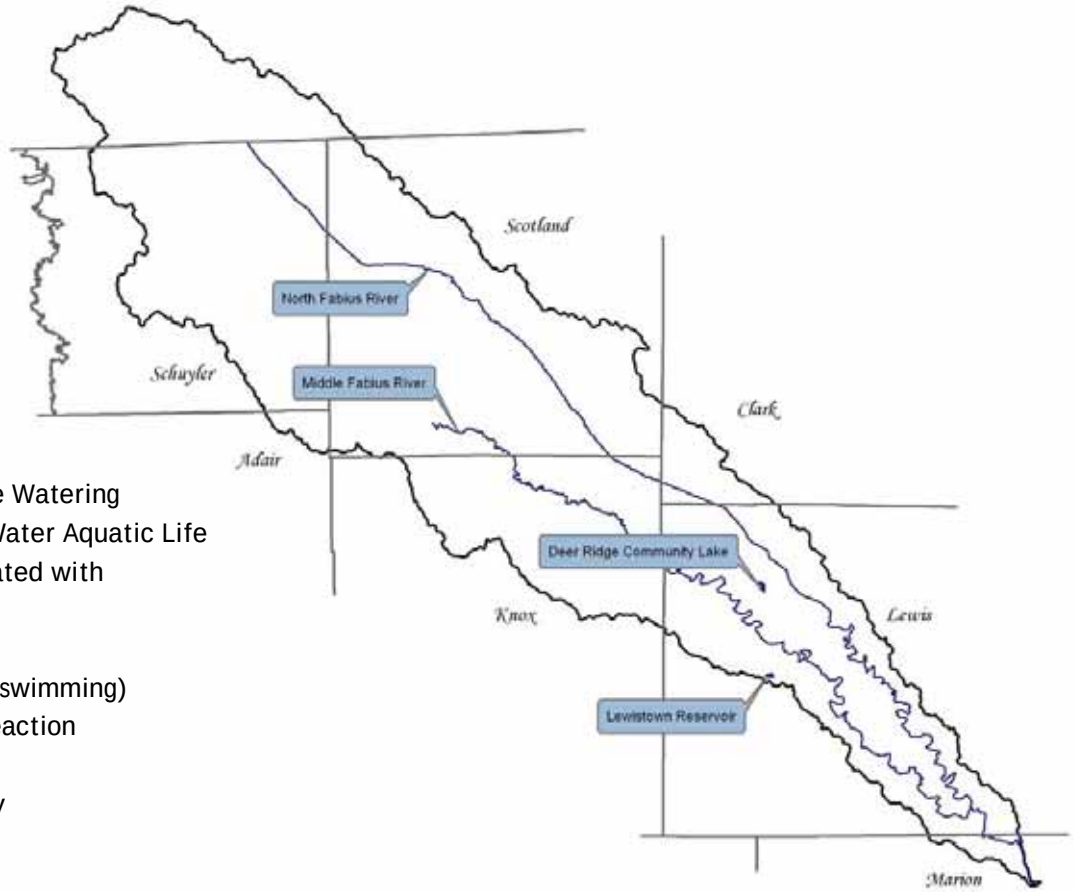
C. Water Quality

303d Listed Waters[16]

Section 303(d) of the federal Clean Water 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. Water quality standards protect such beneficial uses of water as whole body contact (such as swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife. The 303(d) list helps state and federal agencies keep track of waters that are impaired but not addressed by normal water pollution control programs.

Figure 15

Water Body, ID Number, County/ Counties	Size	Pollutant	Source	Impaired Use(s)	Beneficial Use(s)*	Priority
North Fabius River, 56, Clark, Knox, Lewis, Marion, Schuyler, Scotland	82 miles	Manganese Sediment	Ag NPS	Aquatic habitat		Low
Middle Fabius, 63, Knox, Lewis, Scotland	57 miles	Manganese	Natural			Low
Deer Ridge Community Lake, 7015, Lewis	48 acres	Mercury	Atmospheric Deposition	Fish Consumption		Medium
Lewiston Reservior, 7020, Lewis	27 acres	Atrazine, Cyanazine	Corn & Sorghum Production	Corn & Sorghum Production	1, 2, 3,4,8	High



*** Beneficial Uses:**

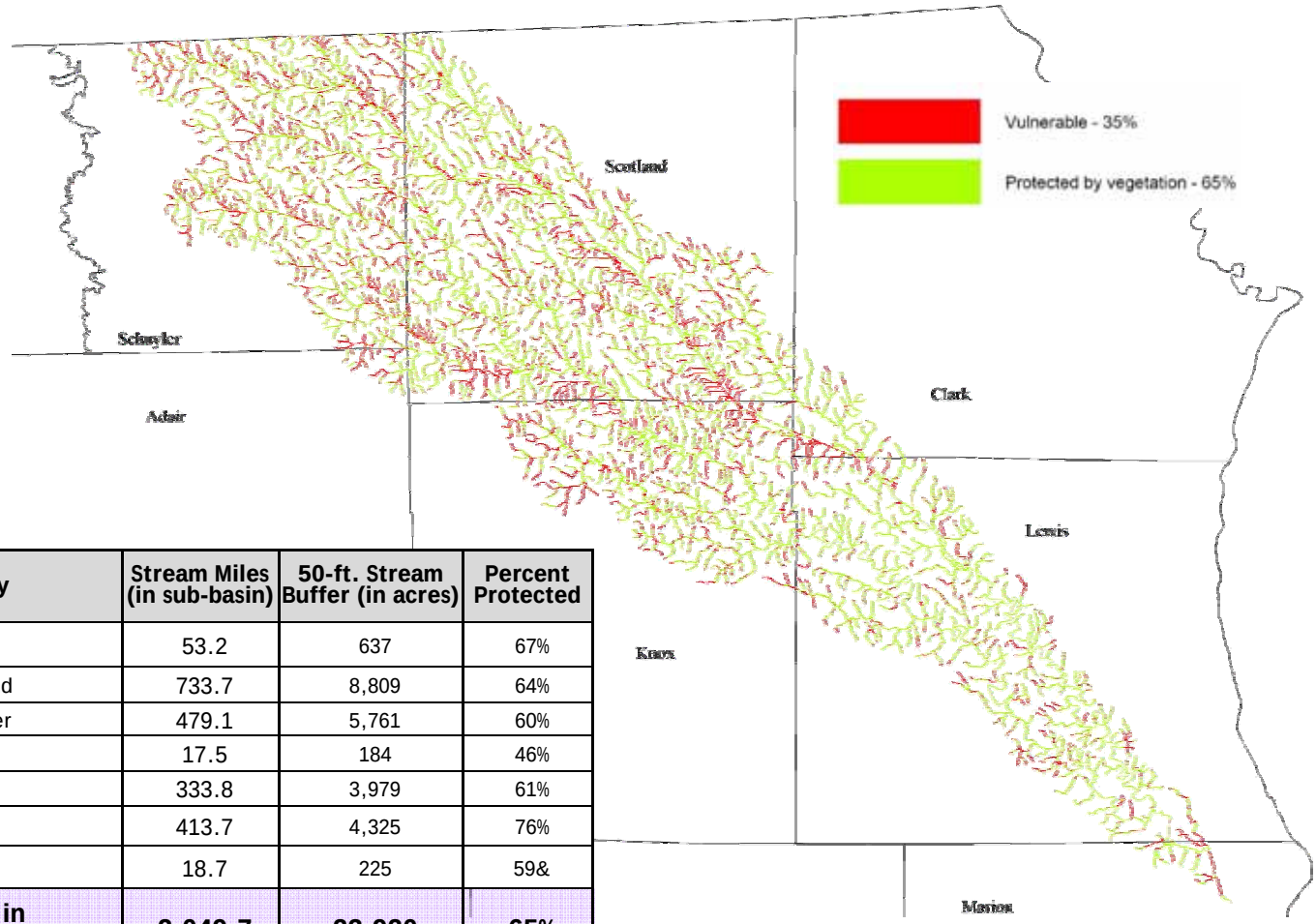
1 Livestock and Wildlife Watering
2 Protection of Warm Water Aquatic Life
3 Human Health associated with Fish Consumption
4 Boating and Canoeing
5 Whole Body Contact (swimming)
6 Secondary Contact Reaction
7 Irrigation
8 Drinking Water Supply
9 Industrial

Riparian Corridor Condition[8,17]

The condition of the riparian zone adjacent to streams has a critical impact on water quality. Permanent and deeply-rooted streambank vegetation slows run-off of nutrients and pollutants, and reduces sedimentation and solar heating. NRCS riparian practice standards specify 50-feet buffers along first and second order streams and 100-feet for third order and higher streams.

The 1:24,000 National Hydrologic Dataset (NHD) stream network is the highest resolution stream representation available consistently for the State. Stream order is not an attribute of these data; therefore, the streams were all buffered by 50-feet to give the most conservative representation of riparian condition. Buffered streams were used to subset the common land unit (CLU) data, land parcel data developed and maintained by the Farm Service Agency. The land cover attribute in the CLU data was used to characterize the vegetative condition of the buffers. Cropland (which includes pasture and hayland), urban, mined and barren cover types were considered "unprotected" or "vulnerable" riparian conditions, while forestland, rangeland and water were considered "protected". Results are presented by county and sub-basin in the table and map below.

Figure 16

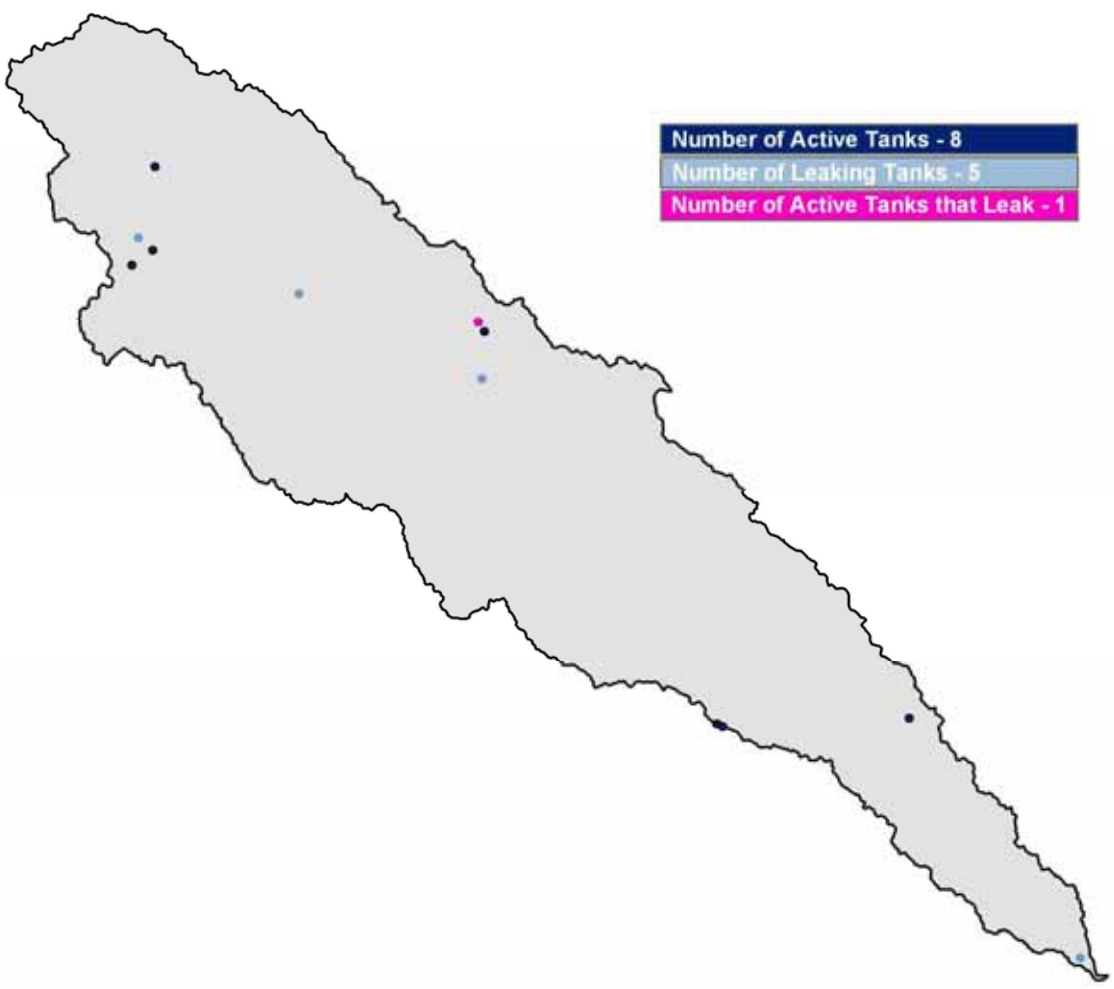


County	Stream Miles (in sub-basin)	50-ft. Stream Buffer (in acres)	Percent Protected
Clark	53.2	637	67%
Scotland	733.7	8,809	64%
Schuyler	479.1	5,761	60%
Adair	17.5	184	46%
Knox	333.8	3,979	61%
Lewis	413.7	4,325	76%
Marion	18.7	225	59&
Total in Sub-basin	**2,049.7**	**23,920**	**65%**

Underground Tanks[21,22]

Registered active underground tanks and locations of leaking underground tanks where clean-up activities are on-going. There are eight active underground tanks, one of which is leaking. There are also five total tanks that are leaking in the sub-basin.

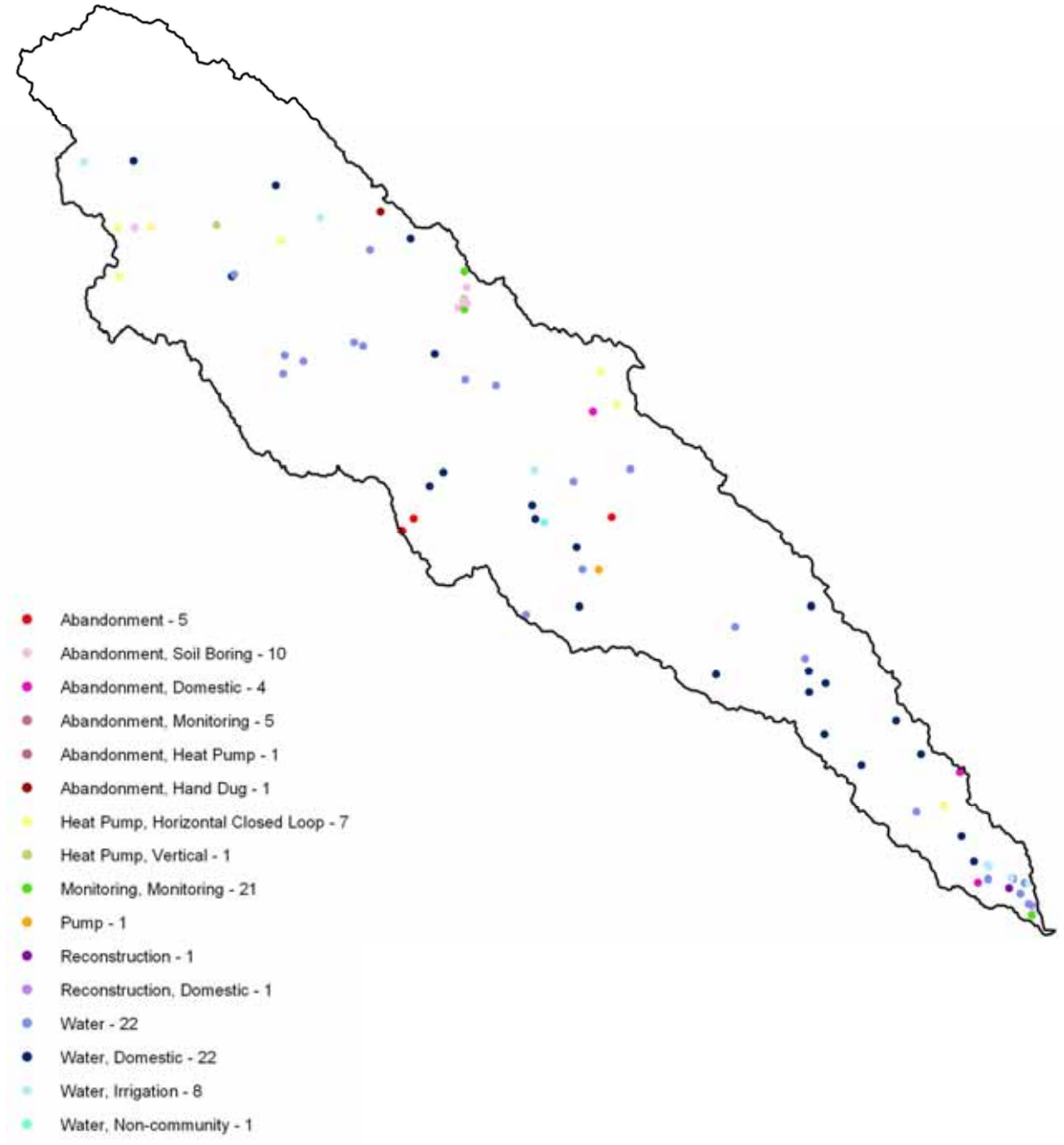
Figure 17



Wells[8]

The Missouri Well Driller's Law (Section 256.600-256.640 RSMo.) established minimum construction standards and state certification requirements of wells constructed after October, 1987. The law was created to protect Missouri groundwater from contamination due to improperly constructed wells. Contaminated groundwater exposes Missourians of all ages to serious health risks that can result from water borne diseases such as typhoid fever, dysentery, cholera, hepatitis and giardiasis. The law is administered through the Department of Natural Resources.

Figure 19



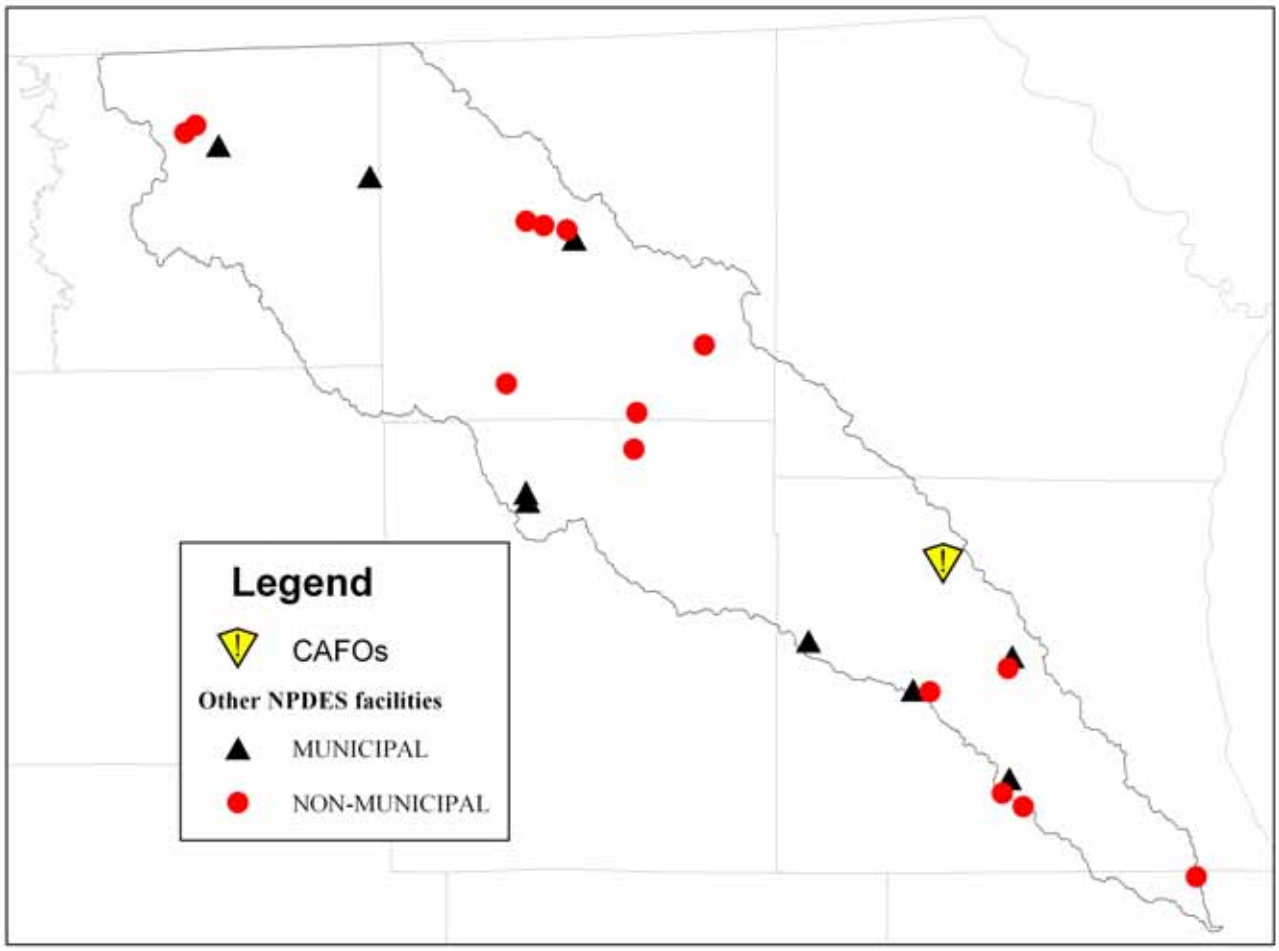
Waste Water Treatment Facilities and Concentrated Animal Feeding Operations[23]

One swine finishing concentrated animal feeding operation (CAFO) is documented in the Missouri National Pollutant Discharge Eliminations System (NPDES) Facilities database in this sub-basin. The NPDES is a point data set depicting outfall locations of waste water facilities requiring and holding Missouri NPDES operating permits.

An animal feeding operation is defined as a CAFO if it has more than 7000 animal units confined in an area with less than 50% vegetation ground cover. Smaller animal unit operations may be designated a CAFO if they discharge directly into waters of the state or have past history of discharge violations. The animal unit is a unit of measurement to compare waste produced by various animal types, using one beef feeder as a reference.

In addition to CAFOs, the NPDES identifies 23 municipal and non-municipal permitted waste water treatment facilities. A majority are for treatment of sewage sludge.

Figure 20



D. Water Quantity

Public Water Supply [24,25,26,27]

Missouri's 5.8 million residents draw their water supplies from ground and surface sources that vary tremendously in both quality and quantity. These variations are, to a large extent, controlled by geology and land use. North of the Missouri River, herbicides and sediment are a primary concerns in surface water sources and well sources contend with heavy mineralization, nitrates and pesticides. In the Ozark Highlands, ground water, the primary water supply source, is vulnerable to aquifer degradation from contaminated surface runoff and leachates through highly permeable soils and bedrock. Missouri's alluvial aquifers supply large quantities of high quality water, primarily to population centers located near the larger rivers and the Mississippi Embayment covering most of the southeastern corner of the state. Shallow wells are vulnerable to nitrate and pesticide contamination and the deeper wells in highly urbanized areas are at risk from a wide variety of chemical pollutants.

This map shows the surface and ground source water areas that have been inventoried for potential sources of drinking water contamination compiled by MDNR. Detailed information is available for individual public drinking supply systems and the spatial distribution of other drinking water supply features (wells, intakes, tanks, treatment plants, pumping stations, springs and lakes) from MDNR. The 2006 Missouri Water Quality Report provides current water quality assessments and summarizes water quality issues around the state. The 2007 Census of Missouri Public Water Systems is a comprehensive description of city, water district, subdivision and non-community water systems including type of treatment processes and chemical analyses of community water systems. The 2005 Missouri Water Supply Study provides detailed technical hydrologic and water resource engineering data for drought planning for 34 community water systems in North and West Central Missouri.

There are no surface or ground source water inventory areas in this sub-basin.

E. Forestry

Missouri is one of America's great forested states, ranking seventh of the 20 northeastern states in the amount of forest land. Forests cover about a third of the state - forests containing some of the finest oak, walnut, pine, and red cedar found anywhere.

Forests are Missouri's greatest renewable resource, providing many economic, environmental and social benefits. They protect hillsides from erosion, keeping streams and rivers clean. They filter the air, soften the extremes of the weather, and add beauty to cities and towns. Much of Missouri's recreation and tourism industry is centered in the forested regions of the state. And forests are a diverse resource of plants, animals, birds, and other life forms.

Annual growth of forests far exceeds the amount harvested, ensuring ample forests for future generations. Forest Products are also important to Missouri. Statewide, nearly 2,500 firms are involved in logging and wood products manufacturing. Harvesting and processing trees into wood products gives thousands of people jobs and contributes about $3 billion each year to Missouri's economy.

Federal, state, and local governments own only 15 percent of the forest land in Missouri, or about 2 million acres. Private landowners control 85 percent of the forest land in Missouri. Part of the challenge of forestry is helping private landowners apply management practices to create and maintain the kind of forest that meets their needs.

The following tables for this watershed are based on data compiled from The Forest Inventory and Analysis (FIA) Program of the U.S. Department of Agriculture (USDA) Forest Service. Information from USDA-Forest Service, National Forest Inventory and Analysis Database, 2005 is available at http://www.fia.fs.fed.us/tools-data/default.asp.

Area of Forestland by Ownership in Sub-Basin

Private	118,718 acres
Federal	0 acres
State	14,933 acres
County and municipal	0 acres
Other	0 acres
Total	133,651 acres

Area of Forestland by Stocking Class in Sub-Basin

Overstocked	0 acres
Fully stocked	50,837 acres
Medium stocked	52,121 acres
Poorly stocked	28,710 acres
Non-stocked	1,983 acres

F. Threatened and Endangered Species[28]

The Missouri Natural Heritage Database stores locations, population status and habitat information about species and communities of conservation concern. The database is a collection of over 18,000 records on 800 species and communities. The table below was generated from a subset of the Heritage Database, restricted to Federally threatened or endangered and state endangered species recorded in the sub-basin. The subset was spatially generalized with buffers around species records that relate to the species' mobility. While Heritage data can not prove absence of a species in an area, it is the best collection available of known locations of sensitive species and is used to assess potential impacts of various land management activities in a region.

Figure 23

Species Common Name	Scientific Name	Threatened, Endangered, or Candidate	Federal or State Listing
Bats			
Indiana Bat	Myotis sodalis	Endangered	Federal / State
Birds			
Barn Owl	Tyto alba	Endangered	State
Greater Prairie Chicken	Tympanchus cupido	Endangered	State
Reptiles			
Western Fox Snake	Elaphe vulpine vulpina	Endangered	State

Census and Social Data

A. Census Bureau[30]

Block group-level GIS data files from the 2000 Census were used to illustrate population, population change, income, and the agricultural cohort for the sub-basin. County block group spatial files were merged and clipped by the sub-basin boundary. The percent of the block group falling in the watershed was calculated, and population figures were prorated by this value. Although this technique erroneously assumes even distribution of the population, it is a more accurate population count for the sub-basin than including the entire block group population.

B. Census Bureau[30]

Block group-level GIS data files from the 2000 Census were used to illustrate population, population change, income, and the agricultural cohort for the sub-basin. County block group spatial files were merged and clipped by the sub-basin boundary. The percent of the block group falling in the watershed was calculated, and population figures were prorated by this value. Although this technique erroneously assumes even distribution of the population, it is a more accurate population count for the sub-basin than including the entire block group population.

Figure 23b. 1990 Population

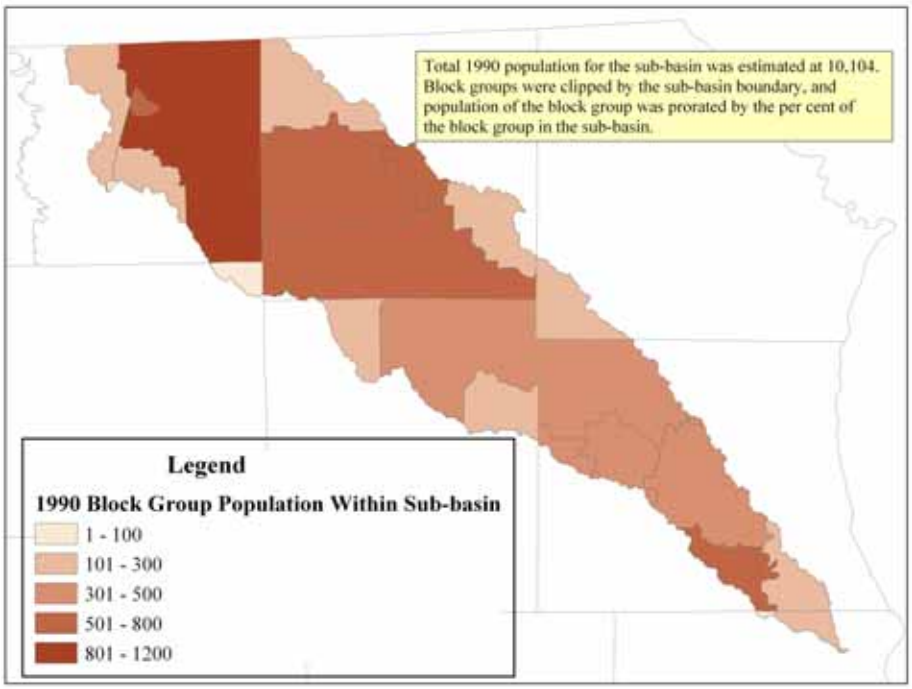
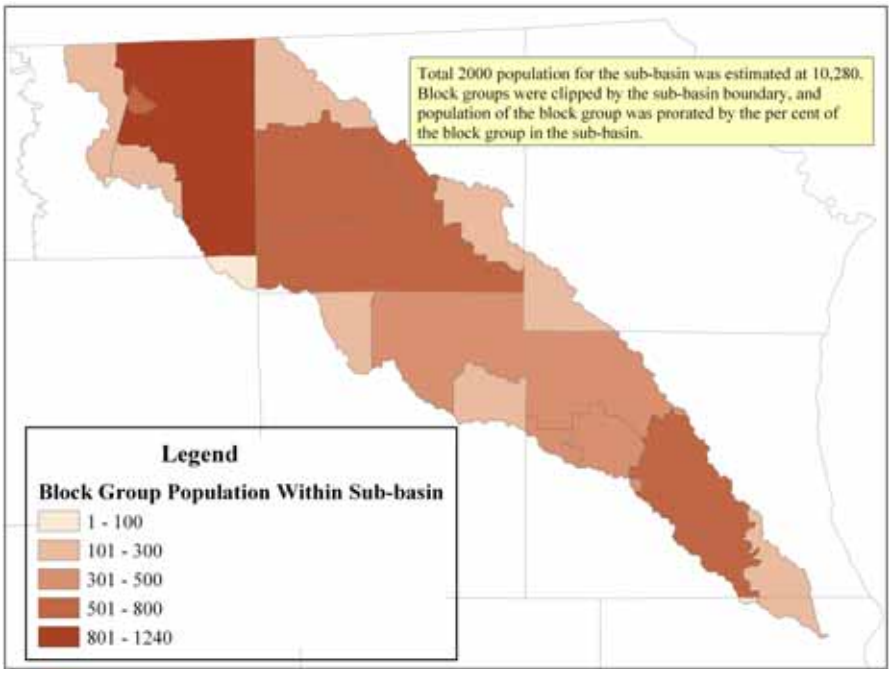
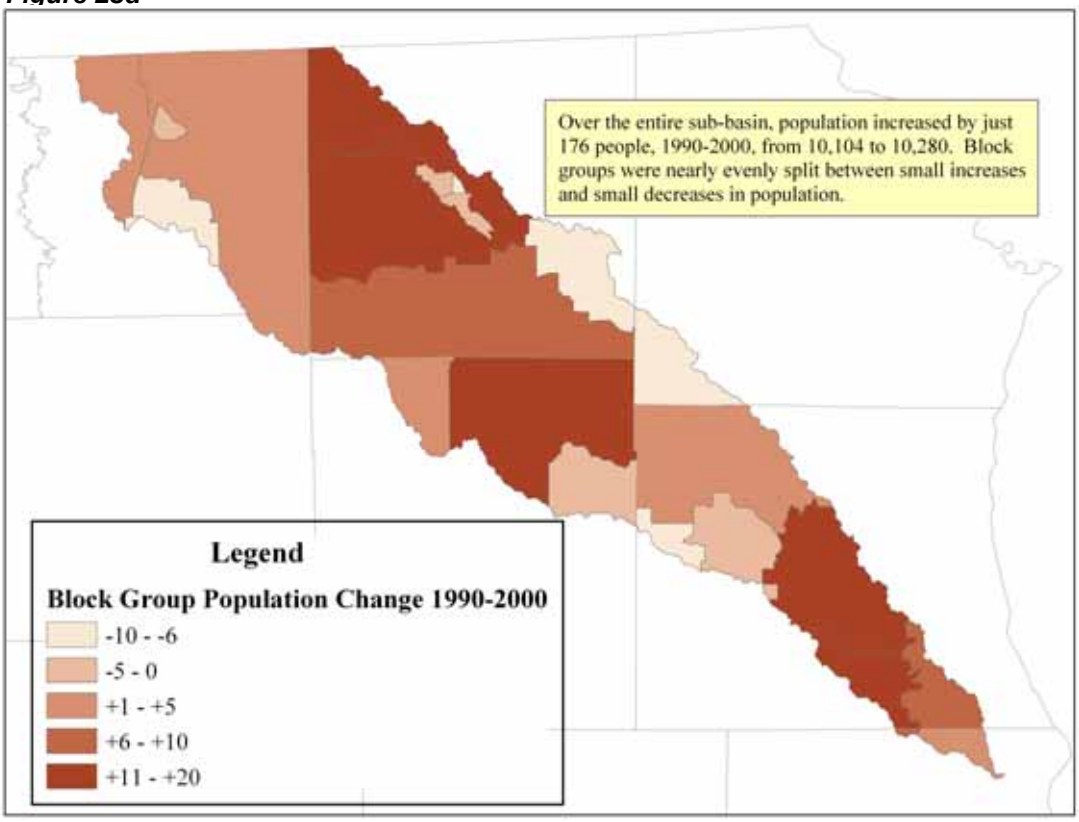


Figure 23c. 2000 Population



Change in Population

Figure 23d

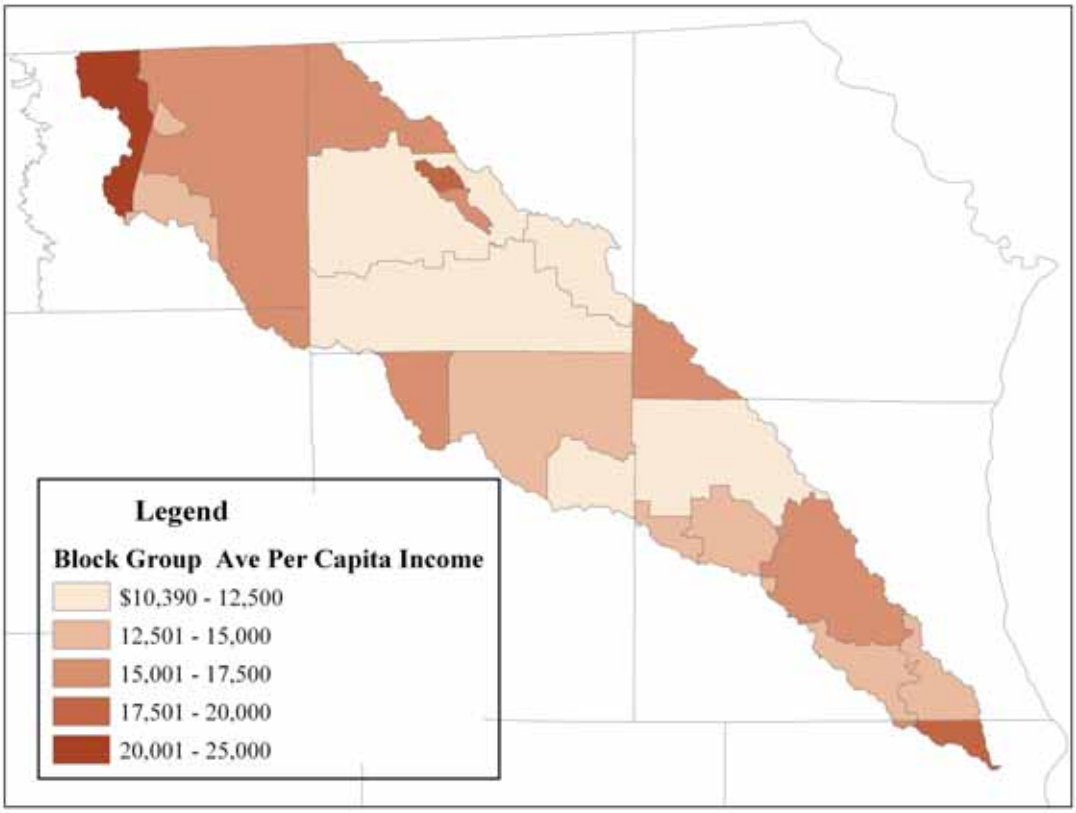


Limited Resource Producer Factor[31]

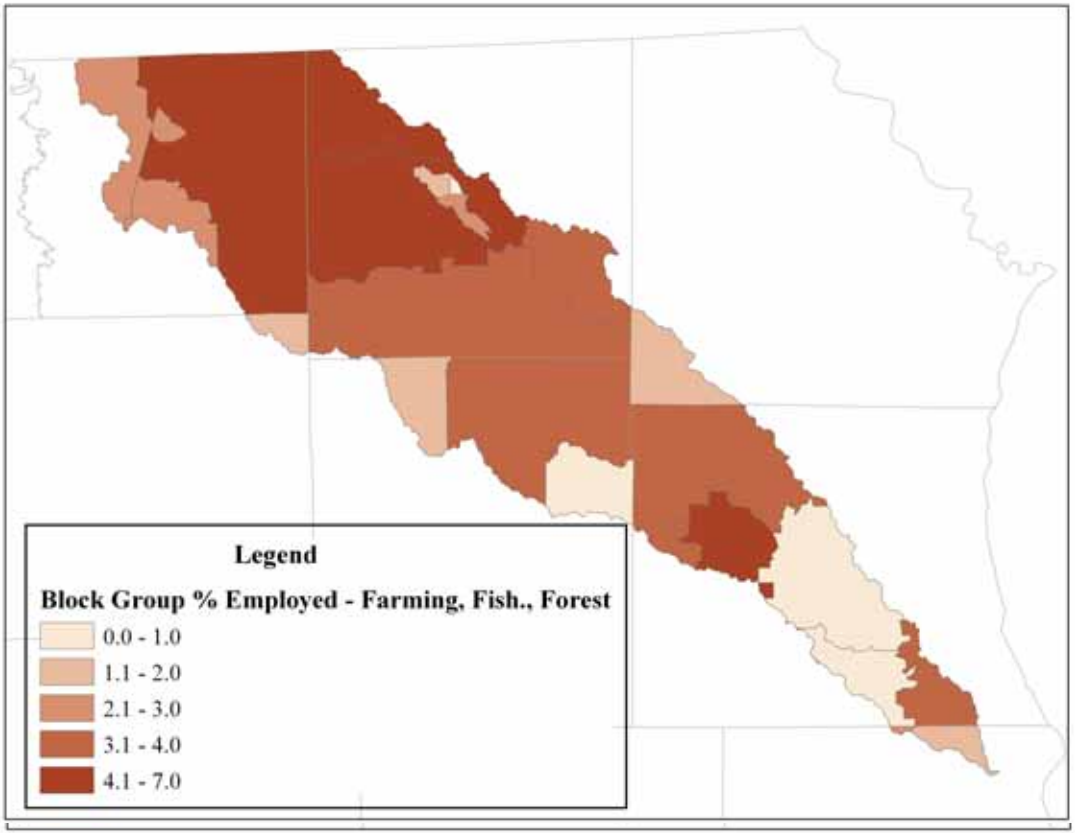
The Factor equals the number of farms in the county multiplied by the percentage of the county's population below the poverty level and then divided by 1,000.

County	Limited Resource Producer Factor
Adair	20
Clark	10
Knox	12
Lewis	13
Marion	9
Schuyler	8
Scotland	11

Income



Farms



B. Agricultural Census[32]

The data shown in the table are based on countywide information. Only those counties that are 35 percent or more within the North Fabius River Sub-basin are represented in the table. It is believed that the countywide data are fairly representative of the sub-basin portion for each of these counties: Knx, Lewis, Schulyer, and Scotland.

Data for Clark, Marion, and Adair counties are not shown. It is believed that countywide data for the sub-basin portions of these counties would have no reliable significance.

Animal data is for grazing livestock only.

Figure 24

COUNTY SUMMARY HIGHLIGHTS, 2002				
	Knox	**Lewis**	**Schuyler**	**Scotland**
Farms	643	838	480	654
Land in Farms	249,139 acres	284,450 acres	146,359 acres	234,417 acres
Cattle	26,372	29,320	23,999	25,049
Sheep	1,207	602	5,144	1,001
Horses & Ponies	308	1,244	780	395
Goats	55	-	202	98
Cropland Used only for Pasture or Grazing	25,415 acres	23,793 acres	32,158 acres	23,904 acres
Woodland pastured	10,090 acres	13,026 acres	6,301 acres	7,872acres
Permanent Pastureland and Rangeland	32,863 acres	27,634 acres	37,365 acres	31,050 acres
Pastureland, All Types	68,368 acres	64,453 acres	75,824 acres	62,826 acres
Percent Pastureland to All Land in Farms	27.4%	22.7%	51.8%	26.8%
Sum of All Grazing Livestock	27,942	31,166	30,125	26,543
Pastureland per Animal	2.4 acres	2.1 acres	2.5 acres	2.4 acres

Status of Resources

A. PRS[33]

NRCS' Performance Results System (PRS) is a consolidated reporting system of conservation activities. The following tables summarize conservation systems and practices planned and applied in the sub-basin for the designated time periods. PRS data, in conjunction with other information, are used to assess the current state of the resources in the sub-basin and past efforts to address resource concerns.

FY = Fiscal Year

PRS Data	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	Average per Year
Total Acres Conservation Systems Applied	2,388	412,421	22,061	13,572	16,461	Not reported by Hydrologic Unit (HU)	15,089	10,866	12,978

Figure 25. Conservation Practices Applied

Summary Conservation Practices (PRS Number)	FY 04	FY 05	FY 06
Comprehensive Nutrient Management Plan (100)			3
Conservation Cover (327)	1,748 acres	3,293 acres	1,241 acres
Conservation Crop Rotation (328)	6,416 acres	7,974 acres	5,378 acres
Contour Farming (330)			103 acres
Cover Crop (340)		90 acres	
Critical Area Planting (342)			6 acres
Dike (356)	1,860 feet		6,410 feet
Diversion (362)		344 feet	
Early Successional Habitat Development/Management (647)			4 acres
Fence (382)	27,512 feet	3,840 feet	10,850 feet
Field Border (386)			
Filter Strip (393)	43 acres	45 acres	19 acres
Forage Harvest Management (511)	734 acres	1,380 acres	882 acres
Forest Site Preparation (490)	26 acres		
Forest Stand Improvement (666)	155 acres		
Grade Stabilization Structure (410)	10	11	12
Grassed Waterway (412)		2 acres	
Heavy Use Area Protection (561)	1 acre		1 acre
Nutrient Management (590)		104 acres	579 acres
Pasture and Hay Planting (512)	1,110 acres	1,401 acres	2,484 acres
Pest Management (595)		104 acres	

Conservation Practices Applied (continued)

Summary Conservation Practices	FY 04	FY 05	FY 06
Pipeline (516)	7,600 feet	4,130 feet	3,460 feet
Pond (378)	2	1	1
Prescribed Burning (338)		612 acres	483 acres
Prescribed Grazing (528)	1,425 acres	1,018 acres	
Pumping Plant (533)			1
Residue and Tillage Management, Mulch Till (345)			2,002 acres
Residue and Tillage Management, No-Till/Strip Till/ Direct Seed (329)			1,405 acres
Residue Management, Mulch Till (329B)	3,022 acres	2,984 acres	1,111 acres
Residue Management, No-Till/Strip Till (329A)	2,978 acres	3,902 acres	161 acres
Residue Management, Seasonal (344)	121 acres	138 acres	360 acres
Riparian Forest Buffer (391)	144 acres	2 acres	
Sediment Basin (350)			23
Stripcropping, Field (586)			6 acres
Structure for Water Control (587)	1		
TA Design (911)			3
Temporary Steel Windbreak (711)			220,045
Terrace (600)	34,950 feet	105,657 feet	
Transition to Organic Production (789)			35 acres
Tree/Shrub Establishment (612)	121 acres	3 acres	
Tree/Shrub Pruning (660)			7 acres
Tree/Shrub Site Preparation (490)			37,151 acres
Underground Outlet (620)	7,863 feet	51,946 feet	1,080 feet
Upland Wildlife Habitat Management (645)	1,383 acres	1,559 acres	1,264 acres
Use Exclusion (472)	1,855 acres	2,567 acres	
Waste Treatment Lagoon (359)			109
Water and Sediment Control Basin (638)	1	6	
Water Harvesting Catchment (636)			1
Water Well			9
Watering Facility (614)	12	3	
Well Decommissioning (351)			60 acres
Wetland Restoration (657)	89 acres		124 acres
Wetland Wildlife Habitat Management (644)	43 acres		
Wildlife Watering Facility (648)	1		

B. Watershed Projects

In addition to the conservation activities itemized for individual land units, watershed programs and Farm Bill easements contribute to the current state of resources. Past and current activities within this sub-basin are summarized in the tables below.

Figure 40

PL-566 Project Name[36]	Acres	Status
Bear Creek	33,253	Completed

AgNPS SALT Project Name[37]	Status
North Fork/Middle North Fabius	In-Progress
South Fork North Fabius	In-Progress

C. Farm Bill Program Lands[38]

In addition to the conservation activities itemized for individual land units, watershed programs and Farm Bill easements contribute to the current state of resources. Past and current activities within this sub-basin are summarized in the table below.

Program	Number of Acres	Number of Contracts or Easements
Conservation Reserve Program (CRP)	53,864	1,065 contracts
Wetland Reserve Program (WRP)	1,300	29 easements

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