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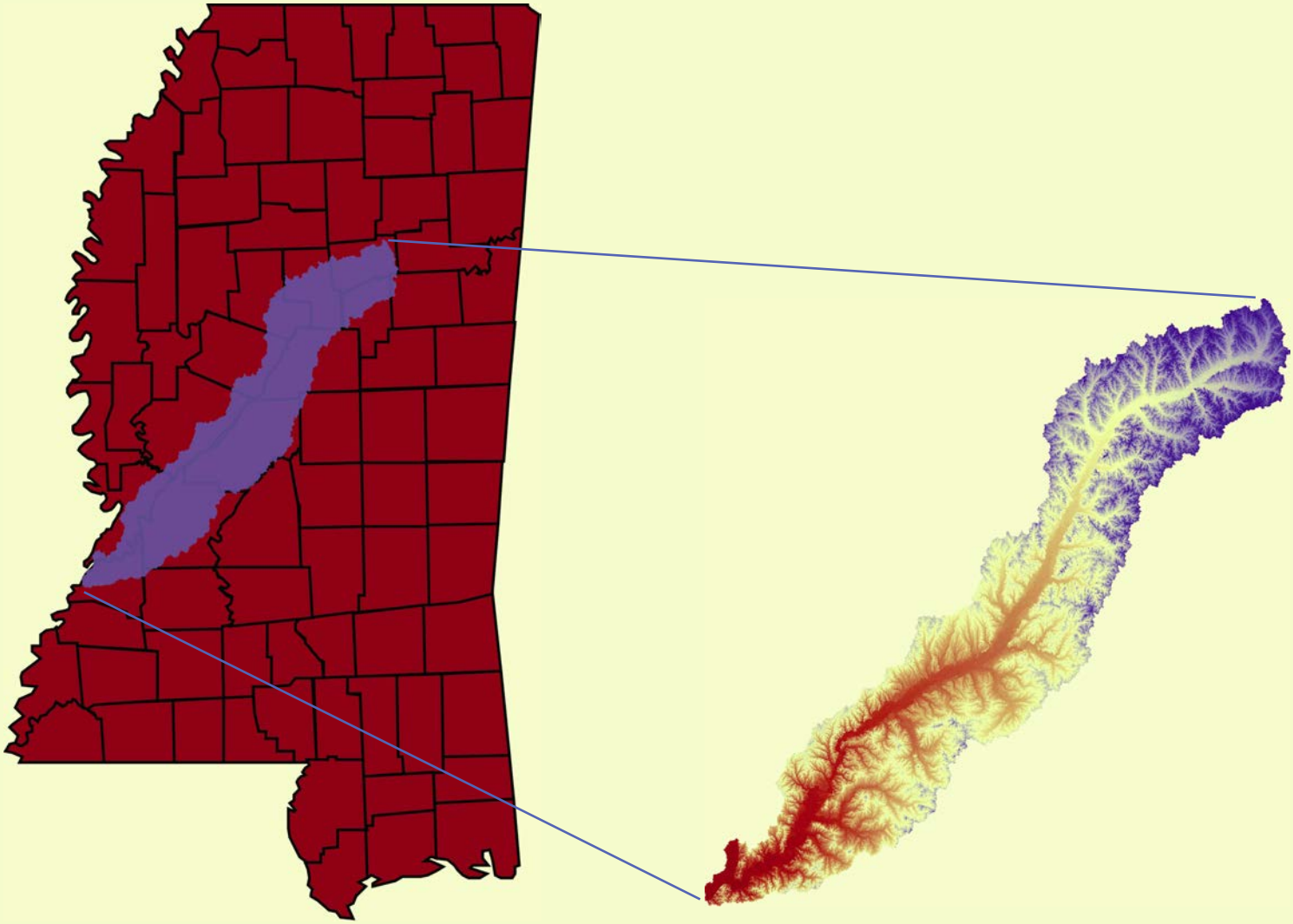
BIG BLACK RIVER WATERSHED ASSESSMENT:

Preliminary Report



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Big Black River Watershed Assessment: Preliminary Report

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Big Black River Watershed Assessment: Preliminary Report

Description

The Big Black River Watershed (BBRW) is approximately 5,500 square kilometers and is located in north-central to western-central Mississippi. On the western side, the watershed is bounded by the Mississippi River. The Big Black River, which lies entirely within the boundaries of Mississippi, begins in Webster County near the town of Eupora in north-central Mississippi and flows southwesterly for approximately 300 miles to its mouth at the Mississippi River, 25 miles south of Vicksburg, Mississippi. Most of the region is made up of hilly to gently rolling land and is largely forested. On the western side of the basin, high bluffs are present as the land nears the Mississippi River (MFC 2006). There are 11 primary counties within the watershed: Attala, Carroll, Choctaw, Claiborne, Hinds, Holmes, Madison, Montgomery, Warren, Webster, and Yazoo.

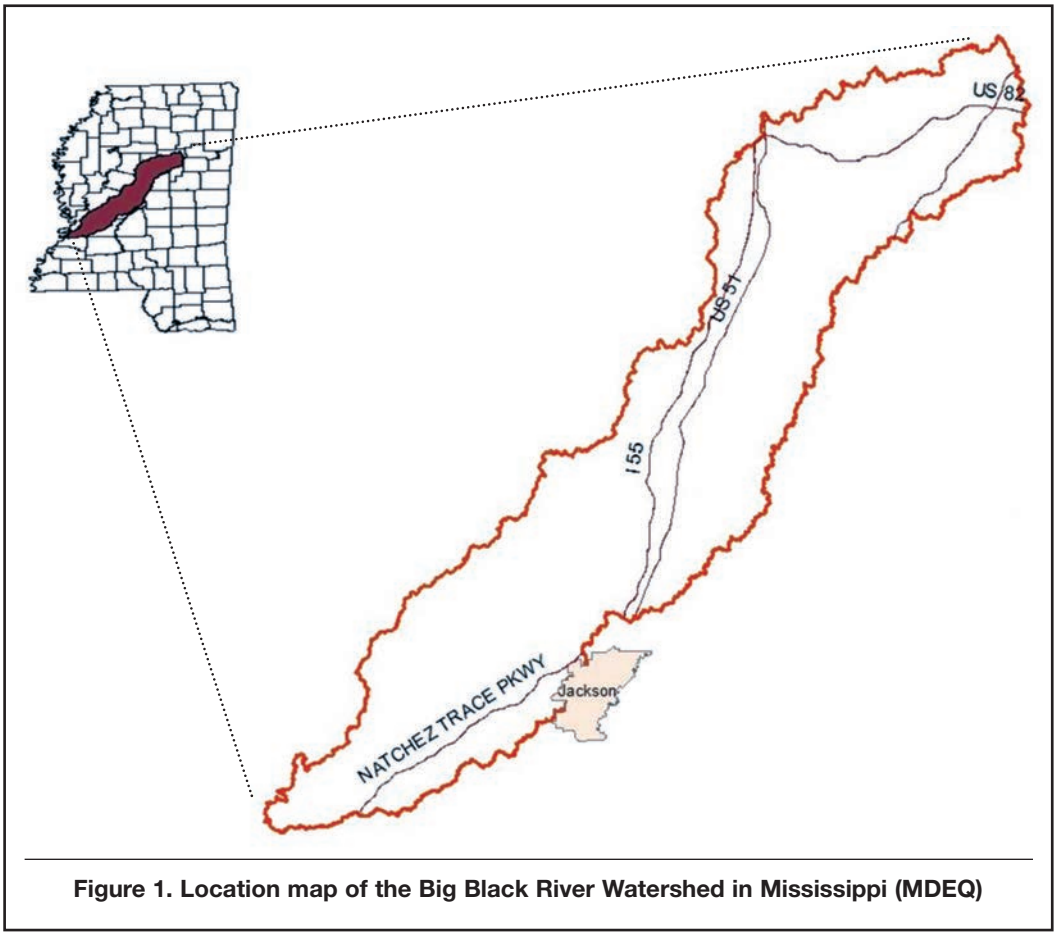

Figure 1. Location map of the Big Black River Watershed in Mississippi (MDEQ)

Overview of Water Quality Issues

The BBRW is primarily threatened by nonpoint-source pollutants, such as old pesticides, livestock operations, and urban development (MDEQ 2005). Even though both DDT and Toxaphene have been out of production since the early 1980s, we are still seeing trace amounts in the BBRW. Extreme rainfall events can carry pollutants, such as pathogens, sediments, pesticides, and nutrients, into the watershed's rivers and streams. Excessive transport of these pollutants can cause the water quality to severely decline. Table 1 lists each specific water body by name and its source of pollutants.

Table 1. Pollutants of concern in the various tributaries of the Big Black River.[1]

Water body name	Pollutants of concern
Jack Lake Creek and Indian Creek	Toxaphene / DDT
Betsy Creek	Organic enrichment / low dissolved oxygen
Big ByWy Creek	Organic enrichment / low dissolved oxygen
Bogue Chitto Creek	pH / organic enrichment / low dissolved oxygen
Cox Creek	Organic enrichment / low dissolved oxygen
Fourteen Mile and Bakers Creeks	Fecal coliform
Hays Creek	Fecal coliform
Bear Creek and Tilda Bogue	Nutrient and organic enrichment /low dissolved oxygen
Panther Creek	Fecal coliform
Porter and Cox Creeks	Fecal coliform
Town Creek	Organic enrichment / low dissolved oxygen

[1]MDEQ 2013

Land Use

Land use classifications are very important when considering the overall quality of a watershed. Different land practices have different affects on water quality and can determine the overall cleanliness of the water. The Water Quality Act of 1965 was the first law passed to require states to maintain certain federal guidelines with respect to water cleanliness (DES 2013). Following the Water Quality Act of 1965 was the Clean Water Act (CWA) of 1972, which was passed to improve water-quality standards. The CWA requires states to determine both point and nonpoint pollutant loads that may enter a water body. The state must then determine how much of the pollutants can be allowed in the water body and still be deemed clean and meet the minimum set standards of the CWA (EPA 2013). This is known as the Total Maximum Daily Load (TMDL). The overall land use in the Big Black River Watershed is pastureland (33%), forestland (63%), residential (2%), and cropland (2%).

Land Use Key — FRSD = Forest-Deciduous, FRSE = Forest-Evergreen, FRST = Forest-Mixed, WETF = Wetlands-Forested, HAY = Hay, JHGR = Johnsongrass, COTS = Upland Cotton, SOYB= Soybean, CORN = Corn, URBN = Residential Urban Area, AGRL = Agricultural Land-Generic, AGRR = Agricultural Land- Row Crops, RICE= Rice, SGHY = Sorghum Hay, SUNF = Sunflower, PNUT = Peanut, SCRN = Sweet Corn, WWHT = Winter Wheat, RYE= Rye, OATS = Oats, SPOT = Sweet Potato, WMEL = Watermelon, PEAS = Garden or Canning Peas, WETL = Wetlands- Mixed, WATR= Water, URLD = Urban Low Density, URMD = Urban Medium Density, URHD = Urban High Density, BARR = Barren, PAST = Pasture.

Land Uses and Soil Types

Table 2. Model-generated subbasins, hydrologic response units (HRUs), land uses, and dominant soils in the watershed.

Subbasin	No. of HRUs	Major land uses	Dominant soil types	Dominant soil textures
1	142	HAY, JHGR, FRSD, FRSE,FRST, WETF	MS155	Oaklimeter, Sweatman
2	187	FRSD, FRST,FRSE	MS019	Chenneby, Sweatman, Maben
3	126	HAY, JHGR, FRSD, FRSE, FRST, WETF	MS155, MS019	Smithdale, Smithdale
4	114	HAY, JHGR, FRSD, FRSE, FRST, WETF	MS097, MS019	Smithdale, Smithdale
5	168	Hay, JHGR, FRSD, FRSE, URBN	MS097	Collins, Smithdale
6	146	Hay, JHGR, FRSD, FRSE, WETF	MS097	Smithdale, Smithdale
7	144	Hay, JHGR, FRSD, FRSE, WETF	MS015	Smithdale, Providence
8	193	JHGR, FRSD, FRSE	MS007	Smithdale
9	114	Hay, JHGR, FRSD, FRSE, WETF	MS015, MS021	Smithdale, Memphis
10	83	Hay, JHGR, FRSD, FRSE, WETF	MS021	Memphis
11	187	HAY, JHGR, FRSD, FRSE, FRST, WETF	MS007	Smithdale, Providence
12	119	Hay, JHGR, FRSD, FRSE, WETF	MS007, MS051	Smithdale, Smithdale
13	200	HAY, JHGR, FRSD, FRSE, FRST, WETF	MS089, MS007	Smithdale, Smithdale, Ora
14	139	HAY, JHGR, FRSD, FRSE	MS051	Memphis, Collins, Smithdale
15	132	Hay, JHGR, FRSD, FRSE, WETF	MS051, MS089	Memphis, Oaklimeter
16	105	Hay, JHGR, FRSD, FRSE, WETF	MS089	Ariel, Oaklimeter
17	163	HAY, JHGR, FRSD, FRSE, FRST, WETF	MS089	Providence, Smithdale, Ariel
18	100	COTS, SOYB, HAY, JHGR, FRSD, WETF	MS163	Loring, Falaya
19	142	CORN, HAY, JHGR, FRSD, URBN, FRSE	MS089	Loring, Ariel
20	124	HAY, FRSD, WETF, CORN	MS089,MS163	Loring, Loring
21	91	HAY, JHGR, FRSD, FRSE	MS049	Riedtown, Loring
22	116	FRSD, WETF, HAY	MS149, MS049	Memphis, Memphis
23	174	HAY, JHGR, FRSD, FRSE, URBN	MS049	Oaklimeter, Memphis

Table 2. Model-generated subbasins, hydrologic response units (HRUs), land uses, and dominant soils in the watershed.

Subbasin	No. of HRUs	Major land uses	Dominant soil types	Dominant soil textures
24	120	COTS, HAY, FRSD, WETF	MS149, MS049	Memphis, Riedtown
25	126	HAY, FRSD, WETF	MS049	Memphis, Riedtown
26	119	HAY, JHGR, FRSD, FRSE	MS049	Memphis, Riedtown
27	90	HAY, FRSD, WETF	MS149, MS021	Memphis, Memphis

[1]MDEQ 2013

Land Use Map

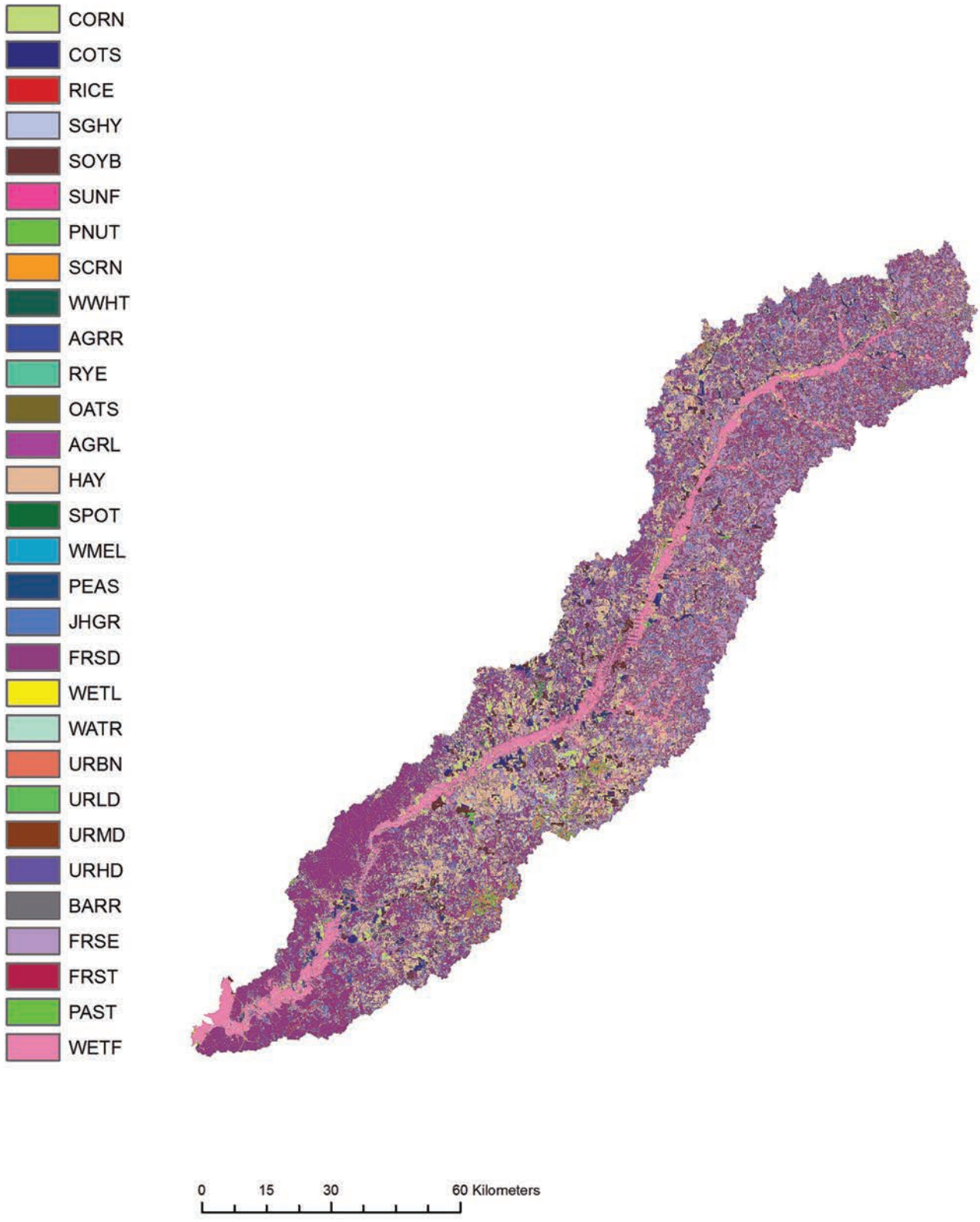

Figure 2. Distribution of land uses within the watershed (USDA/NASS 2009)

Soil

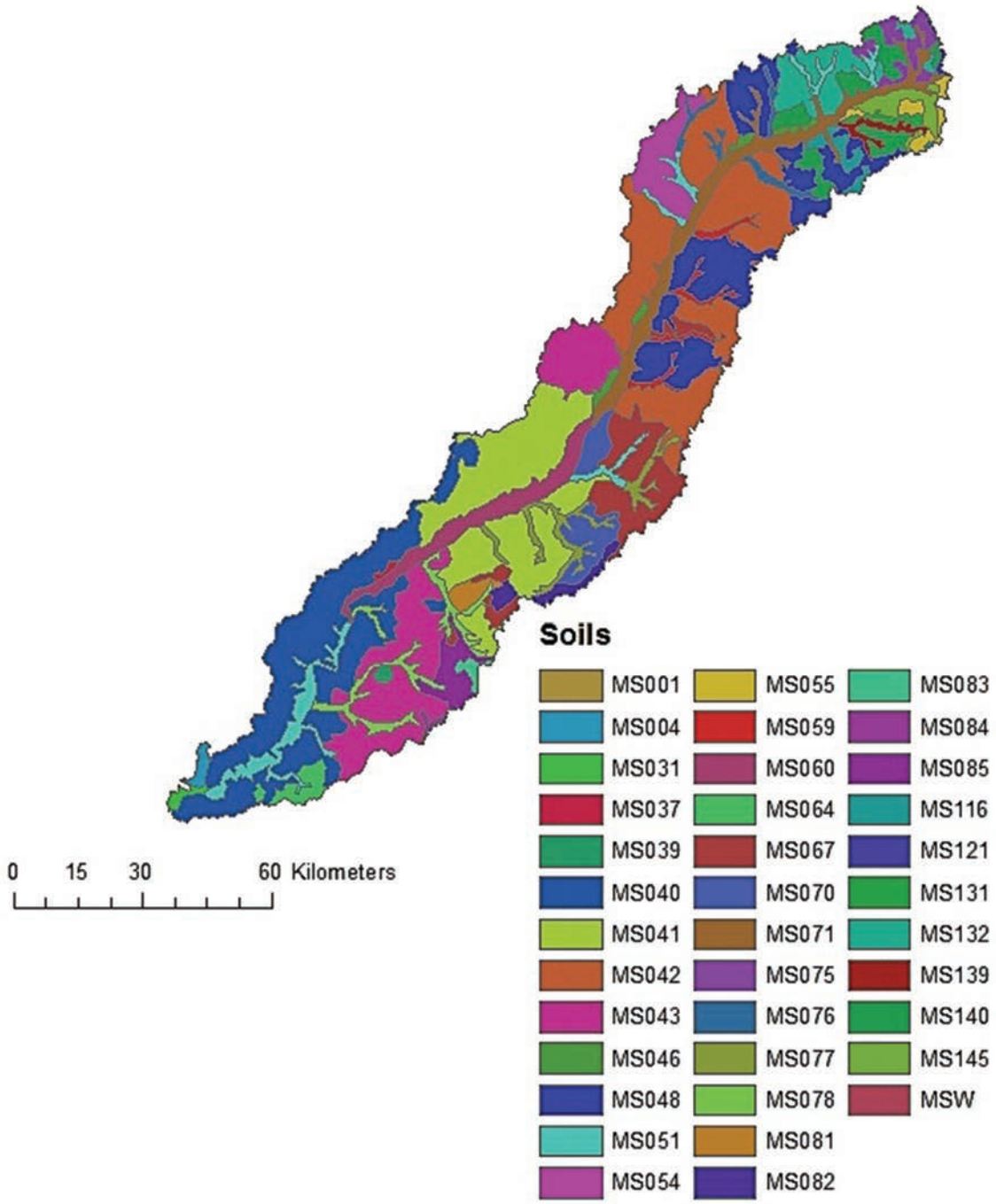

Figure 3. Distribution of state soil textural classes within the watershed (STASGO 2005)

SUBBASINS

Subbasins Map

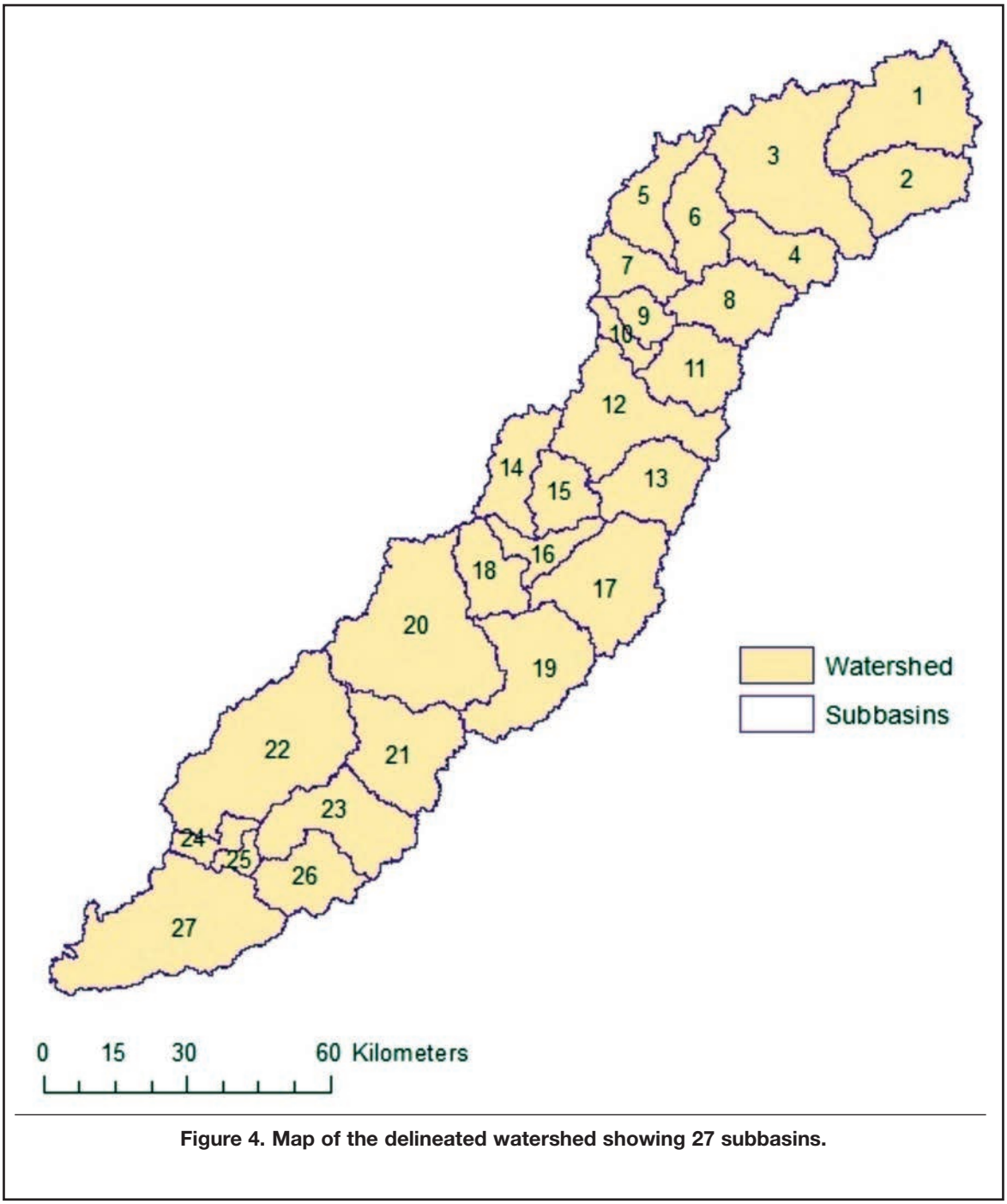

Figure 4. Map of the delineated watershed showing 27 subbasins.

Subbasin Area and Elevation

Table 3. Watershed subbasin area and average elevation.

Subbasin	Area (ha)	Avg. elevation (m)	Subbasin	Area (ha)	Avg. elevation (m)
1	46,344	131	15	16,815	79
2	29,621	133	16	13,023	76
3	68,223	124	17	44,966	90
4	21,161	123	18	19,783	72
5	23,268	117	19	42,235	81
6	23,466	108	20	77,519	71
7	16,432	108	21	39,492	81
8	26,795	118	22	76,542	68
9	9,438	100	23	37,285	79
10	7,311	100	24	8,238	48
11	24,871	113	25	4,732	49
12	46,164	95	26	23,745	51
13	26,920	100	27	71,706	53
14	22,783	91			

U.S. Geological Survey (USGS) Gages

USGS Gage Station Locations

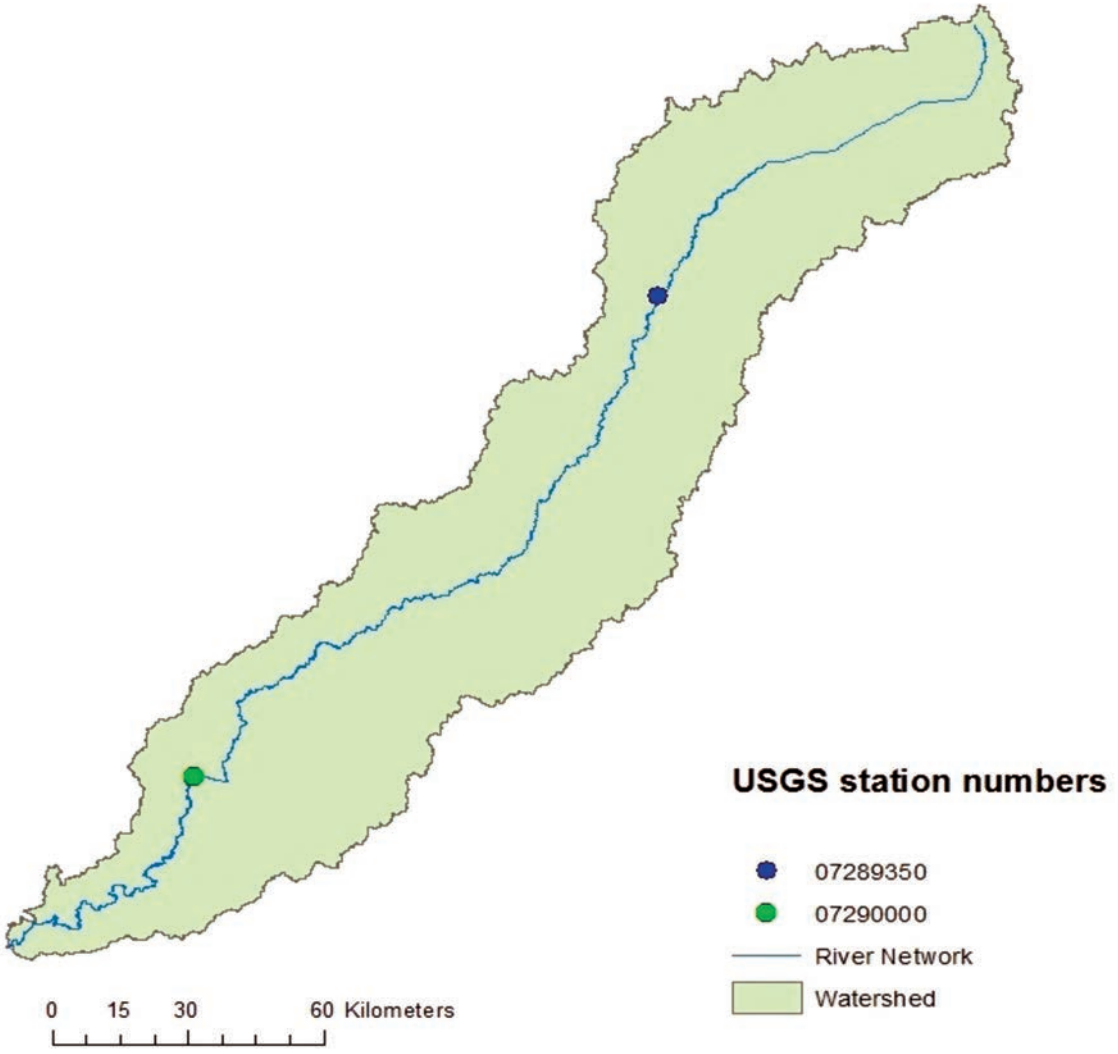

Figure 5. USGS gage stations within the watershed.

Table 4. Name and coordinates of the USGS gage stations in the watershed.

Name	Latitude	Longitude
Big Black River at Bovina, Mississippi (USGS 07290000)	32°20'52"	90°41'49"
Big Black River at West, Mississippi (USGS 07289350)	33°11'40"	89°46'16"

SLOPE

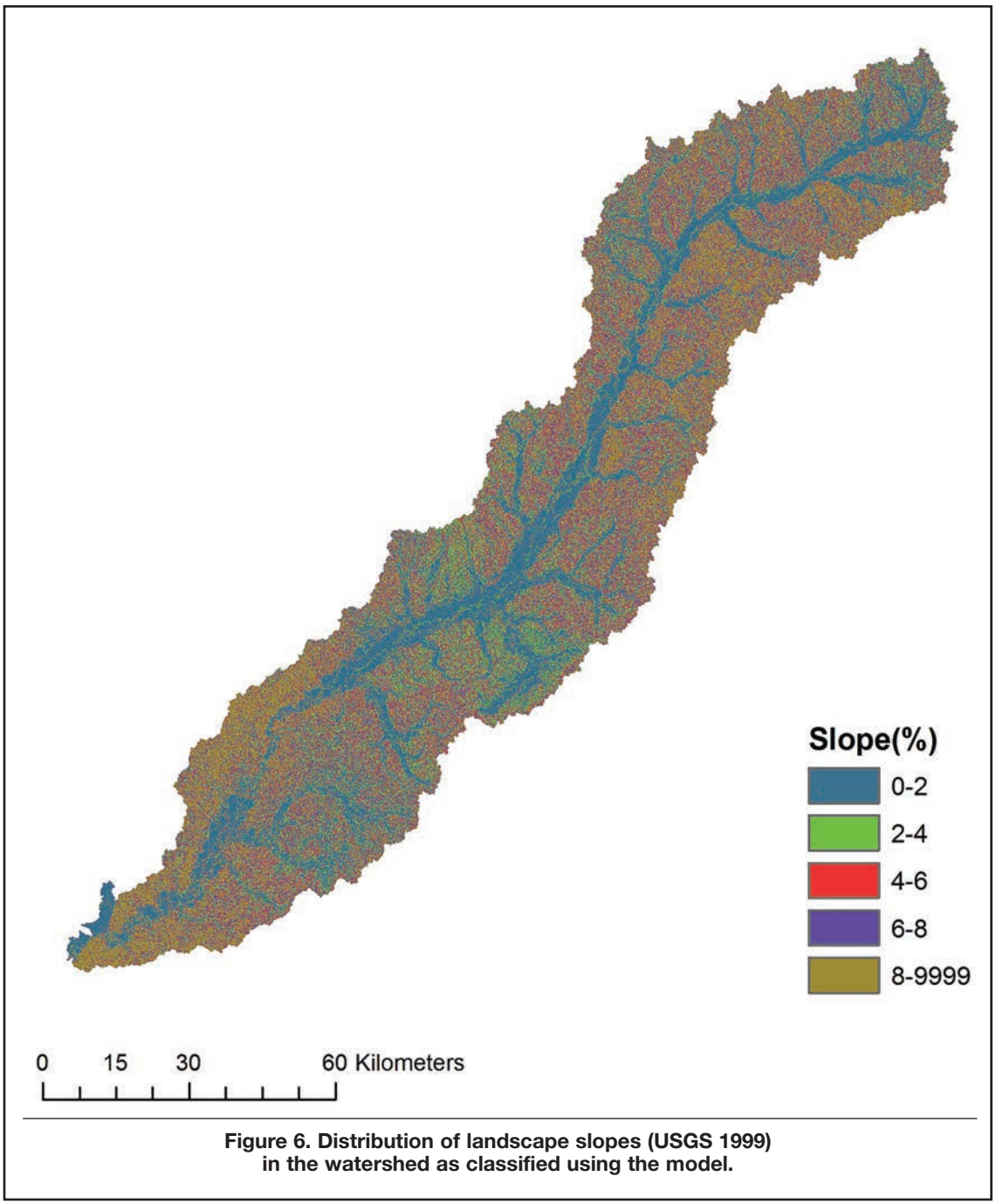

Figure 6. Distribution of landscape slopes (USGS 1999) in the watershed as classified using the model.

Major River Network

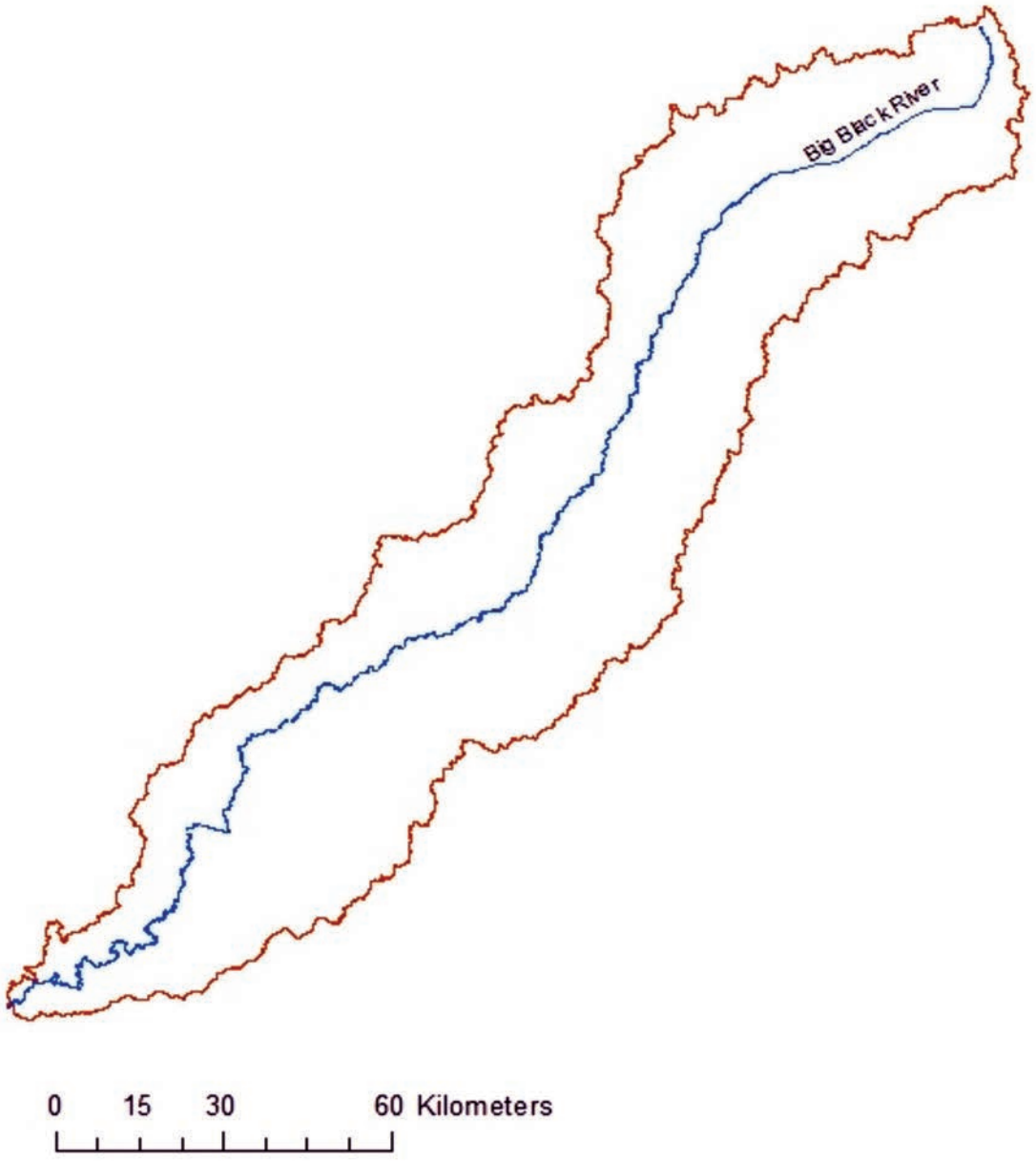

Figure 7. Major river network within the watershed as delineated by the model.

Rain Gage

Rain Gage Stations

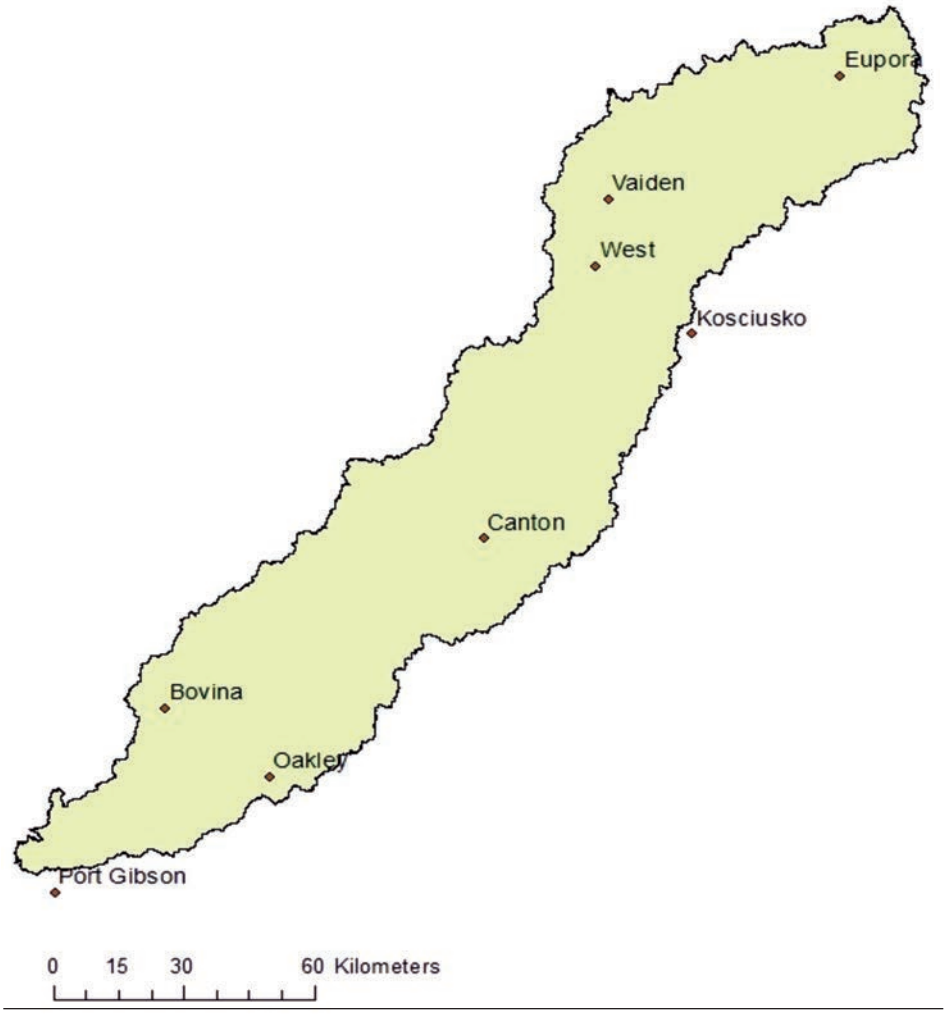

Figure 8. Distribution of rain gages in the watershed.

Rain Gage Data

Table 4. Location of rain gage stations for each subbasin assigned by the model.

Subbasin	Station	Subbasin	Station
1	Eupora	15	West
2	Eupora	16	West
3	Winona	17	West
4	Winona	18	Canton
5	Vaiden	19	Canton
6	Winona	20	Canton
7	Vaiden	21	Canton
8	Vaiden	22	Bovina
9	Vaiden	23	Oakley
10	Vaiden	24	Bovina
11	Kosciusko	25	Oakley
12	Kosciusko	26	Oakley
13	West	27	Port Gibson
14	West		

Table 6. Coordinates and elevations of the rain gage locations used by the model.

Name	Latitude (degrees)	Longitude (degrees)	Elevation (m)
Bovina	32.35	-90.73	72.85
Canton	32.67	-90.04	76.20
Eupora	33.56	-89.24	134.10
Kosciusko	33.06	-89.58	125.00
Oakley	32.21	-90.51	62.50
Port Gibson	31.99	-90.97	36.60
Vaiden	33.33	-89.75	123.10
West	33.20	-89.78	90.10

Hydrologic Soil Group

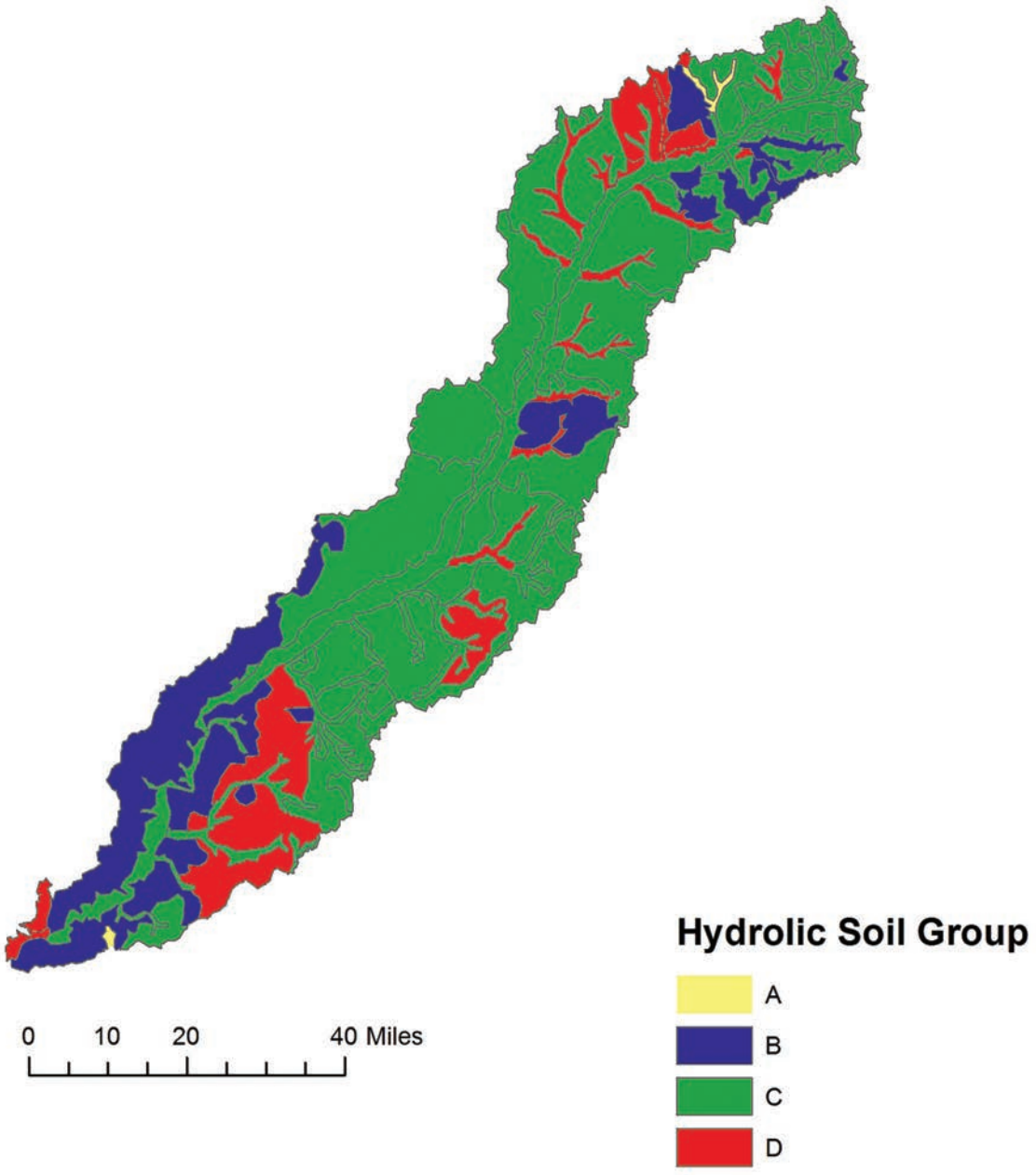

Figure 9. Distribution of hydrologic soil groups within the watershed used by the model using STATSGO Soil. Note: Group A = low runoff potential when very wet; Group B = moderately low runoff potential when very wet; Group C = moderately high runoff potential when very wet; and Group D = high runoff potential when very wet.

Elevation

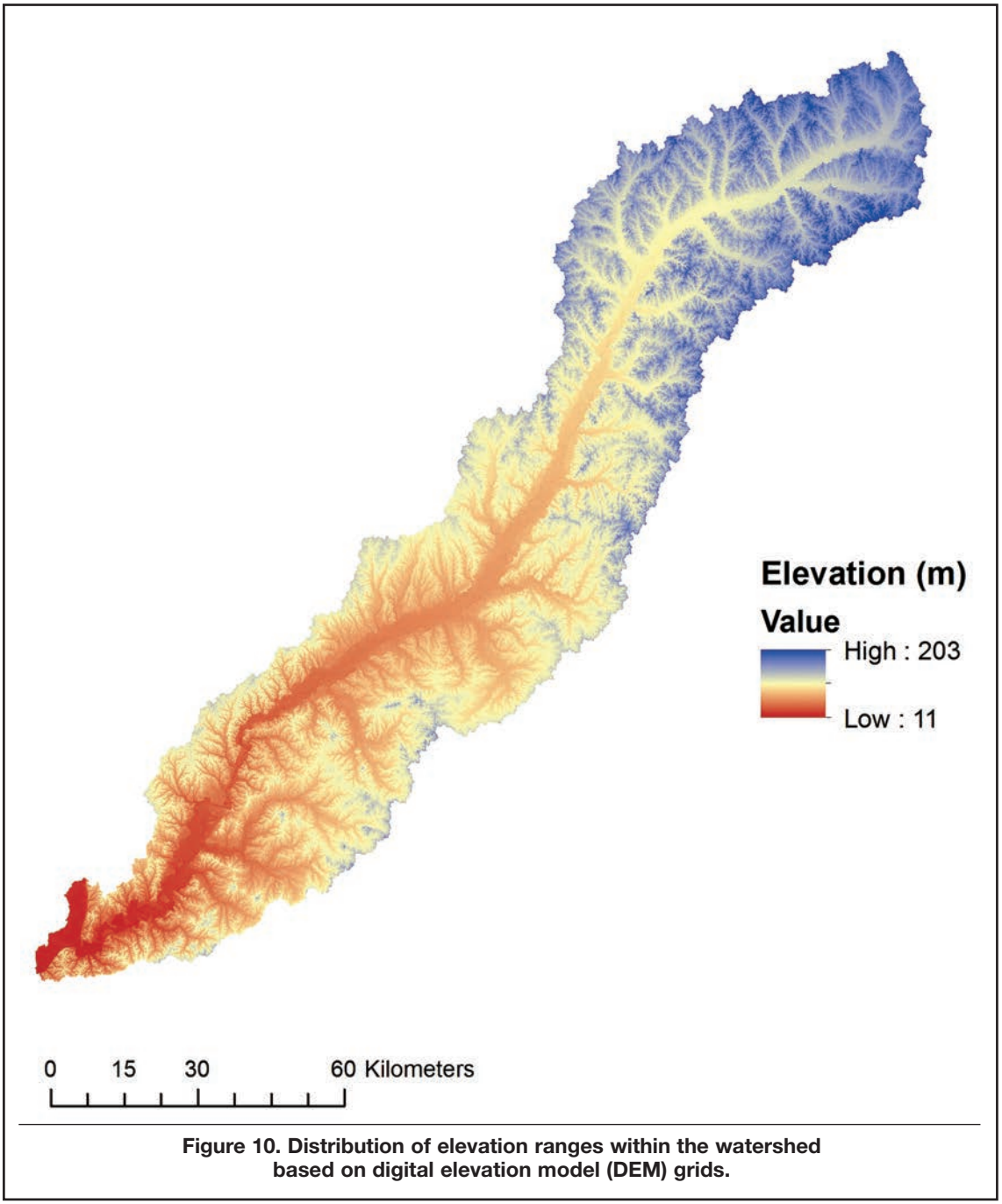

Figure 10. Distribution of elevation ranges within the watershed based on digital elevation model (DEM) grids.

Cities and Towns

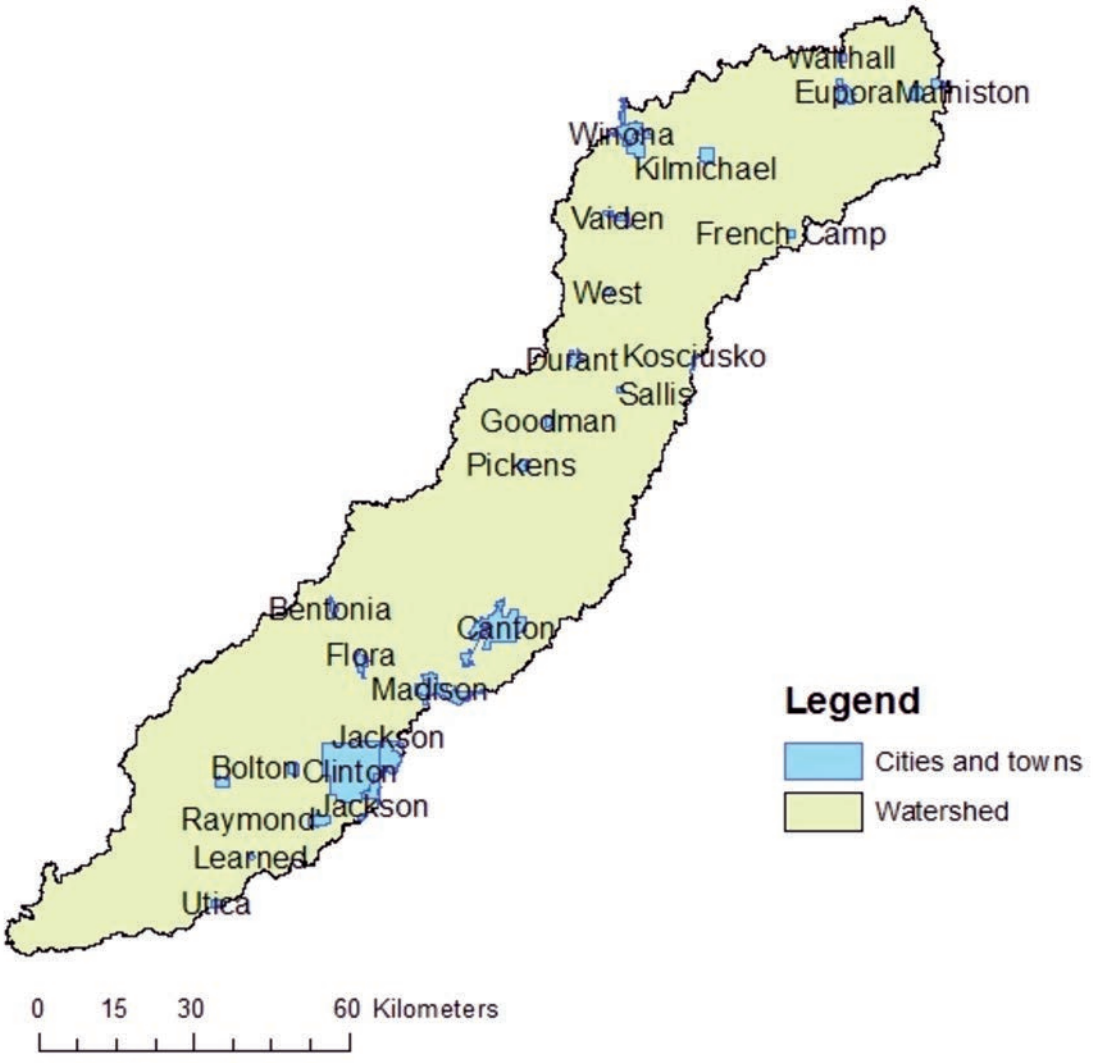

Figure 11. Distribution of local cities and towns in the watershed.

All Cattle and Calves

The 11 major counties comprising the BBRW are Attala, Carroll, Choctaw, Claiborne, Hinds, Holmes, Madison, Montgomery, Warren, Webster, and Yazoo. Figure 12 shows the long-term average of all cattle and calves (by head) for each county from 2003 to 2012 (USDA/NASS 2012).

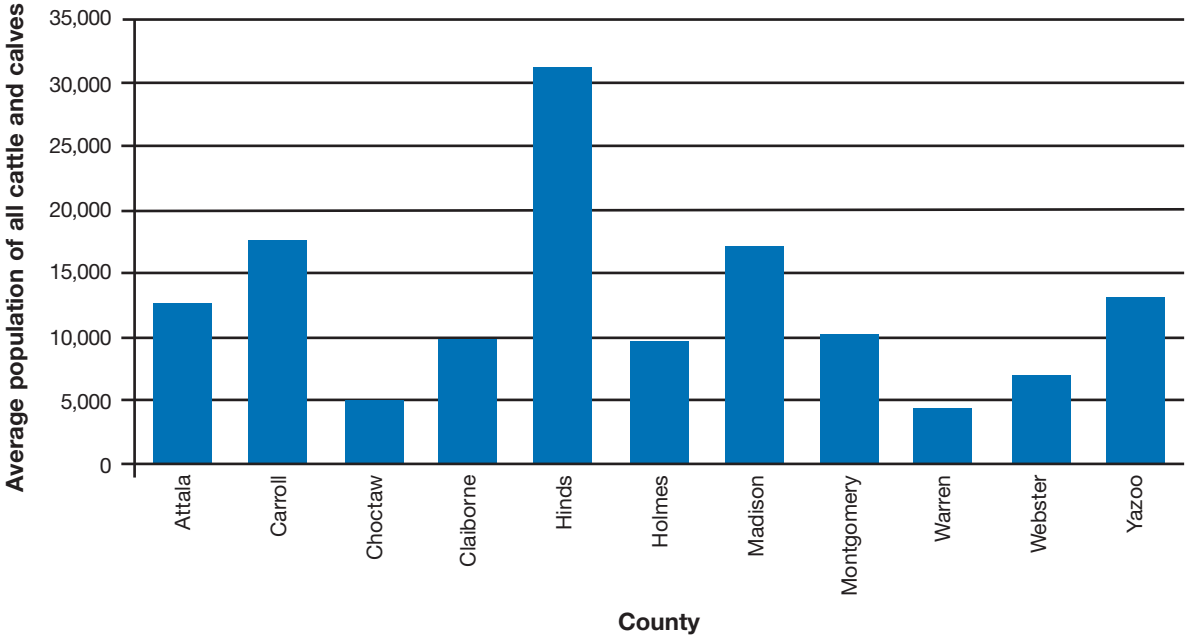

Figure 12. Long-term average (2002–2012) of all cattle and calves by county.

Population by County

Table 6. Estimated populations of each county.[1]

County	Population	County	Population
Attala	19,564	Madison	95,203
Carroll	10,597	Montgomery	10,925
Choctaw	8,547	Warren	48,773
Claiborne	9,604	Webster	10,253
Hinds	245,285	Yazoo	28,065
Holmes	19,198		

[1]U.S. Census Bureau, 2010.

Discussion

This research used the Soil and Water Assessment Tool (SWAT) to simulate monthly stream flows from the Big Black River in Mississippi. The SWAT model was successfully calibrated and validated using stream flow data from the two USGS gage stations (07290000 and 07289350). This preliminary report collected and analyzed geospatial and field data for the watershed. In addition, the calibrated and validated model will help us to perform future modeling studies related to bioenergy production and water quality assessment.

Acknowledgments

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