Yalobusha, Mississippi

(An ARS Benchmark Research Watershed, one of 24 CEAP watershed projects.)

Characteristics

The Yalobusha and Skuna Rivers are the major contributors to Grenada Lake in North Central Mississippi. The Upper Yalobusha River Watershed (YRW), which covers 168,750 ha (651 square miles), was defined from a point in Grenada Lake upstream of the confluence of the Yalobusha and Skuna Rivers. The National Sedimentation Laboratory has focused research in YRW on the Little Topashaw Creek since 2000. CEAP activities will target this 4,000 ha subcatchment and, specifically, a series of about 2-5 ha field sites along a reach of the Little Topashaw Creek instrumented upstream and downstream of the field sites (Fig. B6).

The land use of the YRW consists of 18% cropland, 19% pasture or grassed areas, 53% forested areas, 6% wetland that is largely forest, and 4% surface water or urban areas. A geologic section taken longitudinally along the Yalobusha River shows the Midway Group as the dominant formation. Regional geology is characterized by dispersive silt soils interbedded with sand and clay layers that overlie consolidated clay material. It is the presence of the resistant, clay bed material that makes the Yalobusha River System somewhat unique in comparison to other adjusting stream systems in the mid-continent region. The Major Land Resource Area (MLRA) for the YRW is MLRA 133A - Southern Coastal Plain. Major features of the river system include: (1) relatively erosion-resistant cohesive streambeds overlying sandbeds and with no lithologic bed controls; (2) almost an entire channelized stream network; (2) the straightened and enlarged Yalobusha River main stem terminates in an unmodified, sinuous reach with a much smaller cross section and conveyance; and (4) the lower end of this channelized reach is blocked by a plug of sediment and debris.

Environmental Impacts

The Yalobusha River Watershed experiences deposition and flooding problems in downstream reaches, erosion via headward-progressing knickpoints, and massive bank failures in upper reaches. These general patterns are found throughout the region, and are associated with the consequences of accelerated erosion stemming from land mismanagement and channelization. As a consequence of channel adjustment processes related to channelization in the late 1950's and early 1960's, upstream-migrating knickpoints have caused deepening of upstream reaches and tributary channels. Sufficient deepening occurred to cause significant channel widening by mass failure of channel banks. Woody vegetation, previously growing on these channel banks, delivered to the flow was transported downstream to form large debris plugs. The debris plugs function as dams, causing higher water levels and slower flow velocities than previously measured. This, in turn, causes even greater rates of deposition, further reducing channel capacity, and increasing the magnitude and frequency of floods.

Management Practices

1. Conservation tillage (NRCS codes 329A and 329B)
2. Riparian Forest Buffer (391)
3. Vegetated Barriers (601) e.g., Stiff Grass Hedges
4. Drop-Pipe Structures (410)
5. Willow Establishment in channels (322)

Research Objectives
General: The overall objective is to evaluate watershed responses to field, edge of field, and channel conservation practices.
Specific:
1. Define the variability of hydrologic and biogeochemical processes that influence the effectiveness of conservation practices processes at different scales within the YRW.
2. Identify and quantify the effects of specific management / conservation practices and systems on contaminant and water transport.

Approaches
Subobjective: 1a. Compile the information collected to date in the Yalobusha River system on land use, conservation practices, and soil characteristics. Through a position funded with the Mississippi State University Cooperative Extension office, we will work with USGS, NRCS, The U.S. Army Corps of Engineers and other agencies to develop a detailed land-use inventory, identify and locate conservation practices, acquire digitized soils data, and conduct surveys of farmers.

Subobjective 1b. Compile the information collected to date in the Yalobusha River system on streamflow and sediment, nutrient and pesticide concentrations at baseflow and during storm events. Continuous measurements of stream discharge have been made by USGS at six locations within the defined YRW. These measurements include three locations on the main channel of the Yalobusha River Canal, two on the Topashaw Creek Canal and one on Bear Creek. Continuous measurements of stream discharge have been made by USGS at six locations within the defined YRW. These measurements include three locations on the main channel of the Yalobusha River Canal, two on the Topashaw Creek Canal, and one on Bear Creek. Through the MSU extension position, we will compile historical hydrologic and water quality data from the USGS stream gaging stations.

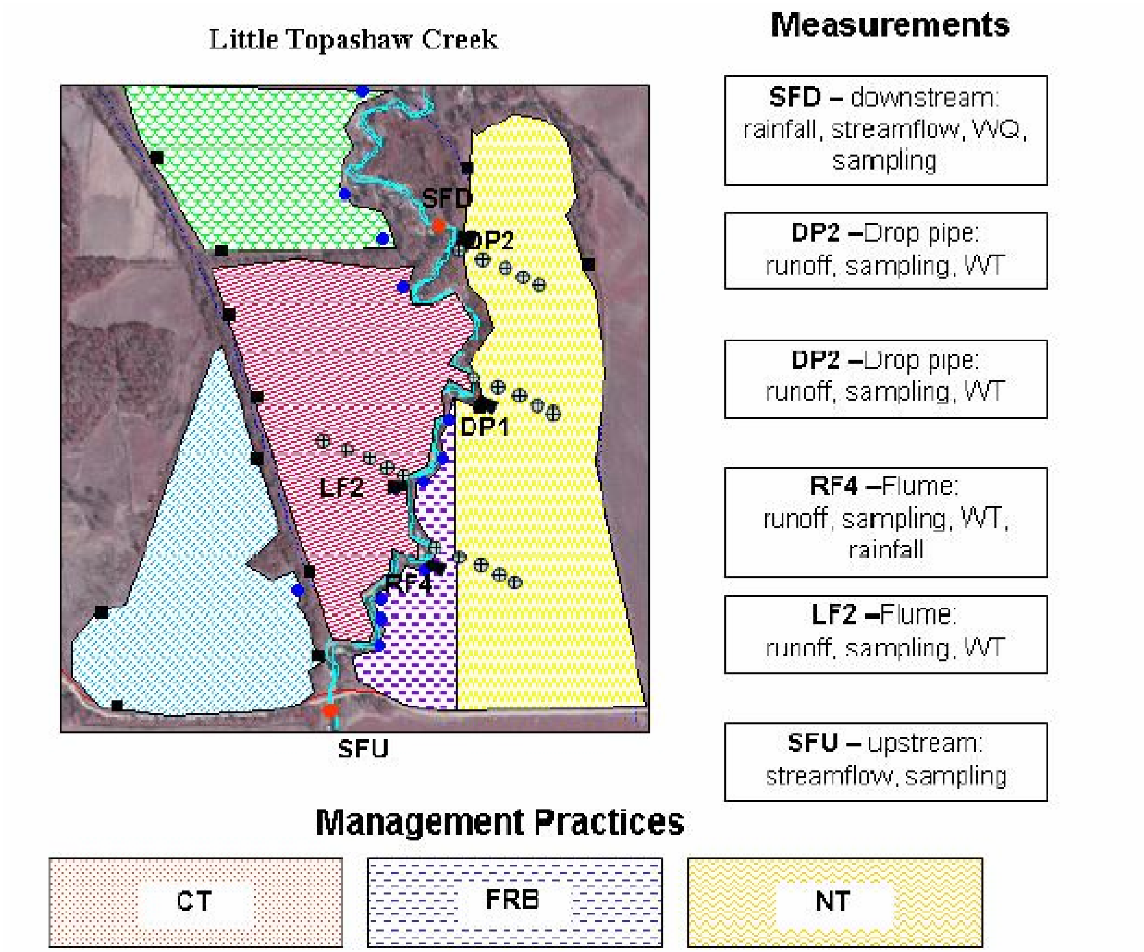
Subobjective 2a. Determine the effects of specific management / conservation practices and systems on contaminant and water transport processes at different scales within the YRW. The historical hydrologic and water quality data compiled by the MSU extension position will be used to evaluate correlations with historical land use and conservation practices for various sized subwatersheds where USGS gages exists.
Subobjective 2b. Determine the effectiveness of riparian buffers, grass hedges, and drop-pipe structures at controlling the magnitude of sediments and contaminants contributed by surface runoff from agricultural areas to stream. The National Sedimentation Laboratory has made continuous measurements of stream discharge at one location on Little Topashaw Creek since 2000 along with measurement of runoff from two edge-of-field gully sites downstream of the stream gage location. Plans for CEAP are to expand this effort, as depicted in Figure B6, by modifying the instrumentation of the two edge-of-field gully sites, adding instrumentation for monitoring two drop pipe structures, and adding instrumentation for stream monitoring downstream of these field sites. This will provide upstream-downstream monitoring with edge of field monitoring from both sides of this stream reach. Field sites on both sides of this stream reach are currently under conventional tillage agricultural production. Landowners will be asked to convert these fields into conventional tillage, no-tillage, and forest riparian buffer areas with and without drop pipe structures as depicted in Figure 1. Stream monitoring instrumentation will include flow velocity meters for stream stage and sediment velocity measurements, Acoustic Doppler current profiler, 5 in 1 DataSonde

sensors for real-time water quality measurement, and flow-proportional samplers for transient/composite sampling of stream sediment deliveries. Edge-of-field sites will be instrumented with flow velocity meters and bubblers for runoff measurement, and flowproportional samplers for transient/ composite sampling of sediment and water quality. Each edge of field site will include a rain gage and a transect of groundwater wells that extend from the streambank adjacent to the edge of field monitoring station out into adjacent field perpendicular to the stream. Samples will be analyzed for sediment and nutrient (N and P) concentrations. To determine sediment source areas and trapping efficiencies of riparian buffers and drop pipes, each field will be sampled by transects to account for soil variability from differences in hydropedologic properties.

Subobjective 2c. Evaluate mechanisms of seepage erosion and its contribution to stream bank failure and the impact of soil conservation practices on these processes. Subsurface flow and corresponding erosion of bank sediment will be quantified at multiple locations along the Little Topashaw Creek and the associated soil physical and hydraulic properties will be characterized. Laboratory experiments will quantify the hydraulic properties controlling the seepage erosion process associated with streambank failure. These data will be used to model contributions of subsurface flow and seepage erosion on stream flow and bank failure, respectively under various conservation practices.

Collaborators and Cooperating agencies and groups
US Geological Service; Natural Resources Conservation Service; US Army Corps of Engineers, Vicksburg District; Local landowners and drainage districts; Mississippi State University, Cooperative Extension Service; University of Mississippi

Yalobusha Watershed



CT-conventional tillage, NT-no-tillage, FRB-forest riparian buffer, SFU-streamflow upstream, SFD-streamflow downstream, LF-left flume runoff, RF-right flume runoff, DP-drop pipe runoff, ⊕- groundwater well