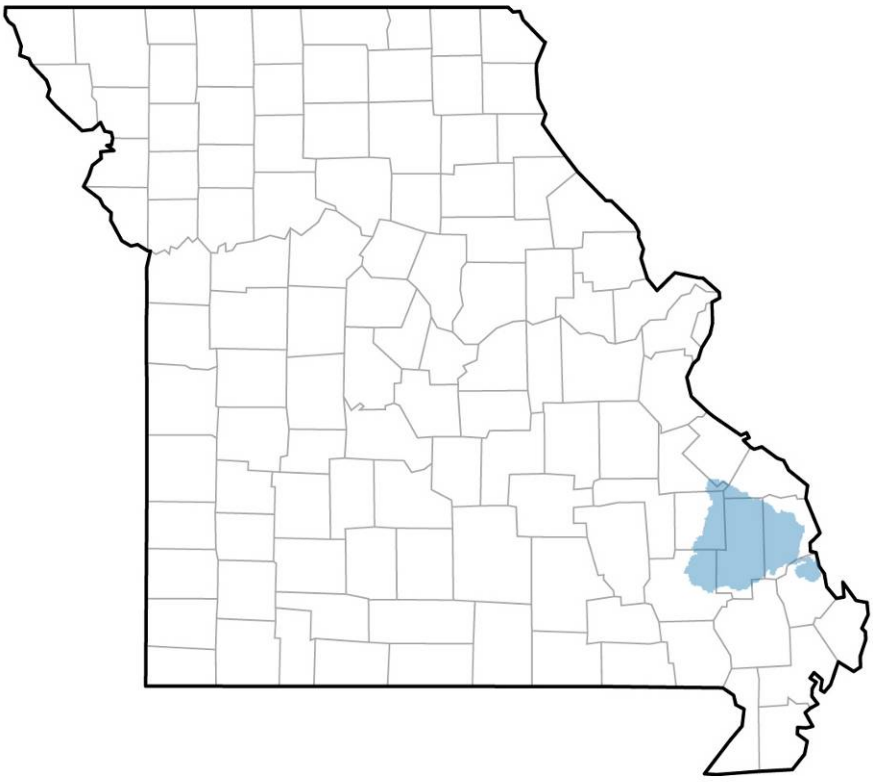
United States Department of Agriculture
Natural Resources Conservation Service

Whitewater Sub-basin

HUC # 07140107



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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Whitewater Sub-basin

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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.

Introduction[1]

Rapid watershed assessments (RWAs) provide initial estimates of where conservation investments would best address the concerns of land owners, conservation districts and other stakeholders within drainage sub-basins. These assessments are designed as quick looks over large drainage areas to provide a starting point for area-wide, watershed or site-specific planning. Missouri has 66 sub-basins averaging 628,000 acres in size.

RWAs contain two parts: a resource profile based on readily available resource information and an assessment matrix of current and future resource conditions and related installation and maintenance costs. The resource profiles provide a general description of the location and primary physical attributes of the sub-basin; known resource concerns; and selected agricultural and socio-economic characteristics. The assessment matrices contain condition tables detailing the current level of conservation in the sub-basin; future considerations tables identifying appropriate suites of conservation practices needed to deal with the primary resource concerns for each major land use; and summary tables that summarize the various costs associated with the Resource Management Systems (RMS) identified in the future considerations tables.

Covering 1,169 square miles in southeastern Missouri, the Whitewater River sub-basin nestles between a broad, gently rolling dissected plain to its north; steep sided rolling hills bordering the Mississippi River to its east; Precambrian knobs, at the structural center of the Ozark dome, to its west; and the Mississippi River alluvial plain to its south. The western edge of the sub-basin, constituting the upper portion of the Castor River watershed, sits on the eastern flank of the Ozark Uplift. With local relief ranging from 150 to 300 feet, the topography consists of moderately to deeply dissected hills formed in Cambrian sandstones and cherty dolomites. The deep, cherty silt loam soils support extensive oak-pine woodlands and forests. The southwest corner of the sub-basin is defined by the lower portion of the Castor River watershed. With topography similar to the upper reaches of the Castor River, this area is distinguished by its underlayment of Ordovician cherty dolomites and sandstones. Moving eastward into the western half of the White River watershed, the topography transitions to a slightly flatter, narrow north/south trending belt of broad rolling hills formed in cherty dolomites under cherty loam soils. This hill land is more open with many of the valley bottoms and ridge tops in cool season pastures. Continuing eastward, the remainder of the sub-basin is dominated by a broad, flat to gently rolling dissected plain developed on Ordovician limestone and dolomite formations with local relief typically less than 100 feet. Presettlement prairies developed on loess soils have given way to a mixture of pasture land and row crops.

Ninety-one percent of the sub-basin's land area is in agricultural land uses and land covers: 39 percent is non-grazed forest; 27 percent is cultivated cropland; 24 percent is grazing land; and 1 percent is in the Conservation Reserve Program (CRP). The 9 percent in non-agricultural uses include: 4 percent in developed land; 2 percent in minor use; 1 percent in water; and 2 percent in federal land.

Figure 1

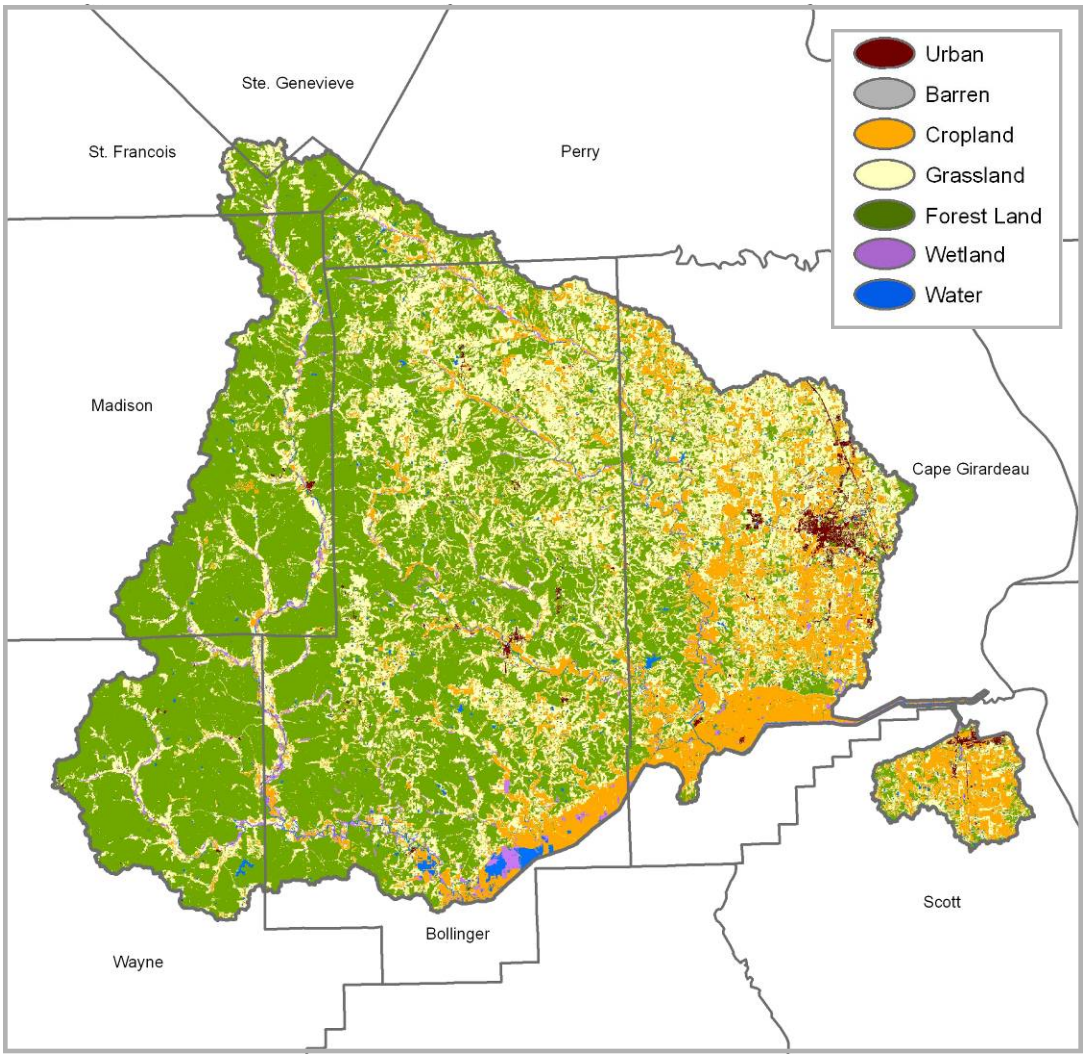
Sub-basin Primary Land Cover/Use Percentages By County

County	Bollinger	Cape Girardeau	Madison	Perry	St. Francois	Scott	Wayne	Sub-basin Total
Cultivated Cropland	7%	6%	0%	0%	0%	2%	0%	15%
Non-cultivated Cropland	5%	5%	1%	0%	0%	0.002%	0.005%	12%
Pastureland	12%	2%	1%	1%	0.003%	0.005%	1%	18%
Forested Land	21%	4%	9%	1%	1%	0.004%	8%	45%
Developed Land	1%	3%	0.002%	0%	0%	0.003%	0.002%	4%

Physical Description

A. Land Use/ Land Cover[2]

Figure 2



Land Use/ Land Cover NRI	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	24,900	166,200	NA	31,900	162,900	335,600	7,800	7,800	11,300
1987 Acres	25,000	195,400	4,200	6,100	157,100	328,900	12,000	8,400	11,300
1992 Acres	26,000	147,300	9,200	45,400	157,600	330,600	12,100	8,500	11,700
1997 Acres	30,100	113,500	9,200	91,700	136,900	333,200	13,200	8,900	11,700
Five Year trend 92-97	**Up 16%**	**Down 23%**	**No change**	**Up 102%**	**Down 13%**	**Up 1%**	**Up 9%**	**Up 5%**	**No change**
Ten year trend 87-97	**Up 20%**	**Down 42%**	**Up 1019%**	**Up 1430%**	**Down 13%**	**Up 1%**	**Up 10%**	**Up 6%**	**Up 4%**
Fifteen year trend 82–97	**Up 21%**	**Down 32%**	**NA**	**Up 187%**	**Down 16%**	**Down 1%**	**Up 69%**	**Up 14%**	**Up 4%**

Land Cover / Land Use Definitions

- Urban – This map category corresponds to the tabled category called Developed Land. Developed Land is a combination of the NRI land cover/use categories large urban and built-up areas, small lbuilt-up areas and rural transportation land. Rural transportation land consists of all highways, roads, railroads and associated right-of-ways outside urban and built-up areas and also includes private roads to farmsteads, logging roads and other private roads.

- Barren – This map category is typically, the surface of sand, rock or exposed soil with less than 5 percent vegetative cover. Barren land acreage is included in the tabled NRI Minor Land category. Minor land is a miscellaneous grouping of land covers and uses that includes farmsteads and farm structures, field windbreaks, and barren land.

- Cropland – This map category most closely corresponds to the tabled category called Cultivated Cropland. Cultivated Cropland comprises land in row crops, close-grown crops and hayland or pastureland in rotation with row or close-grown crops.

- Grassland – This map category includes 4 tabled NRI land cover/use categories:
  Non-cultivated cropland; Conservation Reserve Program (CRP) lands; Pastureland; Rangland. on-cultivated cropland includes permanent hayland and horticultural cropland. The CRP is a federal program established under the 1985 Food Security Act to convert highly erodible cropland to vegetative cover (primarily grass) under 10 year contracts. Pastureland is land managed primarily for the production of introduced forage plants for livestock grazing. Rangeland is land on which the climax or potential plant cover is composed principally of native grasses, grass-like plants, forbs or shrubs suitable for grazing and browsing and introduced forage species that are managed like rangeland.

- Forestland and Woodland – A majority of the acreage for these map categories is captured by the tabled NRI Forestland category, defined as land that is at least 10 percent stocked by single-stemmed woody species of any size that will be at least 4 meters tall a maturity. Ten percent stocked, equates to an areal canopy cover of 25 percent or greater.

- Wetlands – Acreage for this mapped category is not reflected in any of the NRI tabled acreage estimates. The wetland map category is a combination of satellite derived wetland classes, National Wetland Inventory (NWI) acres and Wetland Reserve Program (WRP) acres. (See Wetlands Section for NWI acreage estimates)

- Water – This map category closely corresponds to the NRI table acreage estimate representing water bodies and streams that are permanent open water.

B. Grassland[2]

	Rangeland (acres)			Pastureland (acres)			Grazed Forest Land (acres)		
Year	Total in Sub-basin	Percent of sub-basin	Percent of state land use total	Total in Sub-basin	Percent of sub-basin	Percent of state land use total	Total in Sub-basin	Percent of sub-basin	Percent of state land use total
1997	0	-	-	136,900	18%	1%	46,300	24%	1%

C. Crop History[2]

	Close Grown Crops (acres)	Row Crops (acres)			Hayland (acres)		
Year	Wheat	Corn	Sorghum	Soybeans	Grass	Legume	Grass-Legume
1997	23,600	54,200	0	19,700	43,200	10,900	39,600

D. Public Land[3]

About 33,340 acres or 4.4% of the sub-basin are in public ownership. These public lands include parcels of national forest, 8 conservation or wildlife management areas, 9 river accesses, 1 lake, 2 fire tower sites and 1 state historic site. Public ownership in this region is slightly below Missouri's state average of 6.7%.

Figure 3

Public Land Ownership (acres)				
	Missouri Department of Conservation	Missouri Department of Natural Resources	U.S. Forest Service	Other
Total Acres	21,256	55	11,653	376

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 through 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 through IV. The remaining four classes, V through VIII, are not to be used for cropland, but may have uses for pasture, range, woodland, grazing, wildlife, recreation, and aesthetic purposes.

Figure 4

Land Capability Class	Cultivated cropland (acres)	Non-cultivated cropland (acres)	Pastureland (acres)
I - slight limitations	9,000	-	900
II - moderate limitations	63,300	34,800	59,600
III - severe limitations	35,800	39,700	47,400
IV - very severe limitations	5,300	6,600	22,900
V - no erosion hazard, but other limitations	-	-	-
VI - severe limitations, unsuited for cultivation, limited to pasture, range, forest	100	9,500	600
VII - very severe limitations, unsuited for cultivation, limited to grazing, forest, wildlife	-	1,100	5,500
VIII - misc. areas have limitations, limited to recreation, wildlife and water supply	-	-	-
Total	**113,500 acres**	**91,700 acres**	**136,900 acres**

Prime Farmland[4,5]

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.

Figure 5a

Figure 5b

Prime Farmland Acres[2]		
	Sub-basin Total	% of Sub-basin
1982	225,400	30%
1987	225,100	30%
1992	225,100	30%
1997	224,600	30%
1982-1997 change—acres	Down 800	NA
1982-1997 change—percent	Down 0.003%	NA

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 Whitewater Sub-basin occupies portions of MLRA 115B.1, MLRA 116A.9, MLRA 116A.10, MLRA 116C.1, MLRA 131A.1 and MLRA 131A.3

115B.1 – Outer Ozark Border

The Outer Ozark Border CRA consists of a belt of deeply dissected hills and bluffs and several relatively smooth karst plains. Relief in the river hills is 200-350 feet. Slopes are steep and bedrock exposures are common. Loess, occasionally very thick, mantles the uplands of the entire CRA. Land use is extremely varied, including row crops, improved pasture, and densely wooded valleys.

116A.9 – Eastern Inner Ozark Border

The Eastern Inner Ozark Border CRA consists of dissected plains and rolling hills. Local relief ranges from 150-300 feet. The CRA is defined largely by its association with the dolomites of the Jefferson City-Cotter Formation and loess-mantled ridges. Land use is extremely varied, from row crops and improved pasture to overgrown glades and dense second-growth oak-hickory forests.

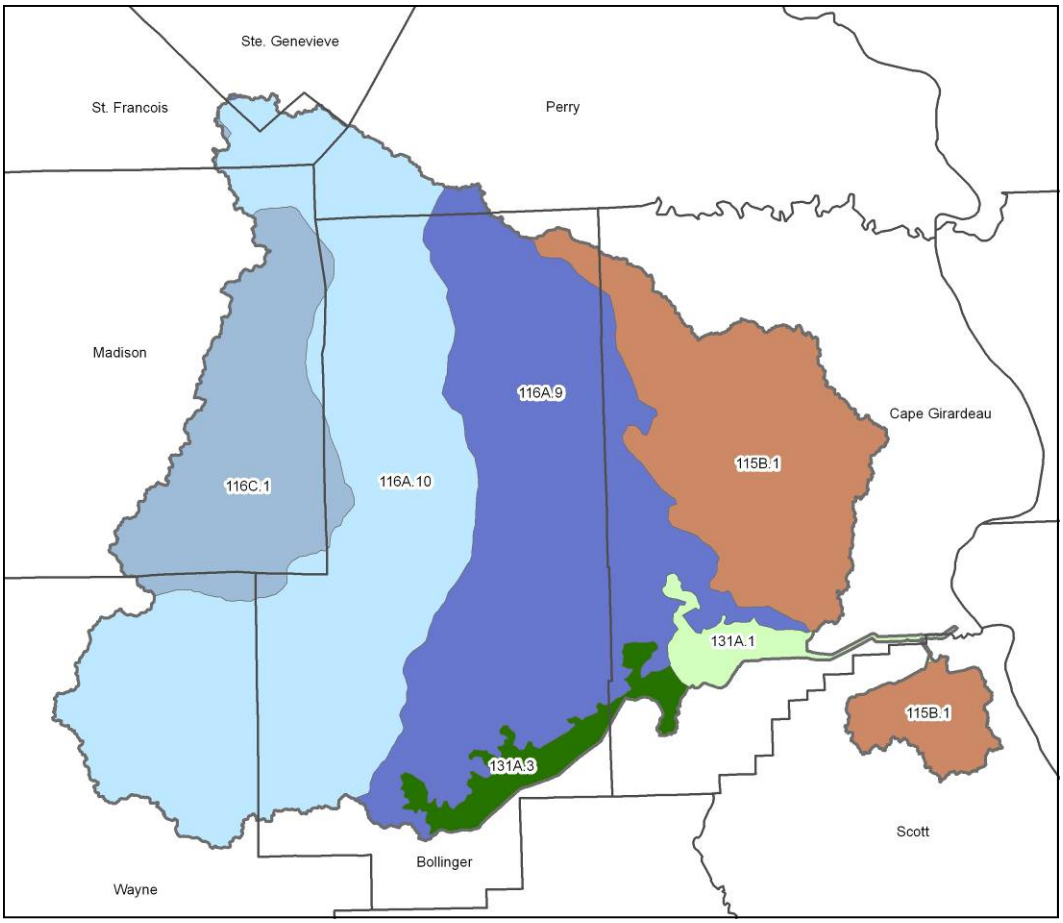
116A.10 – Black River Ozark Border

The Black River Ozark Border CRA consists of dissected plains and rolling hills. Local relief ranges from 150-300 feet. The CRA is defined largely by its association with the dolomites of the Jefferson City-Cotter Formation and loess-mantled ridges. Land use is extremely varied, from row crops and improved pasture to overgrown glades and dense second-growth oak-hickory forests.

116C.1 – St. Francois Knob and Basins

The St. Francois Knobs and Basins CRA is distinctive for bedrock of igneous Precambrian and Cam-

Figure 6. Common Resource Areas in the Whitewater Sub-basin



brian age with rounded, smooth-sided igneous knobs and hills that rise conspicuously to different elevations along with basins and valleys on dolomites and sandstones. Large areas of glades and woodland are present. Pastures and woodlands are common. Lead mining has scarified the land.

131A.1 – Southern Mississippi River Meander Belts

The Southern Mississippi River Meander Belts CRA is dominantly level to nearly level flood plains of the Mississippi River. Soils are deep, fertile, and most are well suited to crop production. Most of the area has been cleared of forest and is used mainly for growing cotton, soybeans, rice and wheat. Some areas require surface drainage for crop production. Some areas of converted wetlands are being restored.

131A.3 – Black and White River Alluvium

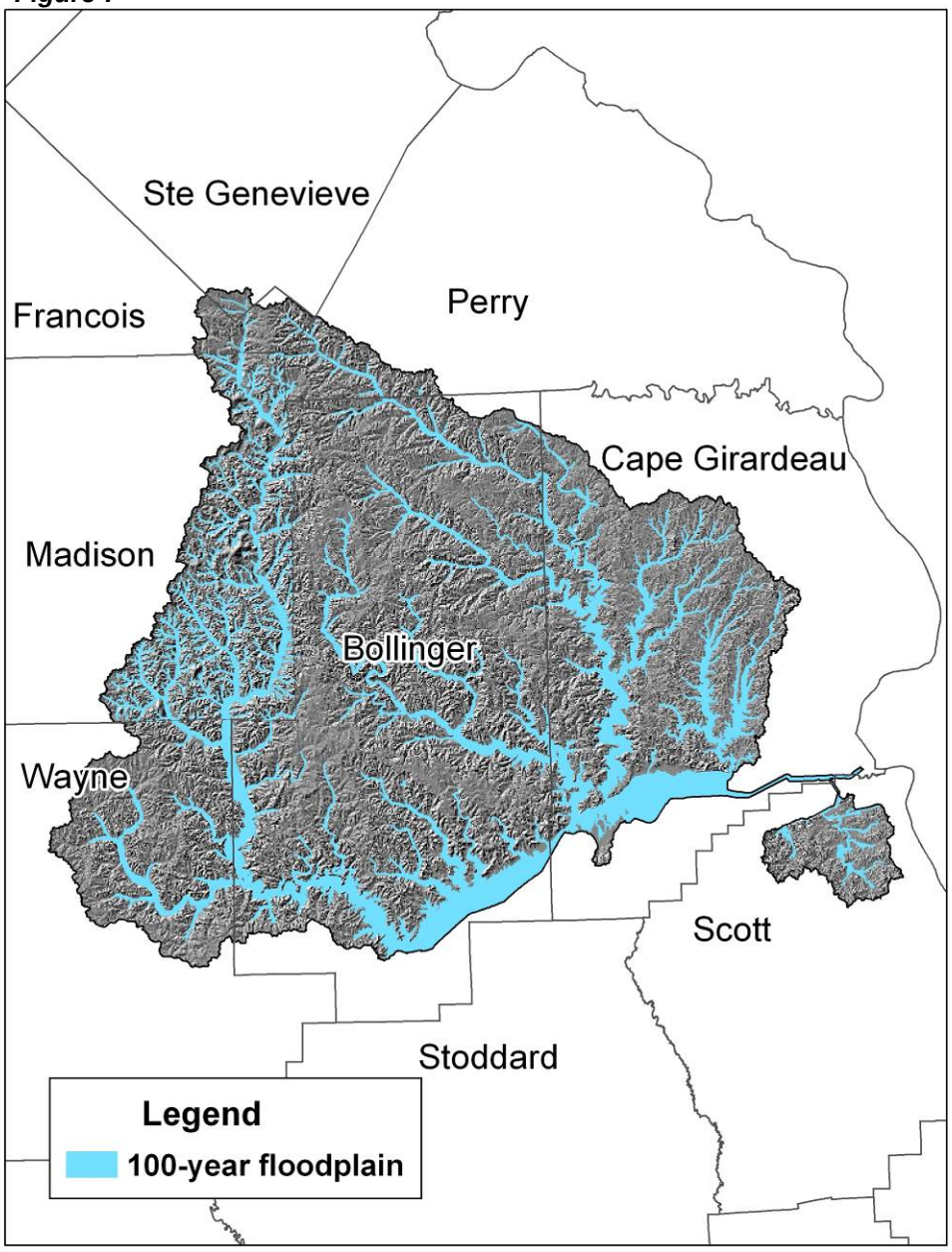
The Black and White River Alluvium CRA consists of level to nearly level alluvial plains of the Black and White Rivers that includes some tracts of windblown sands and some natural wetlands. Soils are deep and most are well suited to crop production. Most of the area has been cleared of forest and is used for growing rice, soybeans, and wheat Some areas of dunes and swales support rare plant species.

G. Streams

Floodplains[7]

The Federal Emergency Management Agency (FEMA) maps areas of flood vulnerability. FEMA has produced maps for 7 of the 8 counties in this sub-basin. For the remaining county (Madison), the SSURGO soil attribute 'flooding frequency' was used. Flooding frequency documented as rare, occasional, frequent and very frequent cumulatively represent the 1% annual chance of flooding, or 100-year floodplain, as shown from the FEMA data. Using these combined methods, 104,601 acres (13.7%) of the sub-basin are in the 100-year floodplain. On the map, the disparate sources of data are apparent, with a seemingly overestimate of flooding chance mapped in the soils data.

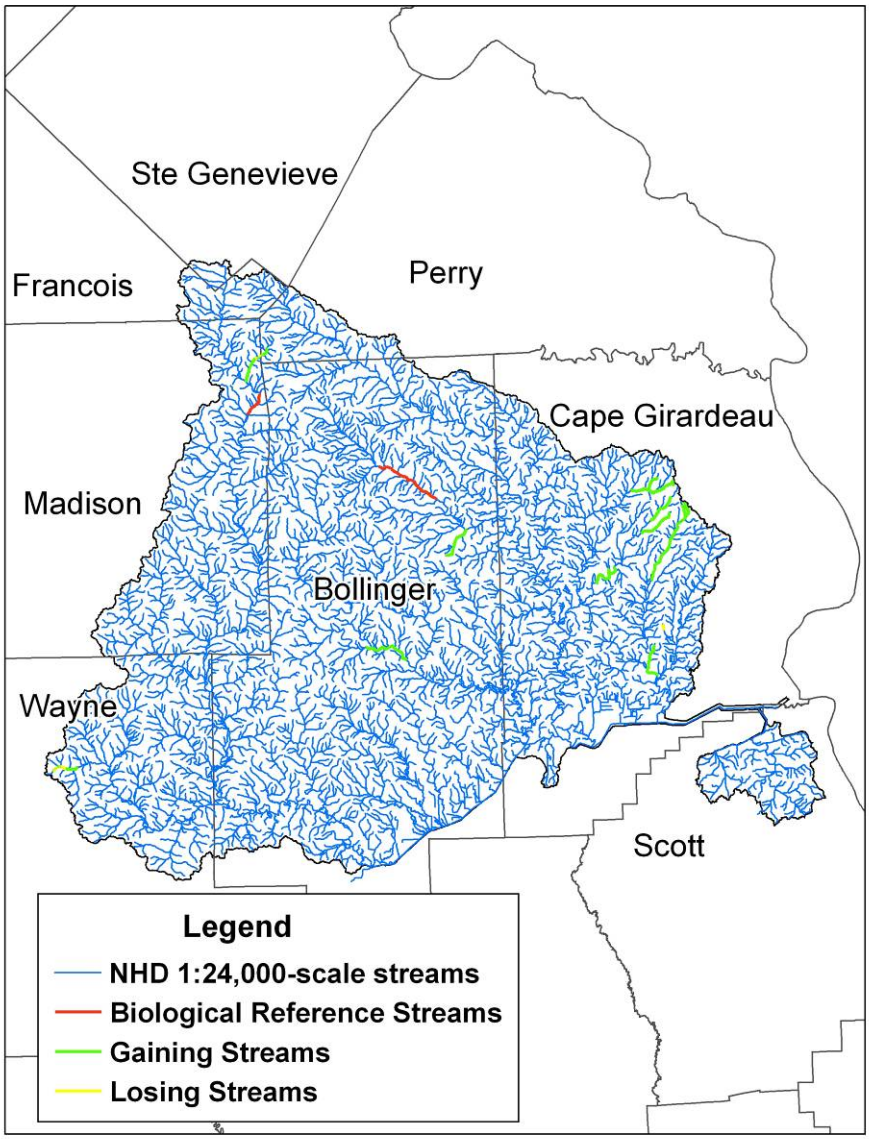
Figure 7



National Hydrography Dataset (NHD) with Gaining Streams and Biological Reference Streams [8 & 15]

High-resolution (1:24,000-scale) streams from the National Hydrography Dataset total 2,119 miles of intermittent and perennial streams in this watershed. Sixty-six (66) miles of streams are considered gaining streams while 7 miles are 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. A 5-mile stretch of Little Whitewater River and a 2-mile segment of the Castor River are biological reference streams in this sub-basin.

Figure 8



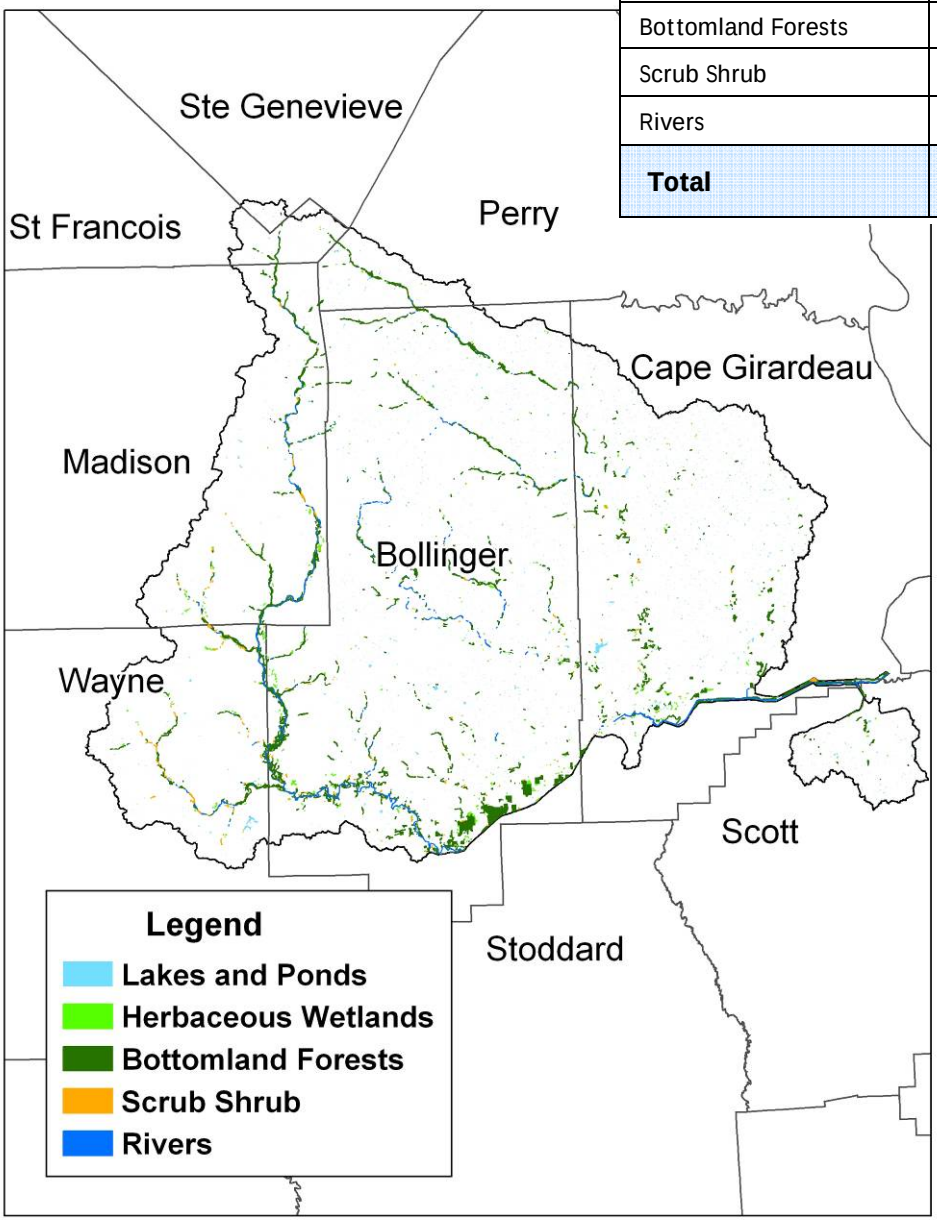
H. Wetlands[9,10]

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

The National Wetland Inventory (NWI) delineated wetlands from early 1980s aerial photography and classified wetlands using a wetland classification scheme developed by Cowardin, et al. The inventory identifies 17,298 acres of various wetland types within the Whitewater sub-basin.

Figure 9

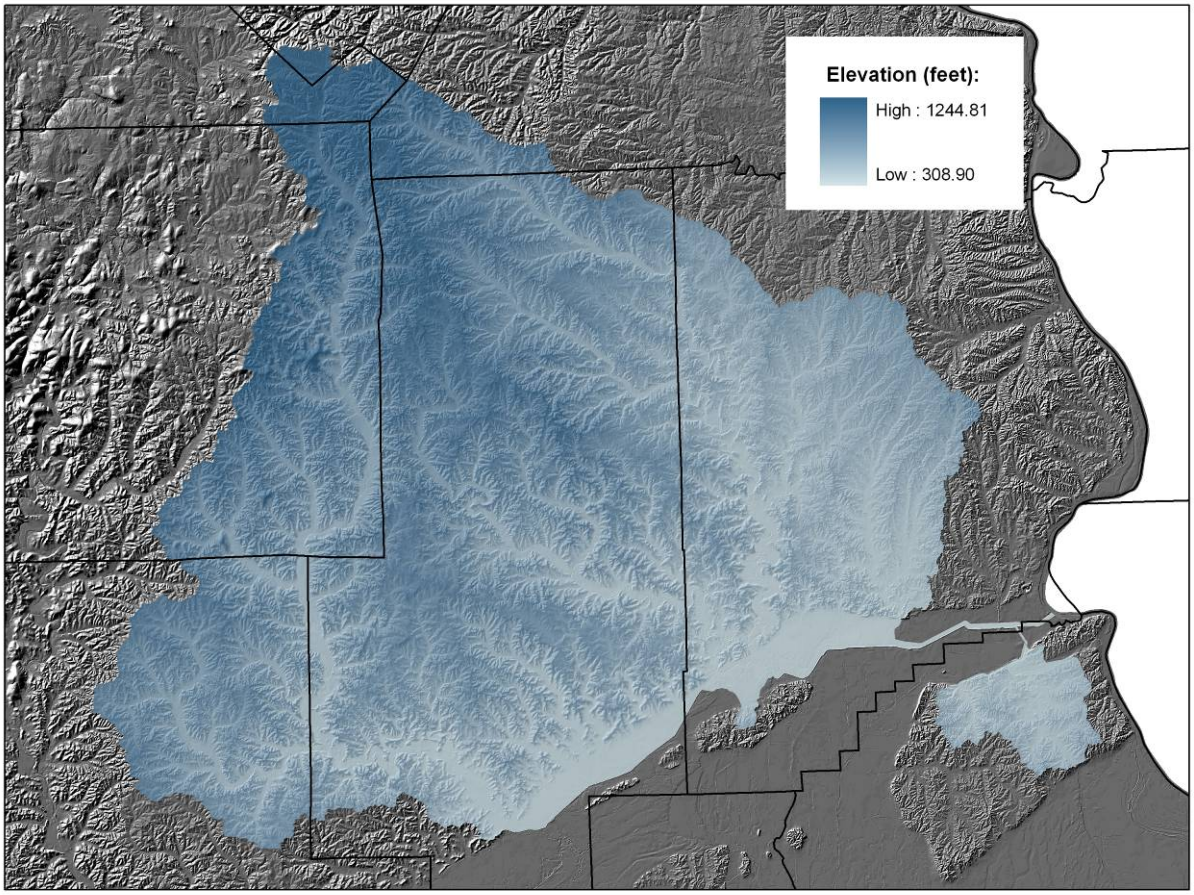
General Wetland Type	Acres	Percent of Sub-basin
Lakes and Ponds	3,292	0.43%
Herbaceous Wetlands	633	0.08%
Bottomland Forests	10,714	1.40%
Scrub Shrub	759	0.10%
Rivers	1,899	0.25%
Total	**17,298**	**2.26%**



I. Relief Map[1,11,12]

The shaded relief map of the Whitewater sub-basin depicts elevations above sea level. The shaded relief and elevation values were derived from digital elevation models generated from U.S. Geological Survey 7.5 minute elevation contours. The area is complex in its bedrock geology ranging from billion year old igneous rocks in the western, Ozark uplift portion of the sub-basin to several million year old Tertiary rocks in the southeast. Consequently, elevations and relief can vary considerably. Elevations in the sub-basin can range from about 300 feet to nearly 1,250 feet. Local relief can vary from a few feet in the stream valleys, from 100 to 200 feet on the dolomite plains, from 200 to 300 feet in the sandstone and cherty hills, and from 300 to 1,000 feet in the igneous Ozark uplift areas.

Figure 10



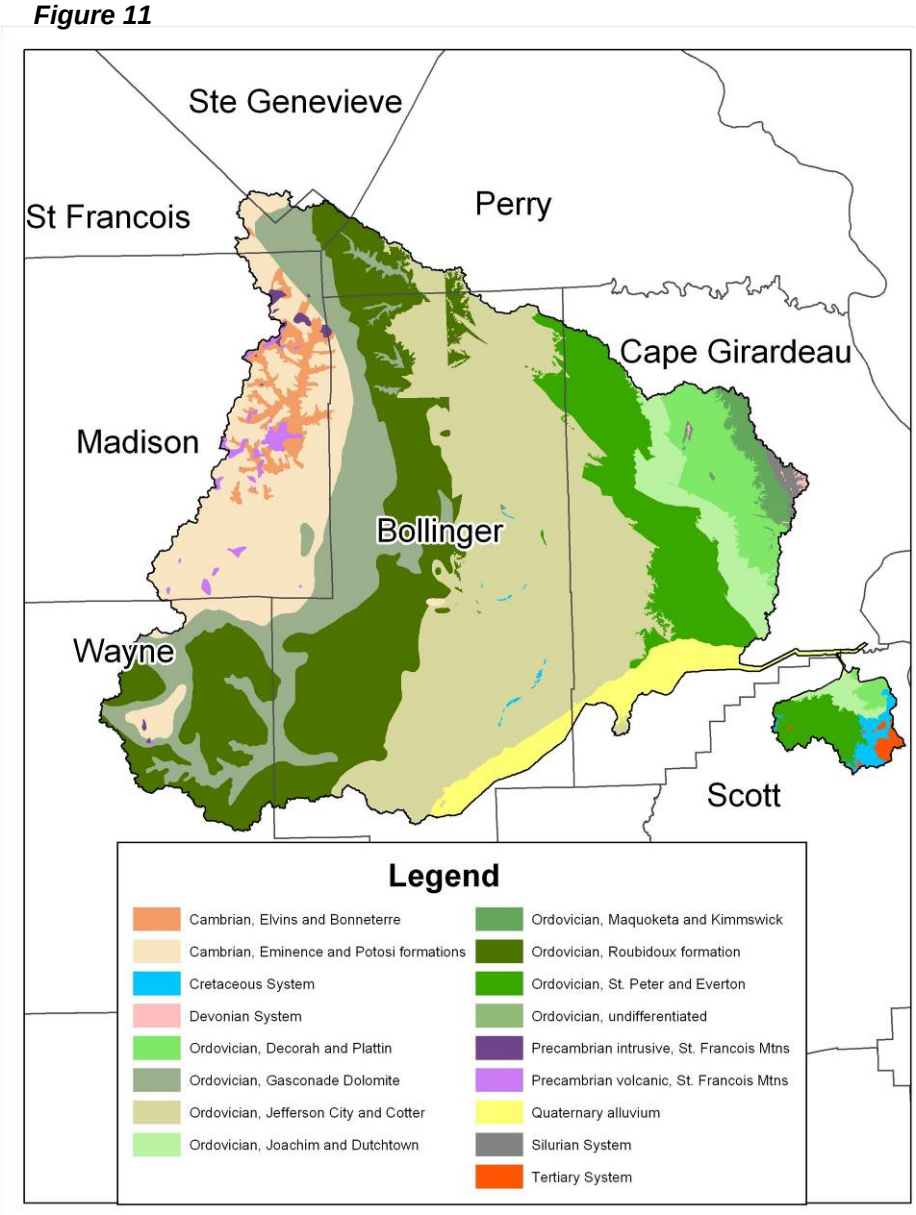
J. Geology[1,13,14,34]

Geology Map

The bedrock geology map is derived from the Geologic Map of Missouri. The Whitewater Sub-basin is complex in its bedrock geology ranging from billion year old igneous rocks in the western, Ozark dome portion of the sub-basin to several million year old Tertiary rocks in the southeast. Sedimentary strata flanking the uplifted dome dip outwardly and become younger to south and east. Bedrock types are quite diverse and consist of igneous rocks (granites, volcanics, etc.), dolomites, sandstones, limestones, shales, etc. A moderately significant number of springs, sinkholes, caves, and losing streams, associated with a karst terrain, are found within the sub-basin.

Bedrock strata in the Whitewater Sub-basin can be further divided into the following stratigraphic units in descending order:

Figure 11



Tertiary System—Can be quite variable and may consist of non-marine silty clays, sandy clays, gravels and sandstones. Noted only in Scott County

Cretaceous System—Variable and may consist of non-marine sands, sandy clays, clays, gravels and sandstones. Noted only in Scott and Bollinger counties.

Devonian System—Consists primarily of thin-bedded limestones and may contain interbedded cherts and shales. Noted only in Cape Girardeau and Bollinger counties.

Silurian System—Consists of crystalline, clayey or silty limestones and shales. Noted on in Cape Girardeau and Bollinger counties

Ordivician System—The sedimentary strata of this system are comprised primarily of dolomites and limestones. However, numerous sandstone and shale formations and members can also be present. The following stratagraphic units comprise the Ordovician System in the Whitewater Sub-basin: Maquoketa Group, Kimmswick Limestone, Decorah Group, Plattin Group, Joachim Dolomite, Dutchtown Formation, St. Peter Sandstone, Everton Formation, Cotter Dolomite, Jefferson City Dolomite, Roubidoux Formation, and the Gasconade Dolomite. The sub-basin also contains some undifferentiated Ordivician strata.

Cambrian System

- **Eminence Dolomite—**Consists predominately of dolomite and may contain small amounts of chert.
- **Petosi Dolomite**—Composed primarily of dolomite and can contain quartz druse and chert.
- **Elvins Group**—Thin to medium-bedded dolomite with alternating beds of siltstone and shale in the upper portions and shale, siltstone, sandstone, dolomite, and limestone conglomerate in the lower portions.
- **Bonneterre Formation—**Crystalline, medium-bedded dolomite. Can be pure limestone in some areas. The lower portion of the formation, which is an important host rock, has produced significant lead production.

Precambrian—Uplifted Precambrian rocks are found along the western side of the sub-basin and make up what is known as the Ozark dome. The rocks consist generally of granites which have been intruded by rhyolites and other volcanics. This mixture of rocks is quite resistant to erosion and has resulted in igneous knobs and hills that stand at higher elevations of the landscape. Valuable mineral deposits of lead, iron, manganese, silver, cobalt, and granite dimension stone are associated with these rock units.

Karst features[15]

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. Ten (10) named and twenty-five (25) unnamed springs are located in this sub-basin, a moderately-developed karst region. The largest 3 springs have flows up to 4,500 gallons per minute (gpm), while the remaining springs have flows of less than 100 gpm or unmeasured flow. Two hundred seventy-six (276) sinkholes are mapped in the area, concentrated in the eastern part of the sub-basin in Cape Girardeau County. Sixty-eight (68) caves are also documented. One dye tracing effort by Missouri Department of Natural Resources (MoDNR) Division of Geology and Land Survey (DGLS) established a flow path of about 100 meters between a wellhead and a spring in the west central part of the sub-basin. As noted in section 2.5, forty-two (42) miles of streams are considered gaining streams while 2 miles are designated losing streams.

Resource Concerns

Resource concerns are issues related to the natural environment. Natural resources include soil, water, air, plants, animals, and humans. Field office personnel of the USDA-Natural Resources Conservation Service were asked to complete inventory sheets in order to identify the 4 primary resource concerns for 5 landuse categories within the Whitewater Watershed (Hydrologic Unit 07140107). The identified concerns are: PASTURELAND - (1) soil erosion-sheet and rill; (2) plant condition-productivity, health, and vigor; (3) plant condition-forage quality and palatability; (4) domestic animals-inadequate stock water. CULTIVATED CROPLAND - (1) soil erosion-sheet and rill; (2) water quantity-inefficient water use on irrigated land; (3) water quality-excessive nutrients and organics in groundwater; (4) water quality-excessive nutrients and organics in surface water. DEVELOPED LAND - (1) soil erosion-sheet and rill; (2) soil erosion-road, roadsides, and construction sites; (3) water quality-excessive nutrients and organics in groundwater; (4) water quality-excessive nutrients and organics in surface water. FORESTLAND - (1) soil erosion-classic gully; (2) plant condition-productivity, health, and vigor; (3) plant condition-threatened or endangered plant species: declining species; (4) plant condition-noxious and invasive plants. NON-CULTIVATED CROPLAND - (1) soil condition-organic matter depletion; (2) soil condition-compaction; (3) plant condition-production, health, and vigor; (4) plant condition-forage quality and palatability.

Figure 12

Resource Concerns/Issues by Land Use

Soil, Water, Air, Plant, Animal, plus Human (SWAPA+H) Concerns	Specific Resource Concern/Issue	Pasture/Grass	Cropland	Non-Cultivated Cropland	Forestland	Urban	Floodplain	Developed Land	Water
Soil Erosion	20% of all cultivated Cropland eroding at levels above "T"		X						
	Erosion on streambanks and streambeds	X	X		X	X	X		
	Sheet and rill erosion on pastureland and developed land	X						X	
	Erosion from ephemeral gullies	X							
	Erosion from classical gullies	X			X	X		X	
Sedimentation	Damage to waterbodies, increased flooding, fertility					X	X		X
Soil Quality	Organic matter depletion			X					
Water Quality	Cultivated cropland primary nonpoint source of pollutants		X						X
Floodplains	104,601 acres fall within the 100-year flood area						X		
Riparian Corridor	34% of riparian zones unprotected or vulnerable	X	X			X	X		

Soil Erosion

- Streambank, streambed, and classical gully erosion occurs in pasture/grassland, cropland, forestland, and urban areas. However, due to a lack of reliable data at the sub-basin (8-digit hydrologic unit) level, the degree and amount of soil loss from these sources is not known.
- Ephemeral gully erosion occurs primarily on cultivated cropland eroding at levels above the tolerable limit ("T"). No sub-basin level data are available to determine the degree and extent.
- An estimated 20 percent (22,200 acres) of all cultivated cropland is eroding at levels above "T".
- The estimated USLE soil loss on highly erodible, cultivated cropland (eroding above "T") is 24.1 tons/acre/year.
- Sheet and rill erosion is a concern on pastureland and developed land.

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.

Soil Quality

- Excessive soil erosion is a primary contributor to soil quality degradation. This limits the productivity and sustainability of the soil resource.
- Organic matter depletion has affected soil condition on non-cultivated cropland.

Water Quality

- Highly erodible and cultivated cropland with USLE soil losses above tolerable limits ("T") is a primary non-point source of sediment, nitrogen, and phosphorus pollutants that enter the stream system.

Floodplains

- An estimated 104,601 acres fall within the 100-year return period flood area. This can result in damages to crops, pastures, and other resources, as well as damages to roads, bridges, and buildings.

Riparian Corridors

- The data suggest that about 34 percent of the riparian corridors, primarily in cropland, pasture/grass, and urban areas, are unprotected or vulnerable. Protected riparian corridors can act as filters to trap nutrients, sediment, and other pollutants.

A. Soils

Most of the upland soils in this sub-basin formed in residual material weathered primarily from ordovician age cherty dolomite mantled by a layer loess (silty wind blown sediments) of variable thickness. On steeper areas the soils formed entirely in colluvium and residuum weathered from the cherty dolomite. These upland soils are typically very deep and moderately well drained to well drained.

The loess deposits are thickest in the eastern and southern part of the sub-basin. Soils on the gently sloping to moderately sloping ridgetops formed entirely in loess. In areas where the loess mantle is thinner, the soils developed in a combination of loess and the underlying material weathered from cherty dolomite. There is frequently a dense, brittle layer at the contact between the loess and the underlying soil material. This dense layer inhibits root grown and water movement. These soils formed under forest vegetation and have thin silt loam surface layers. Subsoil textures range from silt loam to extremely gravelly clay.

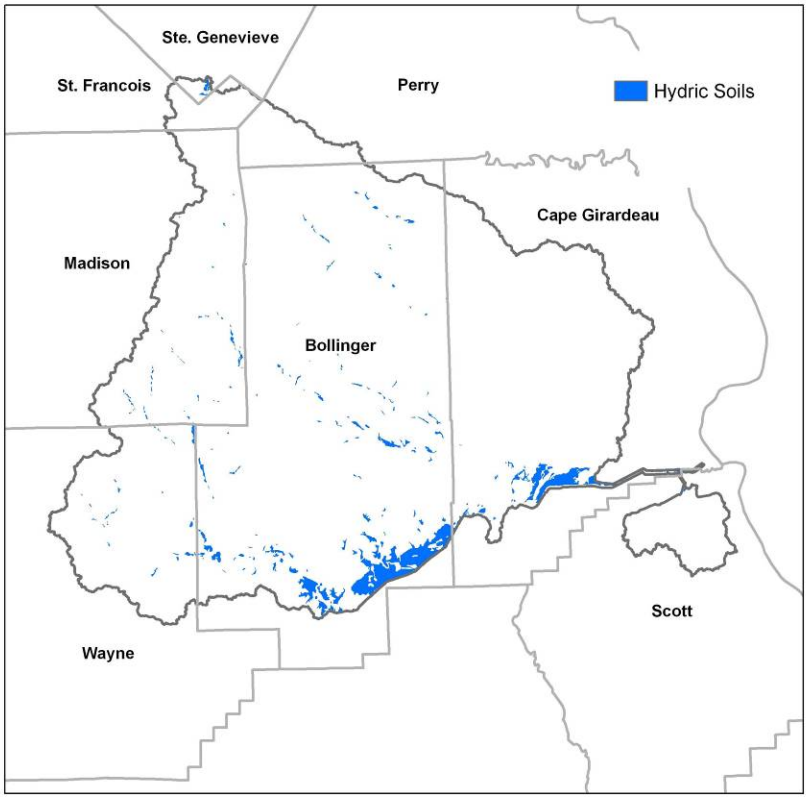
Soils on the steep back slopes typically formed in material weathered from cherty dolomite with some thinly interbedded sandstone. These soils are typically gravelly to extremely gravelly. They formed under forest vegetation and as a result have thin surface layers. Texture is typically silt loam or loam in the upper part of the profile and clay in the lower part.

The floodplain and terrace soils along the major streams formed in mixed alluvial sediments. These alluvial soils are very deep and range from well drained to poorly drained. Textures are typically silt loam, loam, or fine sandy loam with a variable amount of gravel.

Hydric Soils[5]

Hydric soils are those that developed under sufficiently wet conditions (saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions) to support the growth and regeneration of hydrophytic (water-loving) vegetation. Soils that are sufficiently wet because of artificial measures are included in hydric soils.

Figure 13



B. Soil Erosion[16]

The objectives of this section are to profile cropland erosion rates and identify cropland areas within the Whitewater 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 soil erosion on cropland, streambanks and streambeds and runoff from construction sites and developed land are an ongoing resource concern throughout the Whitewater River sub-basin. Cropland and pastureland are the primary nonpoint sources of sediment loss in this heavily forested sub-basin and account for 45 percent of the sub-basin's total surface area. In sub-basins like the Whitewater River, the acres most in need of conservation treatment are those with waterborne sediment, nitrogen and phosphorus losses.

The consequences of excessive soil erosion are well known. Waterborne 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 are scientifically based soil erosion estimates for the entire sub-basin. This focus does not suggest that sedimentation related to urban stormwater runoff, stream bank erosion, classical gully erosion and ephemeral gully erosion on cropland is not significant in volume or impact. However, there is a lack of reliable data at the sub-basin level for these other sources of sediment. The erosion rate data have 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 cropland and non-cultivated cropland 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 14

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"	1.49	0.9
HEL Eroding above "T"	24.07	8.19
All HEL	18.84	1.37
NON-HIGHLY ERODIBLE LAND (Non-HEL)		
Non-HEL Eroding at or below "T"	2.39	0.24
Non-HEL Eroding above "T"	6.25	0
All Non-HEL	2.88	0.24
ALL CROPLAND		
All Land Eroding at or below "T"	2.36	0.65
All Land Eroding above "T"	13.72	8.14
All Land	4.58	0.96

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"	2,800	23%	3%	0.003%
Highly Erodible Cropland above "T"	9,300	77%	8%	1%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**12,100**	**100%**	**11%**	**1%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	88,500	87%	78%	12%
Non-Highly Erodible Cropland above "T"	12,900	13%	11%	2%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**101,400**	**100%**	**89%**	**14%**
GRAND TOTALS	**113,500**	**100%**	**100%**	**15%**

Non-Cultivated Cropland

CROPLAND CATEGORY	Total Acres	% of Cropland Category	% of all Cropland	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	54,300	94%	59%	7%
Highly Erodible Cropland above "T"	3,700	6%	4%	1%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**58,000**	**100%**	**63%**	**8%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	33,700	100%	37%	5%
Non-Highly Erodible Cropland above "T"	0	0%	0%	0%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**33,700**	**100%**	**37%**	**5%**
GRAND TOTALS	**91,700**	**100%**	**100%**	**13%**

All Cropland

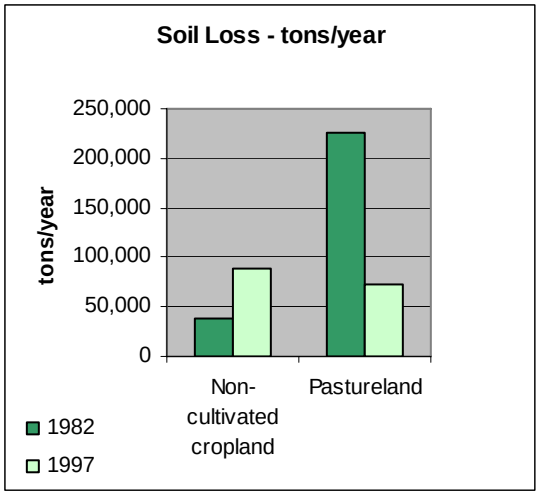
CROPLAND CATEGORY	Total Acres	% of Cropland Category	% of all Cropland	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	57,100	81%	28%	8%
Highly Erodible Cropland above "T"	13,000	19%	6%	2%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**70,100**	**100%**	**34%**	**10%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	122,200	90%	60%	16%
Non-Highly Erodible Cropland above "T"	12,900	10%	6%	2%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**135,100**	**100%**	**66%**	**18%**
GRAND TOTALS	**205,200**	**100%**	**100%**	**28%**

Pastureland Erosion[2]

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

PASTURELAND CATEGORY	Total Acres	% of Category	USLE tons/acre/year	% of Sub-basin
HEL				
Highly Erodible Cropland at or below "T"	0	0%	-	0%
Highly Erodible Cropland above "T"	0	0%	-	0%
TOTALS FOR HIGHLY ERODIBLE CROPLAND	**0**	**0%**	**-**	**0%**
NON-HEL				
Non-Highly Erodible Cropland at or below "T"	135,900	99%	0.48	18%
Non-Highly Erodible Cropland above "T"	1,000	1%	6.45	0.001%
TOTALS FOR NON-HIGHLY ERODIBLE CROPLAND	**136,900**	**100%**	**0.52**	**18%**
GRAND TOTALS	**136,900**	**100%**	**-**	**18%**

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



Non-cultivated Cropland

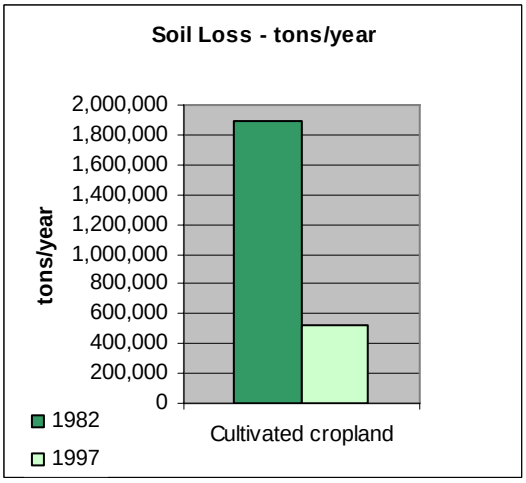
1982 38,000 tons per acre

1997 88,100 tons per acre

Pastureland Cropland

1982 225,900 tons per acre

1997 72,400 tons per acre



Cultivated Cropland

1982 1,898,300 tons per acre

1997 520,800 tons per acre

C. Water Quality

Riparian Corridor Condition[8,18]

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 vegetated 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 sub-basin states. 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 USDA-Farm Service Agency. The land cover attribute in the CLU 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 15a

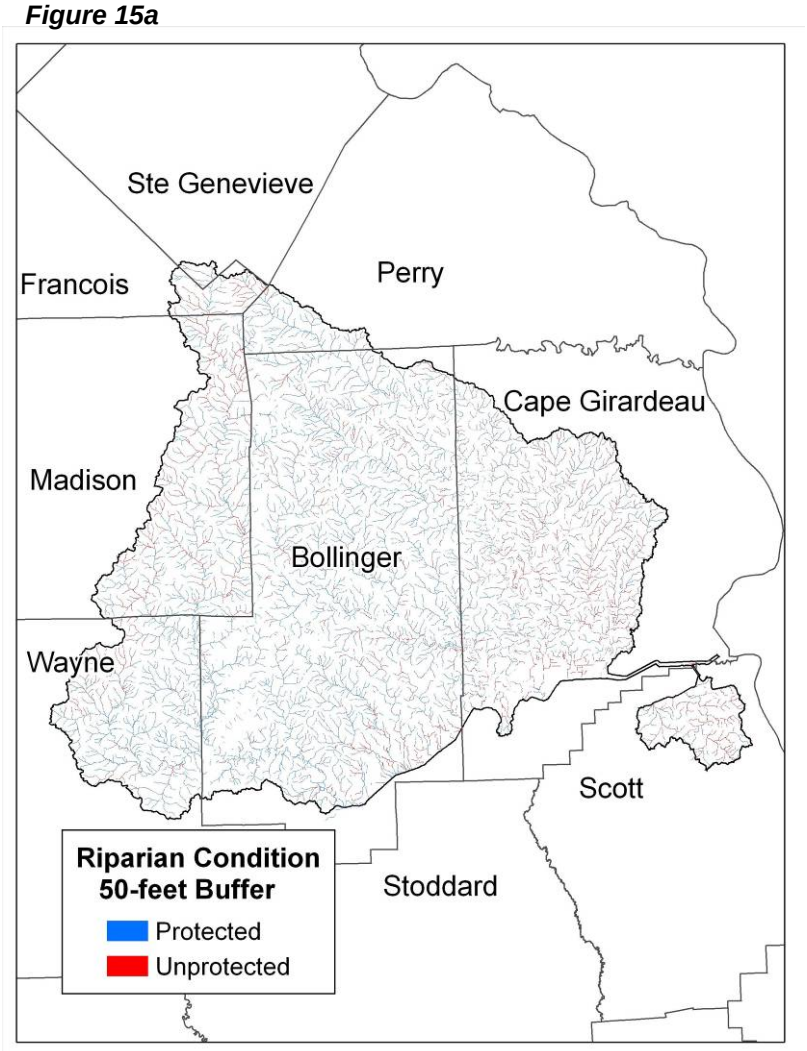


Figure 15b

County	Stream Miles (in sub-basin)	50-ft. Stream Buffer	Percent Protected
Bollinger	1,491	16,455 acres	78%
Cape Girardeau	812	8,556 acres	49%
Madison	404	4,881 acres	54%
Perry	71	860 acres	86%
Scott	99	1,115	31%
St. Francois	43	522	39%
Ste. Genevieve	7	87	67%
Wayne	336	4,035	79%
Total in Sub-basin	**3,263**	**36,511**	**66%**

D. Water Quantity

Public Water Supply[20,21,22,23]

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, sediments, and nutrients are the primary concerns in surface water sources while 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 wills in highly urbanized areas are at risk from a wide variety of chemical pollutants.

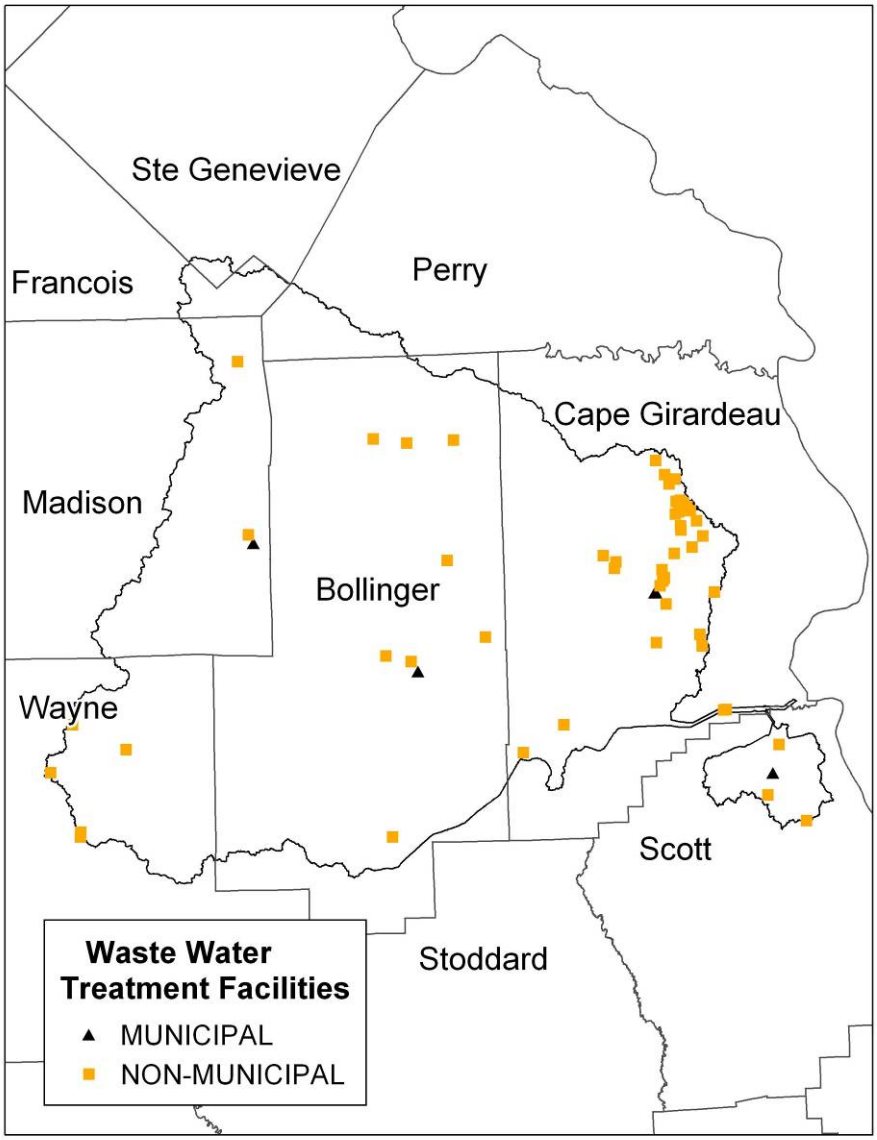
Detailed information is available for individual public drinking supply systems and the spatial distribution of other drinking water supply features (wells, intakes, tanks, treatment plants, pumping stations, springs, and lakes) from MDNR. The 2006 Missouri Water Quality Report provides current water 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.

Waste Water Treatment Facilities and Concentrated Animal Feeding Operations[19]

The National Pollutant Discharge Eliminations System (NPDES) facilities database is a point data set depicting outfall locations of waste water facilities requiring and holding NPDES operating permits. One type of NDPES facility is a concentrated animal feeding operation, or CAFO. A CAFO is defined as having 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 a post 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.

The Whitewater sub-basin has no CAFOs. It has 6 municipal and 56 non-municipal waste water facilities. The municipal sites are for sewage treatment while the non-municipal sites are small rural industry, schools and sewage treatment for unincorporated developed areas.

Figure 16



E. Forestry

Forests cover about a third of Missouri - forests containing some of the finest oak, walnut, 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 in Missouri far exceeds the amount harvested, ensuring ample forests for future generations. The majority of tree species are hardwoods with softwoods locally important in certain regions of the state. Forest products are also important to Missouri. Harvesting and processing trees into wood products gives thousands of people jobs and contributes about $3 billion each year to Missouri's economy. Private landowners control 85 percent of the forest land in Missouri. Most of these private forested acres in Missouri are not following a management plan.

The following tables for this sub-basin 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 www.fia.fs.fed.us/tools-data/default.asp.

Area of Forestland by Ownership in Sub-Basin

Private	241,774 acres
Federal	12,409 acres
State	17,382 acres
County and municipal	3,683 acres
Other	0 acres
Total	275,248 acres

Area of Forestland by Stocking Class in Sub-Basin

Overstocked	3,556 acres
Fully stocked	108,753 acres
Medium stocked	135,843 acres
Poorly stocked	25,913 acres
Non-stocked	1,183 acres
Total Growing Stock	275,248 acres

Area of Forestland by Productivity Site Class in Sub-Basin

165-224	0 acres
120-164	4,477 acres
85-119	83,610 acres
50-84	138,815 acres
0-49	48,346 acres
Total	275,248 acres

Net Volume of Growing Stock on Forestland by Species Type in Sub-Basin

Softwoods	28,395,958 cubic feet
Hardwoods	301,147,653 cubic feet
Other	0 cubic feet
Total	329,543,611 cubic feet

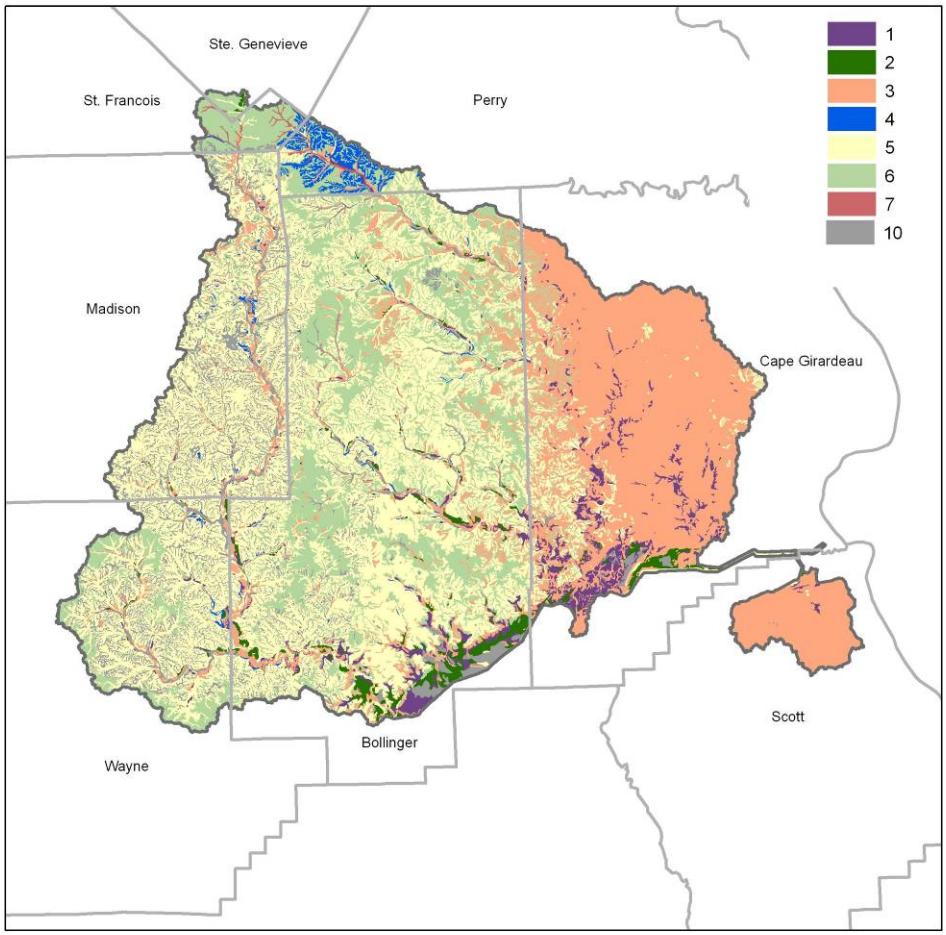
Forest Productivity[5]

This information can help forestland owners or managers plan the use of soils for wood crops. It shows the potential productivity of the soils for wood crops by Conservation Tree and Shrub Groups (CTSG).

The CTSGs were developed by foresters and soil scientists from soil properties stored in USDA's National Soils Information System (NASIS). A report build in NASIS "automatically" evaluates specific soil properties directly related to growth. The properties include: depth to limiting layer (water table, limiting layer, bedrock, etc.), available water capacity, calcium carbonates, pH, flooding frequency and duration.

Vegetation examples are commonly grown trees that forestland managers prefer for planting, seeding, or natural regeneration and those that remain in the stand after thinning or partial harvest.

Figure 17



CSTG Definitions:

- **Group 1 - 3% of sub-basin**
  Soils in CTSG-1 are somewhat poorly drained to moderately well-drained and at least moderately deep. They receive beneficial moisture or have a seasonable high water table from .5-1.5 feet during the growing season. Flooding frequency ranges from none to rare. The available water capacity is at least 3 inches. Sodium adsorption rates are less than 1. Subgroups may be acid, clayey, shallow, flooded, calcareous, strongly contrasting horizon, or sandy.

  Vegetation examples: Shumard Oak, Red Maple, Shingle Oak, Bur Oak, Pecan, American Sycamore, Shellbark Hickory, American Basswood, Musclewood, Eastern Cottonwood

- **Group 2 – 2% of sub-basin**
  Soils in CTSG-2 are poorly drained or very poorly drained and at least moderately deep. They have a seasonal high water table from 0-.5 feet during the growing season. Flooding frequency ranges from none

to rare. Available water capacity is greater than 3 inches. This group also includes peat, muck, or muck-peat soils. Sodium adsorption rates are less than 1. Subgroups may be acid, clayey, shallow, flooded, organic, calcareous, or sandy.

Vegetation Examples: Green Ash, Red Maple, Black Willow, Pecan, Silver Maple, River Birch, Swamp White Oak, Pin Oak, Green Hawthorn, Pecan

- **Group 3 – 26% of sub-basin**
  Soils in CTSG-3 are deep loamy, moderately well drained to well drained soils. The depth to a water table during the growing season is greater than 1.5 feet. Flooding frequency ranges from none to rare. The available water capacity is at least 9 inches. Soil depth is greater than 40 inches to a restrictive layer. Sodium adsorption rates are less than 1. Subgroups may be acid, flooded, or calcareous.

  Vegetation examples: Blackgum, Tuliptree, Scarlet Oak, Cucumber-tree, Shumard Oak, White Ash, Black Cherry, Eastern Redbud, Flowering Dogwood, Serviceberry, Kentucky Coffeetree

- **Group 4 – 1% of sub-basin**
  Soils in CTSG-4 are moderately well to well drained with some or all horizons that are clayey or clayey skeletal or fine and very fine. The depth to a water table during the growing season is at least 1.5 feet. Flooding frequency ranges from none to rare. The available water capacity is at least 6 inches. Soil depth is at least 40 inches to a restrictive layer. Sodium adsorption rates are less than 1. Subgroups may be acid, clayey, flooded, calcareous, or dry.

  Vegetation examples: Pignut Hickory, Black Hickory, Blue Ash, Shortleaf Pine, Southern Red Oak, Mockernut Hickory, Persimmon, White Oak, Black Oak, Flowering Dogwood

- **Group 5 – 40% of sub-basin**
  Soils in CTSG-5 are deep loamy moderately well to well drained with moderate AWC. Depth to the water table is at least 1.5 feet. Flooding frequency ranges from none to rare. The available water capacity is between 6 and 9 inches. Sodium adsorption rates are less than 1. Subgroups may be acid or flooded.

  Vegetation examples: Shortleaf Pine, Sassafras, Northern Red Oak, Shagbark Hickory, Red Mulberry, Post Oak, Bur Oak, Eastern Redcedar, American Sycamore, American Cottonwood

- **Group 6 – 19% of sub-basin**
  Soils in CTSG-6 are moderately well to well drained with a root restrictive zone (bedrock, fragipan, sand and gravel) at 20-40 inches. Flooding frequency ranges from none to rare. The depth to a water table during the growing season is at least 1.5 feet. The available water capacity is 6 inches or less. Sodium adsorption rates are less than 1. Subgroups may be acid, calcareous, or strongly contrasting horizon.

  Vegetation examples: Sweet Crabapple, Big Tree Plum, Blackgum, Pignut Hickory, Sassafras, Scarlet Oak, Shortleaf Pine, Slippery Elm, Blackjack Oak, Cockspur Hawthorn

- **Group 7 – <1% of sub-basin**

Soils in CTSG-7 have a sandy texture for all horizons. Soil depth is at least 40 inches. The available water capacity is at least 3 inches. Depth to water table during the growing season is greater than 6.5 feet. Flooding frequency ranges from none to rare. Sodium adsorption rates are less than 1. Subgroups may be wet.

Vegetation examples: Blue Ash, Black Hickory, Rock Elm, Black Hickory, Pignut Hickory, Slippery Elm, Black Oak, Chinkapin Oak, Blue Ash, Blackjack Oak, Persimmon, Post Oak

- **Group 10 – 9% of sub-basin**
  Soils in CTSG-10 have one or more characteristics that are severely limiting to the planting and growth of trees and shrubs. Soil depth is less than 20 inches; available water capacity is less than 3 inches; depth to a water table during the growing season is less than 0.5 feet; pH is less than 4.0 or greater than 8.5, sodium adsorption rate is greater than 25; flooding duration is very long. This group also includes urban land and water.

  Vegetation examples: none

F. Threatened and Endangered Species[24]

The Missouri Natural Heritage databases store locations, population status and habitat information about species and communities of conservation concern. The table below is a subset of the Heritage records that occur in the Whitewater sub-basin, restricted to federally threatened, endangered or candidate and state threatened or endangered species. While Heritage data can not prove the 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 the region.

Figure 18

Species Common Name	Scientific Name	Threatened, Endangered, or Candidate	Federal or State Listing
Birds			
Bald Eagle	Haliaeetus leucocephalus	Threatened/ Endangered	Federal/ State
Barn Owl	Tyto alba	Endangered	State
Interior Least Tern	Sterna antillarum athalassos	Endangered/ Endangered	Federal/ State
Fish/Mollusks/Crustaceans			
Elephantear	Elliptio crassidens	Endangered	State
Harlequin Darter	Etheostoma histrio	Endangered	State

Threatened and Endangered species continued

Species Common Name	Scientific Name	Threatened, Endangered, or Candidate	Federal or State Listing
Fish/Mollusks/Crustaceans			
Snuffbox	Epioblasma triquetra	Endangered	State
Spring Cavefish	Forbesichthys agassizi	Endangered	State
Mammals			
Gray Bat	Myotis grisescens	Endangered/ Endangered	Federal/ State
Indiana Bat	Myotis sodalis	Endangered/ Endangered	Federal/ State
Plains Spotted Skunk	Spilogale putorius interrupta	Endangered	State

Census and Social Data

A. Census Bureau[25]

Block group-level GIS data files from the 2000 Census were used to illustrate population, income and the agricultural cohort for the sub-basin. Spatial files were 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 spatial distribution of population, it is a more accurate population count for the sub-basin than including the entire block group population.

Figure 19a. 1990 Population—The 1990 estimated population of the sub-basin was 34,867.

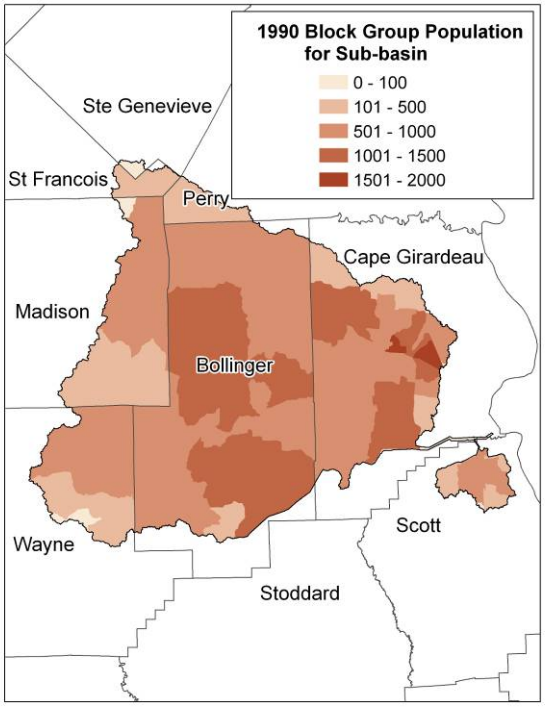
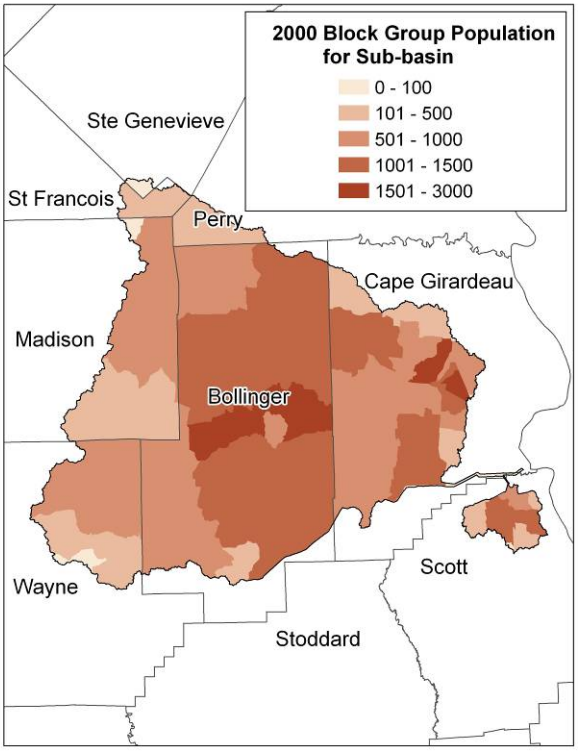


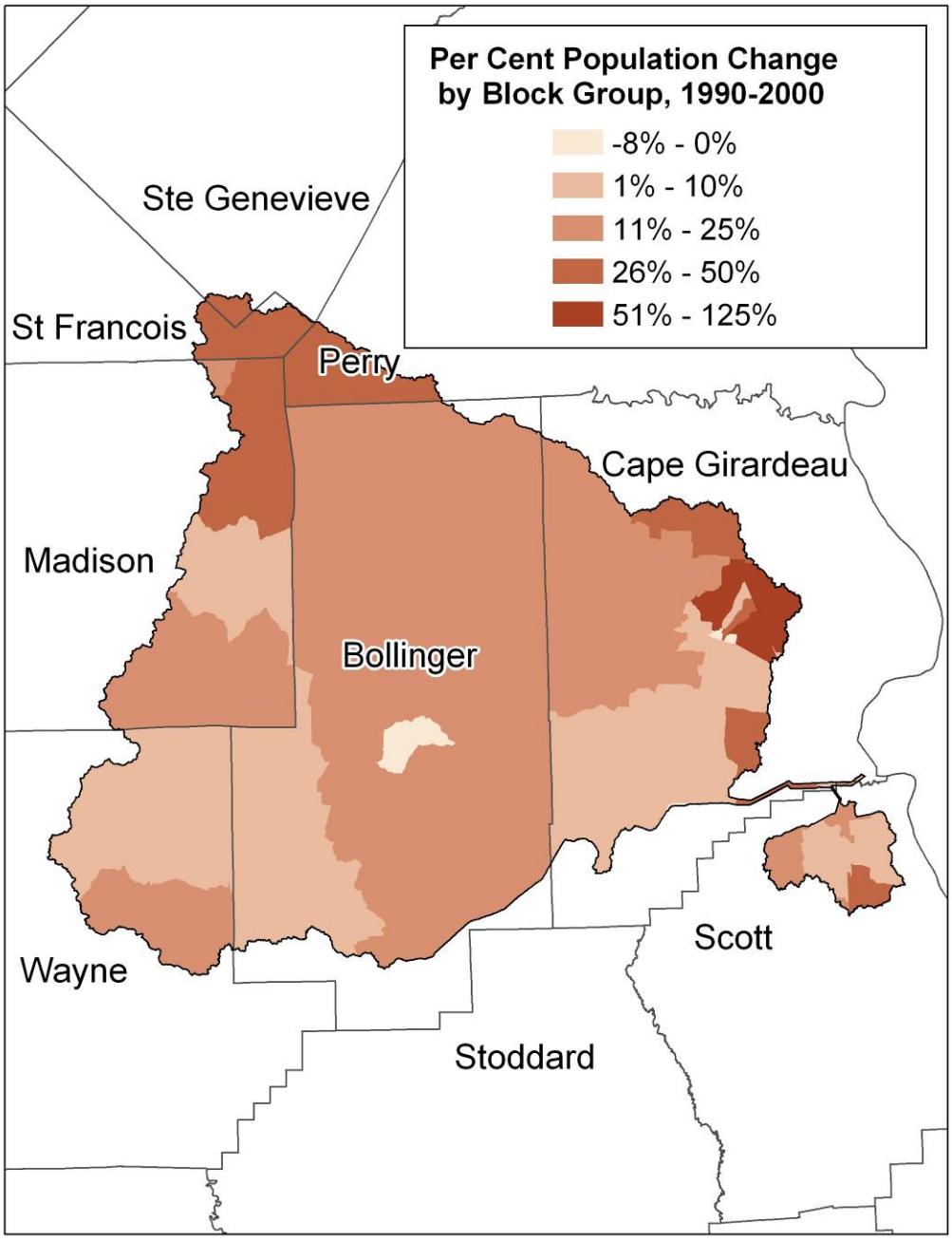
Figure 19b. 2000 Population—The 2000 estimated population of the sub-basin was 41,756.



Change in Population

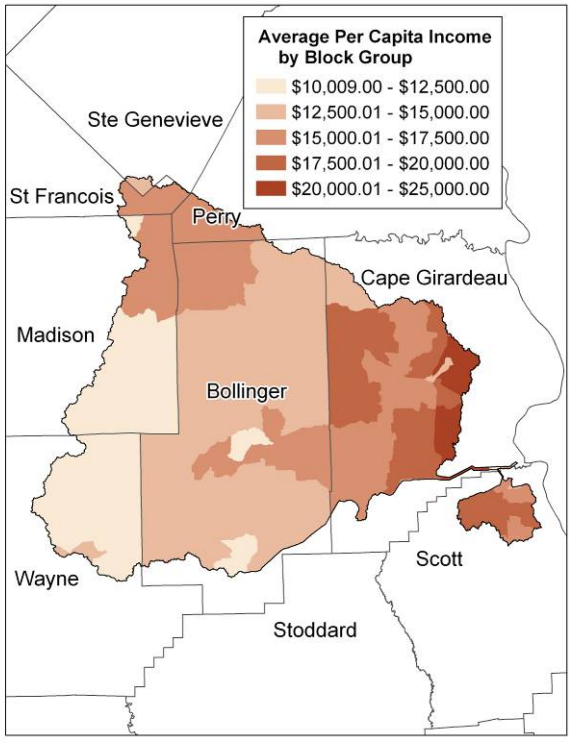
The 1990 estimated population of the sub-basin was 34,867 and grew to 41,756 by 2000, representing a 6,889 person increase or about 20 per cent. With a total of 58 block groups in the sub-basin, 52 showed a gain in population while only 6 lost population.

Figure 19c



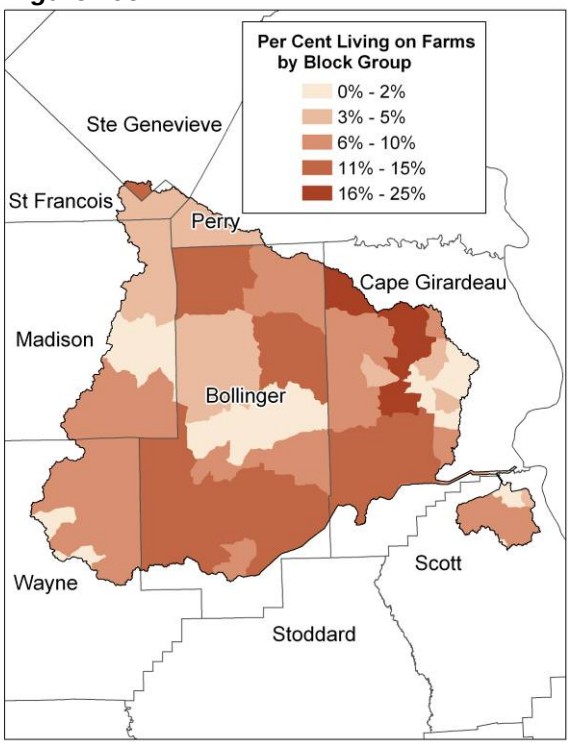
Income

Figure 19d



Farms

Figure 19e



B. Agricultural Census[27]

The data shown in the table are totals for complete counties. County land area acreages and percentages are supplied to assist the user in calculating sub-county estimates. Grazing livestock includes cattle, sheep, horses and ponies and goats.

Figure 20

COUNTY SUMMARY HIGHLIGHTS, 2002							
	Bollinger	**Cape Girardeau**	**Madison**	**Perry**	**St. Francois**	**Scott**	**Wayne**
Farms	913	1,204	463	914	735	514	445
Land in Farms	228,067	260,980	122,726	221,854	128,536	223,678	113,740
Hogs & Pigs	5,099	8,350	11,903	15,003	2,392	927	599
Poultry	914	888	1,014	1,293	161,214	2,805,478	785
Cattle	32,163	44,284	19,750	36,110	21,328	7,616	14,388
Sheep	403	288	175	22	290	unavail-able	87
Horses & Ponies	1.037	1,474	671	506	1,257	363	807
Goats	516	183	185	84	538	38	655
Cropland Used only for Pasture or Grazing	32,681 acres	38,316 acres	20,195 acres	26,342 acres	25,619 acres	7,369 acres	15,569 acres
Woodland pastured	30,476 acres	11,768 acres	15,494 acres	17,645 acres	15,424 acres	2,507 acres	11,297 acres
Permanent Pastureland and Rangeland	28,936 acres	19,310 acres	17,575 acres	19,451 acres	20,474 acres	5,154 acres	14,259 acres
Pastureland, All Types	92,093 acres	69,394 acres	53,264 acres	63,438 acres	61,517 acres	15,030 acres	41,125 acres
Percent Pastureland to All Land in Farms	40.4 %	26.6%	43.4%	28.6%	47.9%	6.7%	36.2%
Sum of All Grazing Live-stock	34,119	46,229	20,781	36,722	23,413	8,017	15,937
Pastureland per Animal	2.7 acres	1.5 acres	2.6 acres	1.7 acres	2.6 acres	1.9 acres	2.6 acres

Status of Resources

A. PRS[28]

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 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	Average per Year
Total Acres Conservation Systems Applied	10,479	8,786	10,779	7,666	Not reported by Hydrologic Unit (HU)	7,729	8,085	9,103	8,306

Figure 21. Conservation Practices Applied

Summary Conservation Practices	2005 Applied	2006 Applied	2007 Applied
Conservation Cover (327)	62 acres	543 acres	201 acres
Conservation Crop Rotation (328)	1,410 acres	357 acres	577 acres
Critical Area Planting (342)	3 acres	3 acres	67 acres
Dike (356)	2,750 feet		
Diversion (362)	500 feet	1,058 feet	184 feet
Early Successional Habitat Development/Management (647)		23 acres	
Fence (382)	9,079 feet	16,432 feet	66,116 feet
Field Border (386)	5,375 feet	101,943 feet	13,033 feet
Filter Strip (393)	33 acres	97 acres	27 acres
Forage Harvest Management (511)	54 acres	9 acres	14 acres
Forest Site Preparation (490)	15 acres		
Forest Stand Improvement (666)	175 acres		303 acres
Forest Trails and Landings (655)	120 acres		
Grade Stabilization Structure (410)	10	36	22
Nutrient Management (590)	102 acres	369 acres	479 acres
Pasture and Hay Planting (512)	788 acres	1,265 acres	1,695 acres
Pest Management (595)	102 acres	207 acres	365 acres
Pipeline (516)	1,347 feet	8,463 feet	7,863 feet
Pond (378)	8	10	10
Prescribed Burning (338)	36 acres		
Prescribed Grazing (528)	421 acres	1,932 acres	2,320 acres
Prescribed Grazing (528A)	1,981 acres	322 acres	101 acres

Conservation Practices Applied (continued)

Summary Conservation Practices	2005 Applied	2006 Applied	2007 Applied
Residue and Tillage Management, Mulch Till (345)		43 acres	18 acres
Residue Management, Mulch Till (329B)	338 acres		79 acres
Residue Management, No-Till/Strip Till (329A)	347 acres	217 acres	
Residue Management, Ridge Till (329C)	102 acres		
Residue Management, Seasonal (344)	212 acres	216 acres	112 acres
Restoration and Management of Declining Habitats (643)	19 acres		
Riparian Forest Buffer (391)	37 acres	49 acres	1 acres
Structure for Water Control (587)	1	15	32
Tree/Shrub Establishment (612)	99 acres	6 acres	2 acres
Tree/Shrub Site Preparation (490)		1 acres	
Underground Outlet (620)	2,300 feet	1,905 feet	680 feet
Upland Wildlife Habitat Management (645)	1,472 acres	1,931 acres	2,174 acres
Use Exclusion (472)	407 acres	259 acres	1,295 acres
Water and Sediment Control Basin (638)	2	2	2
Water Well (642)	1	2	2
Watering Facility (614)	3	14	8
Wetland Restoration (657)	129 acres		36 acres
Wetland Wildlife Habitat Management (644)	254 acres	791 acres	36 acres
Wildlife Watering Facility (648)	5		1

B. Watershed Projects

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

Figure 22

319 Project Name[36]	**Status**
Hubble Creek Watershed Restoration Project	Completed

AgNPS SALT Project Name[29]	**Acres**	**Status**
Hubble Creek	44,875	Completed
Ramsey Creek	22,606	In-Progress

C. Farm Bill Program Lands[30]

USDA programs involving long-term contracts or long-term to permanent easements on land units allow for sustained conservation and restoration goals. In this sub-basin, the Conservation Reserve and Wetlands Reserve programs have considerable participation, as summarized in the table below.

Figure 23

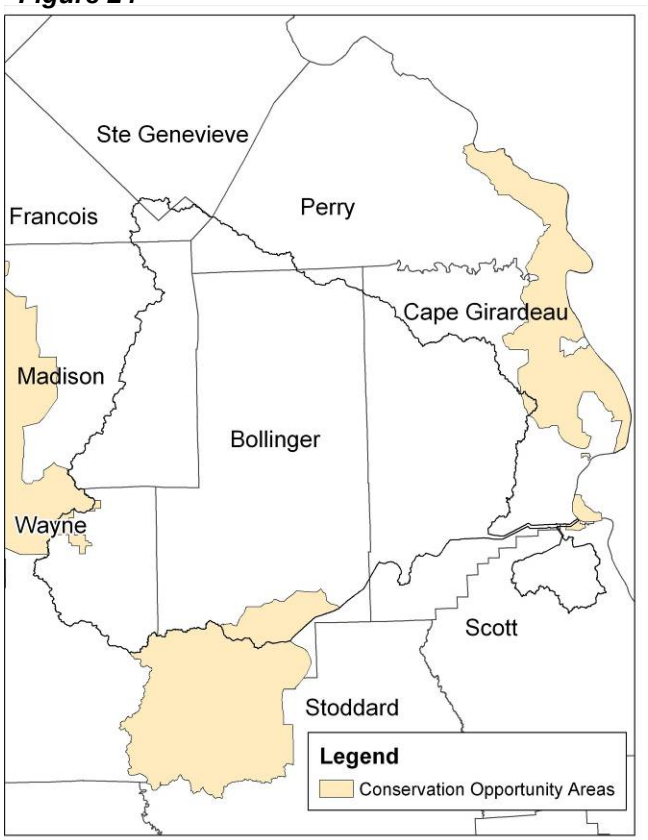
Program	Number of Acres	Number of Contracts or Easements
Conservation Reserve Program (CRP)	11,532	417 contracts
Wetland Reserve Program (WRP)	1,896	10 easements

D. Conservation Opportunity Areas[31]

The Missouri Department of Conservation joined with resource partners to take an "all conservation" approach via a framework referred to as Conservation Opportunity Areas (COAs). COAs identify the best places where partners can combine technology, expertise and resources for all conservation, with such focused efforts providing enhanced results. Various future funding opportunities for resource projects will give priority to work addressing the conservation goals within COAs.

Stakeholder groups have been formed and resources profiles developed for thirty-three of the highest priority COAs in Missouri. The Whitewater River sub-basin contains a small portion of three COAs – St. Francois Knobs, Cape Hills and Mingo Basin. St. Francois Knobs is the primary igneous landscape in Missouri covered with forests, woodlands and glades. The Cape Hills are a forested landscape more similar to the Appalachian Mountains than the Ozark Highlands. Mingo Basin is a wetland area containing the largest remaining bottomland forests of the Missouri Bootheel.

Figure 24



E. Environmental Protection Agency Priority Watersheds[32,33]

The Environmental Protection Agency (EPA) has worked in conjunction with Kansas Department of Health and Environment and Missouri Departments of Natural Resources to identify priority watersheds in each state. The prioritization process paid particular attention to those watersheds where there is a high potential to accomplish measurable water quality improvements in a relatively short time. The target watersheds are used to target requests for Clean Water Act 319 funds. No EPA target watersheds are in the Whitewater sub-basin.

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