Chapter 1
Watershed Description

Location and Physical Setting

The Bayou Bartholomew Watershed is located in the southeastern Arkansas and northeastern Louisiana. The Bayou Bartholomew is the main stream found within the watershed. It flows for 269 miles through six counties in Arkansas and Morehouse Parish in Louisiana. Counties in Arkansas through which the stream flows include Jefferson, Lincoln, Drew, Ashley, Desha, and Chicot Counties. Small portions of the latter two counties are within the watershed. The extreme northeastern corner of Cleveland County is within the watershed; however the stream does not flow through that county (Figure 1).

Fiigure 1. Bayou Bartholomew Watershed.

The western edge of the watershed, to the west of the Bayou Bartholomew, lies within the West Gulf Coastal Plain Natural Division. The eastern side of the watershed is within the Mississippi Alluvial Plain Natural Division. The Bayou Bartholomew lies on the boundary between these two ecoregions, thus comprising a diverse ecotone as related to the aquatic community which it harbors. Consequently, differences in stream characteristics, land use, vegetation, and wetland types are found between east and west portions of the watershed. Flat farmlands characterize the eastern watershed while rolling forested hills predominate in the western part of the watershed.

Landscape and Topography

Land formations within the watershed are the result of the actions of both wind and water, both of which contributed to cyclic soil erosion and deposition. Alluvial deposits of the Mississippi and Arkansas Rivers were the predominant causes of soils found in the eastern portion of the watershed. Slopes of less than one percent characterize this area while elevations range from 100 to 400 feet above sea level (USDA 1975, 1976, 1979, 1980). In the southwestern, south-central, and to some degree the center portion of the watershed extending far northward in the watershed, soils originated from loess (windblown) deposits. Usually these areas also have slopes of less than one percent though some ridges occur with up to eight percent slopes. Elevations where loess occurs are from 150 to 500 feet above sea level. Ancient marine deposits are also found in the northwestern portion of

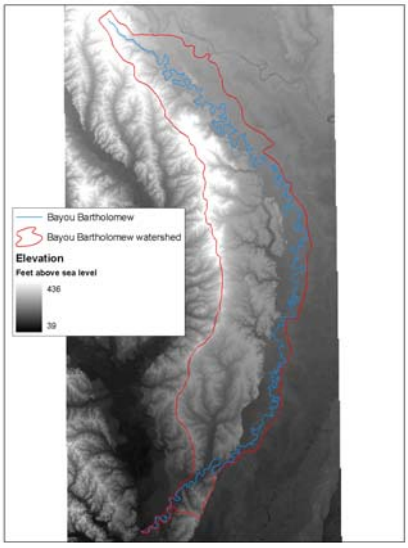


Figure 2. Elevations range up to 439 feet above sea level in the watershed.

the watershed with slopes ranging from one to eight percent and occasionally up to 12 percent (Figure 3).

Geomorphology

Melt waters from glaciers greatly influenced the topography of the watershed. Glacial flows deposited sediments from north and west of the watershed into the area known as the Lower Arkansas River Alluvial Valley. Between Little Rock, Arkansas and the Mississippi, some six meander belts of the Arkansas River have been identified (Saucier 1994). The Bayou Bartholomew in its present-day location occupies one of these meander belts. Most of the oxbow lakes found along the Bayou Bartholomew were formed when the Arkansas River occupied the present day Bayou Bartholomew channel. This is thought to have occurred some 2,000 years before present.

Figure 3. The surface soils found in the Bayou Bartholomew watershed are placed in three categories based on their method of deposition.

Many sandy and silty soils were deposited as point bars and natural levees by this prehistoric river channel. Areas outside the initial deposition zone, still within the floodplain, referred to as back swamps, had silt, clays, and other fines deposited as a result of overland flooding.

but

These late Pleistocene and Holocene alluvial features were deposited in areas where the higher and older Prairie terraces had been eroded away. The Prairie Terrace consists of glacial melt and alluvial deposits laid down earlier in the Pleistocene, and overlain with windblown loess deposited by prevailing winds (Saucier 1994). This terrace is higher than the late Pleistocene and Holocene alluvial terraces, and still exists in the watershed in the form of isolated patches within the alluvial plain, and in the silty uplands west of the alluvial plain.

The coastal plain lies to the west of the silty uplands and encompasses portions of the northwestern portion of the watershed. It is composed of ancient marine deposits little affected by rivers except for more recently formed flood plains of small streams.

Hydrography

A network of streams, bayous, ditches, oxbow lakes, and-made reservoirs is found within the watershed (Figures 4 and 5). Dendritic stream patterns occupy the western coastal plain portion of the watershed while meandering stream patterns are found in tributaries to the Bayou Bartholomew entering from the delta. The Bayou Bartholomew retains its

sinuosity in a somewhat natural state while some of its tributaries on the eastern side have seen extensive channel alteration. Major tributaries to the Bayou Bartholomew include Deep Bayou, Cousart Bayou, Ables Creek, Cutoff Creek, Bearhouse Creek, Chemin-a-Haut Creek and Overflow Creek.

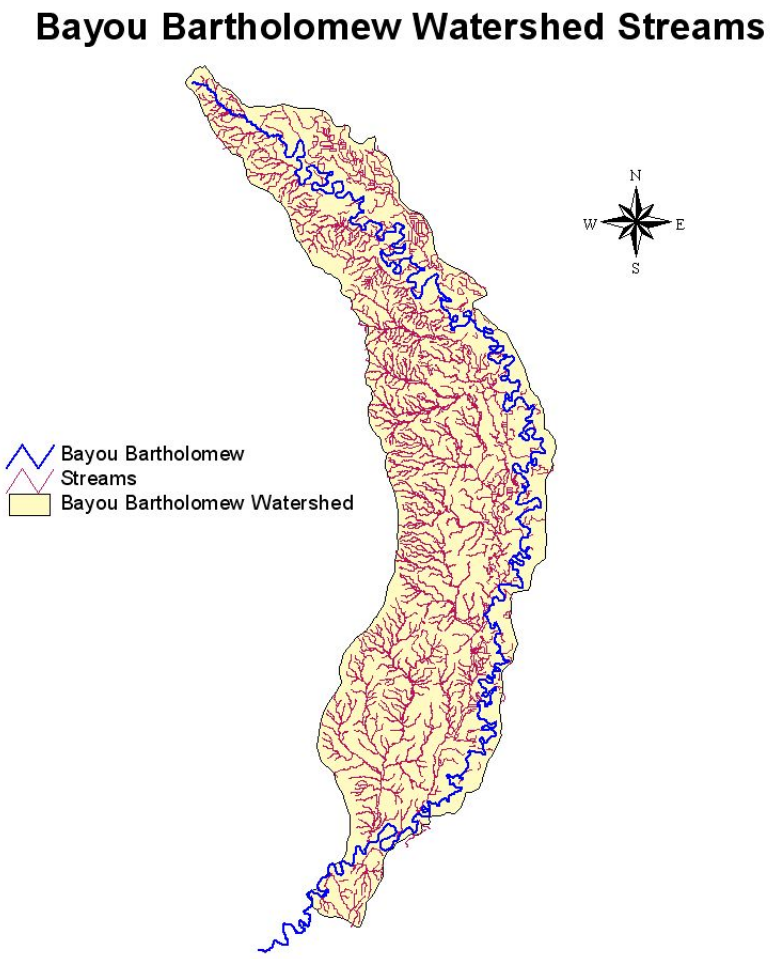


Figure 4. A network of streams interlaces the Bayou Bartholomew Watershed. The Bayou Bartholomew follows the eastern side of the watershed, essentially separating the Gulf Coastal Plain and the Delta Ecoregions.

The majority of lakes found within the watershed are oxbow lakes that were formed by the meandering of the Arkansas River during its occupancy of the Bayou Bartholomew Meander Belt. A number of man-made lakes, both public and private, are used for fishing and waterfowl hunting. Cane Creek Lake is a man-made impoundment on a tributary of the Bayou Bartholomew. Seasonal impoundments are found on state and federal lands used principally for hunting and include Seven Devils Wildlife Management Area (WMA), Cutoff Creek WMA, and the Overflow National Wildlife Refuge. The Arkansas Game and Fish Commission own or leases several naturally formed oxbow lakes managed primarily for fishing. These include Lake Wallace, Lake Grampus, Wilson Brake, and Lake Enterprise. Lakes range from 150 to 300 acres in size (AGFC 2001).

Hydrology

A number of activities both within and outside of the watershed have altered the hydrology of the watershed in the past century and a half. Dams, weirs, levees, channelization, draining and filling of wetlands, and removal and/or addition of water to stream channels have resulted in hydrological changes.

Streams and aquifers in the watershed are intimately connected. Changes in stream flow or stage of a stream result in changes in the head, or flow, in related aquifers (Broom and Reed 1973). The natural sinuosity of the Bartholomew is pointed out by its length,

traveling some 279 miles to the Louisiana border, an actual straight-line distance of 90 miles. Channel slopes average approximately one-half foot per mile. Most streams occurring in the Mississippi River Alluvium are described as gaining streams. USGS (1969) determined during dry periods, the Bayou Bartholomew gained 45.5 cubic feet per second between Pine Bluff in its upper end to the Louisiana border. Seventy-five percent of that gain occurred downstream of McGehee far to the south. Spring and fall potentiometric maps of aquifers in the area indicate that the Bayou Bartholomew is primarily a drain for groundwater flow from the west and a recharge source for aquifers to the east. The Arkansas River at high flows is also a recharge area for the aquifers to the east of the Bartholomew, thusly affecting water levels in the Bayou Bartholomew.

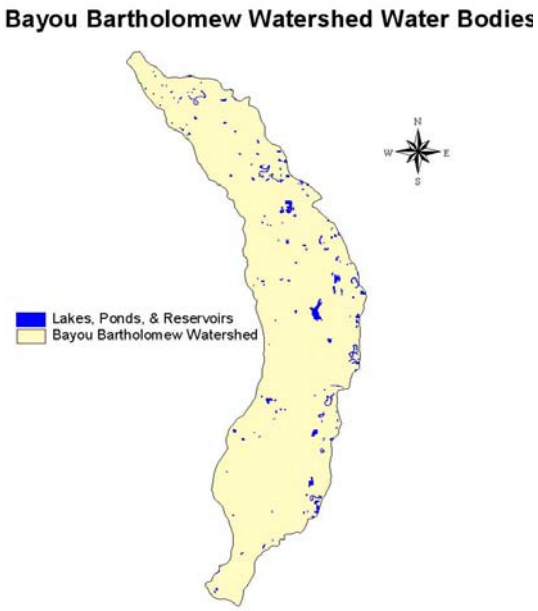


Figure 5. Many natural and man-made water bodies are found throughout the watershed.

The Bayou Bartholomew and its tributaries carry their highest flows during the months of January through May, due to higher rainfall events during those times. Minimum flows usually occur during the period from August to October (ASWCC 1987, 1988). Natural flow regimes have been drastically altered by removal of water for irrigation, with some 87 percent of the available surface water in the stream being removed during summer (ASWCC 1987). Layher and Phillips (2000) calculated minimum flow values needed at points in the Bayou Bartholomew to maintain historical levels of fisheries based on existing hydrological records for the stream. The majority of the watershed has been declared a critical surface water area (ASWCC 1990).

More farmers in the area have turned to surface water in the watershed as a result of aquifer declines in the area. This has further reduced surface water flows in the Bartholomew. The U. S. Army Corps of Engineers is currently studying the feasibility of pumping Arkansas River water into the Bayou Bartholomew to augment flows to supply farmers in Southeastern Arkansas with irrigation water. This action will further affect hydrology of the watershed. Layher and Phillips (2001) further emphasize that potential benefits of the proposed alteration should be evaluated with regard to any potential negative impacts and recommend examining more efficient irrigation methods, dry crop alternatives, and off stream reservoirs as well as reducing cropped acreage through CRP and WRP as more viable long term water supply solutions for the watershed.

Groundwater

Groundwater supplies have been declining throughout eastern and southeastern Arkansas for decades. Geology of the watershed consists of unconsolidated strata composed of clay, silt, sand, and grave. Some of the sand and gravel layers function as high yield

aquifers. The aquifer that lies under the Mississippi Alluvial Plain has been used extensively for irrigation for row crop agriculture. Wells typically produce 1,000 to 2,000 gallons per minute (Broom and Reed 1973). The deeper Sparta aquifer produces 500 to 1,500 gallons per minute and is used primarily by industries such as paper mills or for municipal water supplies.

Ninety-three percent of all groundwater used in Arkansas in 1985 was for agricultural purposes (ASWCC 1987). Four percent of the groundwater pumped was from the Sparta formation. Combined withdrawals from these aquifers have resulted in wells exhibiting saltwater intrusion and high chloride levels have rendered some wells unfit for producing irrigation water for crop production. This has further forced farmers to rely on stream flow from the Bayou Bartholomew. Additionally, withdrawals from aquifers exceeded recharge by 17 percent in 1985. Currently portions of Ashley, Drew, Lincoln, Cleveland, Jefferson, Desha, and Chicot counties have been declared critical groundwater areas. One of the greatest challenges facing natural resource managers in the watershed is to balance the use of surface and groundwater to provide for drinking, industrial, agricultural needs of people while still maintaining critical aquatic fish and wildlife habitats.

Soils

Soils in the watershed can be placed in three general categories based on their method of formation. Soils along the eastern portion of the watershed were deposited by the Arkansas River. These soils are characterized as excessively drained to poorly drained, loamy and clayey soils that formed on natural levees and in back swamps.

West of the alluvial deposits, soils of the Southern Mississippi Valley Silty Uplands can be found. These depositional features are found in narrow strips in the northern portion of the watershed and over most of the western two-thirds of the watershed in its southern one-half (see figure 3).

Soils in the northwestern watershed are composed of sediment deposited from the Gulf of Mexico. These loamy soils are moderately to poorly drained soils.

Vegetation

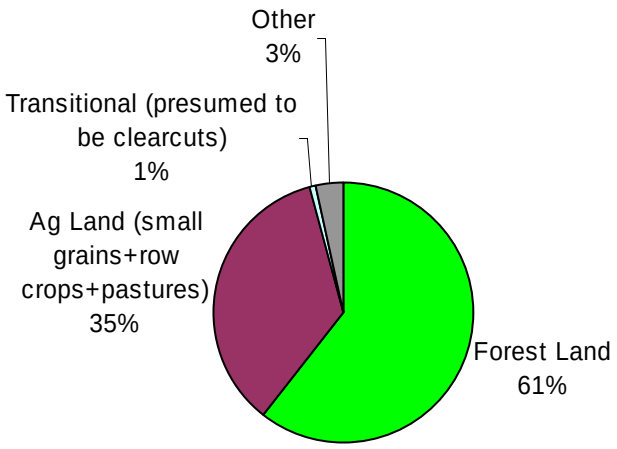
Vegetative composition in the watershed has been altered drastically since settlement began in an intensive manner in the 19th century. Prior to settlement water-tolerant hardwood species dominated the landscape throughout the flood-prone bottomlands. Elevated, well-drained uplands contained forests that were composed of mixed pine and hardwood species. Nearly all of the original forest has been removed. Bottomlands were converted to row crop agriculture while uplands have been planted to intensively managed forests to produce forest products, especially fast growing pines. The only pre-settlement vegetation that remains today is bands of cypress that grow in the channel or along banks of the Bayou Bartholomew and its tributaries or in isolated brakes.

Forest types found today that are not intensively managed are dictated by topography, soil type, and frequency and duration of flooding. The eastern portion of the watershed lies in the flood plain of the Bayou Bartholomew and contains species which can tolerate having roots inundated by flood waters for months at a time. The higher elevations in the western portion of the watershed support forests and tree species which are less tolerant of flooding.

Forests in the western portion of the watershed are primarily mixed hardwoods and pines with stands of pure pine on recently disturbed or managed areas (Arkansas GAP 1992). Dominant upland species include shortleaf and loblolly pine, white oak, red oak, and hickory. Streams in the upland portion of the watershed have small flood plains with narrow riparian corridors. These areas may be subject to short term flooding, and contain some hardwoods more characteristic of bottomlands such as water oak, willow oak, overcup oak and bitter pecan. Immediately adjacent to the water in these areas one may also find bald cypress, water tupelo, cottonwood, and sycamore.

Species in the eastern portion of the watershed are those typical of flat terrain, and found on alluvial soils. The species are distributed based on their ability to withstand long periods of submergence. Common bottomland oak species include Nuttall oak, water oak, willow oak, and overcup oak. Also found are typical bottomland hickories, bald cypress, and water tupelo. Numerous cypress/tupelo "brakes" occur along the Bayou Bartholomew and its tributaries. These brakes are remains of oxbow lakes that have silted in and allowed the colonization of these species.

Figure 6. Forest types in the Bayou Bartholomew watershed as calculated from Arkansas and Louisiana GAP analyses datasets.



Wetlands

The Bayou Bartholomew watershed contains some existing wetlands. These occur primarily along the northern portion of the watershed in Jefferson and Lincoln Counties. The northern one-half of Lincoln County contains significant wetland tracts. Some 259,000 acres of wetlands are found in the Bayou Bartholomew Wetland Planning Area as defined by the Arkansas State Multi-agency Wetland Planning Team (MAWPT) (Layher and Phillips 2000). The wetland planning area however contains some land area outside of the actual watershed, and so the acreage in

Many rare plants can be found in wetlands of the watershed including this yellow-crested orchid.

wetlands within the watershed is somewhat less than that cited above.

The watershed contains a number of wetland types as organized in a classification scheme developed by the MAWPT and based on the Hydrogeomorphic Classification developed by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) (Klimas 1998, 1999; Brinson1993; Smith et al. 1995). The classification system includes three hierarchical classification levels to describe wetlands: Class, Subclass, and Community Type. Geomorphic setting is used to group wetlands into one of five Classes: Depression, Flat, Fringe, Slope, and Riverine wetlands. Hydrologic environments further divide these classes into Subclasses that reflect considerations such as the connection of the wetland to upstream or downstream systems, the energy of water flowing through the wetland, and the acidity or alkalinity of the water. Finally, these subclasses are divided into community Types based on unique vegetation types, geology, and soils. Representatives of all five HGM wetland classes are present in the watershed. A complete description of wetland classes, subclasses, and community types along with typical plant communities occurring in each can be found in Layher and Phillips (2000).

Layher and Phillips (2000) included maps depicting hydric soils, vegetative covers, and existing wetlands within the watershed. Areas which are highest and high priority areas for restoration have also been identified in that source and plotted. MAWPT identified three goals as a starting point for a strategy to restore wetlands in the watershed: 1) rebuild forested riparian corridors along the rivers, streams, and bayous of the watershed where they have been cleared to the channel; 2) widen the riparian corridor where possible; and 3) protect and expand the larger existing blocks of bottomland hardwood forest for wetland areas outside the corridor.

Fish and Wildlife Resources

The Bayou Bartholomew watershed contains a rich diversity of both plant and animal species. The Nature Conservancy has compiled a list of species which are known to occur in the watershed (Appendix I, Table I). Additionally the Bayou Bartholomew Alliance has conducted surveys of fish species at thirteen locations since 1992. They have recorded 117 fish species in the Arkansas portion of the Bayou Bartholomew (Appendix I, Table II). Other surveys of fishes have been conducted by Thomas (1976) and Hutchins (1988). The Nature Conservancy has funded several mussel surveys and found 31 species of freshwater mussels in the Bayou Bartholomew. These mussels and fishes combine to make the Bayou Bartholomew the most diverse aquatic habitat in the southeastern United States (Ulmer personal communication 2005) and one of the most diverse sites in North America (TNC 2001). The Arkansas Natural Heritage Commission lists thirteen animal species and 18 plant

Wood ducks resting.

species as sensitive in the watershed (Layher and Phillips 2000) (Appendix I, Table III). Two federally endangered mussel species, the pink mucket and the fat pocketbook mussels, have been found in the Bayou Bartholomew (Layher and Phillips 2000). Fish distributions and mussel distributions based on collections funded by the Nature Conservancy have been plotted to determine areas of concentration (Appendix I, Figures 1-8). Some 31 species of mussels have been found in the Bayou Bartholomew which together with the large number of fishes also occurring there makes this stream one of the most diverse stream systems on the North American continent. The federally endangered red-cockaded woodpecker is found in the watershed. Both the American alligator and the bald eagle which are threatened occur in the watershed. Bald eagles are now known to nest in both Lincoln and Ashley Counties along the Bayou Bartholomew. Even small areas of wetlands or riparian habitats support an amazing array of wildlife. Local birding enthusiasts have recorded 108 species of avian fauna (Appendix I, Table IV) at the newly constructed William G. Layher Nature Trail in Pine Bluff. That trail, 1.78 miles in length traverses wetlands, floodplain hardwoods, and mixed forest habitats.

A variety of migrating and resident waterfowl utilize wetland resources in the watershed. These areas provide food, resting places, areas to form pair bonds, and in some cases to reproduce. In winter moist soil units, wildlife management areas, seasonally flooded hardwoods, oxbow lakes, and cypress/tupelo brakes become havens for migrating and wintering waterfowl. Mallards and wood ducks utilize recently flooded hardwoods as a source of acorns and invertebrates. Shallow wetlands provide a source of seed that is produced by herbaceous plants. Waterfowl also utilize rice fields and other artificially flooded crop fields. Seasonally flooded forests, beaver ponds, lakes and brakes provide crucial resting areas and areas for courtship activity to occur. Wood ducks and hooded mergansers nest in hollow cavities of cypress, oak and other trees in riparian zones.

Wetlands and upland sites provide for many wildlife species in the watershed. Whitetail deer, fox and gray squirrels, cottontail and swamp rabbits, wild turkeys, a variety of raptors and song birds can all be found throughout the watershed depending on species specific habitat requirements. Beaver, mink, otter, muskrat, raccoon, opossum, striped skunk, red fox, and gray fox are found commonly throughout the watershed and are often associated with forested areas close to water bodies and streams. Many reptiles and amphibians occur in the watershed, including alligators, which are dependent on water bodies and associated habitats.

Demographic and Socioeconomic Characteristics

The watershed is characterized by large tracts of agricultural or timber production lands interspersed with small rural communities. Cities that occur in the watershed include Pine Bluff with a population of over 50,000 people and located at the upstream end of the Bayou Bartholomew. Other cities within the watershed include Monticello (9,146); White Hall (4,732); Star City (2,471); Dermott (3,292); and Hamburg (3,039) (U.S. Census Bureau 2000). The former two cities have boundaries which include areas outside of the watershed.

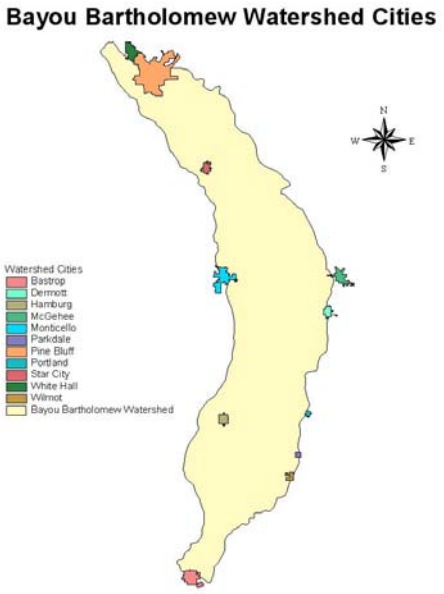


Figure 7. Cities within the Bayou Bartholomew watershed.

Jefferson County and Ashley County have shown decreases in population since 1990 by 1.4 percent and 0.5 percent, respectively. Drew and Lincoln Counties have experienced some population growth, though small. For instance, in the ten year period Drew County gained 1,354 individuals which is the largest growth of any county within the watershed.

Ninety-seven percent of the land within the watershed boundary is under private ownership (Arkansas GAP 1992). Individual ownership ranges in size from residential lots to tens of thousands of acres. Large tracts of timberland are owned by paper and timber companies. Many large farms are under the management of land trusts and are operated by tenant farmers. The majority of agricultural lands in the watershed are devoted to growing row crops such as cotton, soybeans, winter wheat, and sorghum. Rice is also grown extensively. The value of crops sold in 1997 for Lincoln County alone exceeded 80 million dollars. Confined animal operations are few; however poultry production is growing especially in Lincoln County.

State land holdings include Wildlife Management Areas which are managed by the Arkansas Game and Fish Commission. These areas include Cut-Off Creek WMA (9,080); Seven Devils WMA (4,445 acres); and the Little Bayou WMA (1,284 acres) (Arkansas GAP 1992; AGFC 2001).

The Arkansas Natural Heritage Commission owns the Byrd Lake Natural Area (144 acres) and the Taylor Woodlands (137 acres) which are both located in Jefferson County. Additionally the agency holds 900 acres of land within the Seven Devils WMA discussed above. Cane Creek State Park in Lincoln County contains a lake formed by impounding Cane Creek and covers some 1,675 acres. The Park includes 378 acres of surrounding lands (ASP 2001).

Federal ownership is limited to Overflow National Wildlife Refuge in Ashley County.

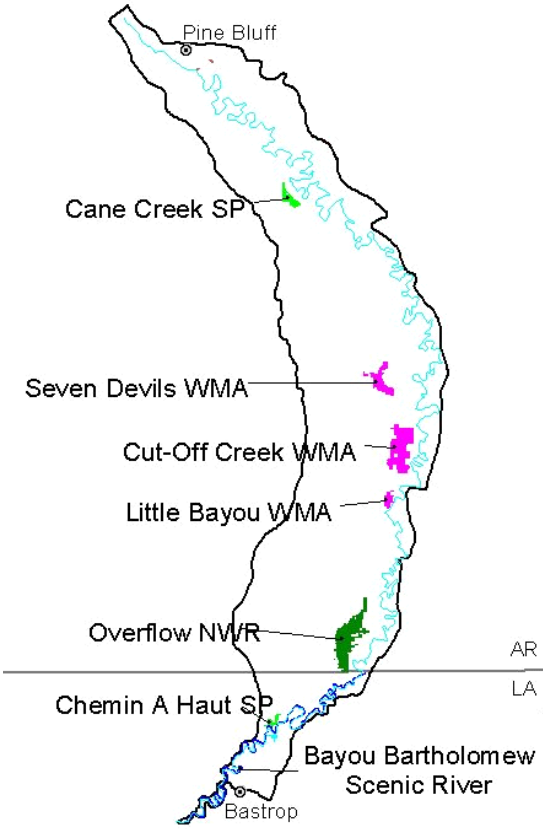
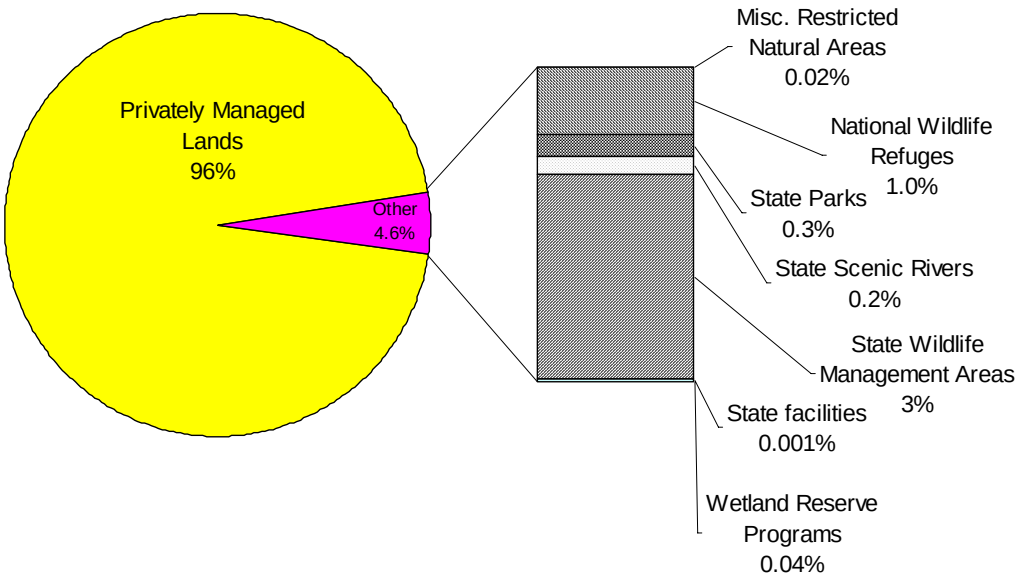


Figure 8. Public lands in the Bayou Bartholomew watershed.

Figure 9. Land ownership within the Bayou Bartholomew watershed (UARK 2004 and LSU 2004 as cited in Winrock 2005).

This 12,247 acre refuge preserves bottomland hardwood forest along Overflow Creek which is a tributary to the Bayou Bartholomew.



While agriculture and silviculture are the predominant land uses in the watershed, a relatively small work force is associated with those industries. For instance agriculture employs less than six percent of the workforce in all counties except Lincoln where it represents 11.3 percent (U.S. Census Bureau 1990). Some manufacturing occurs in especially Pine Bluff and Monticello.

The percent of individuals at or below poverty level is relatively high throughout the watershed. Layher and Phillips (2001) report nearly 25 percent of the population in all counties in the watershed to live below poverty levels. Median family income is over $10,000 below the national average and median income in all cases averages less than $9,800.

Water Quality

ADEQ has designated the following beneficial uses for the Bayou Bartholomew: (1) primary and secondary contact recreation; (2) domestic, industrial, and agricultural water supply; and (3) seasonal and perennial Gulf Coastal Plain fishery and perennial Delta fishery. ADEQ assesses 359.4 stream miles in the watershed. This includes the entire channel length of the Bayou Bartholomew, in Arkansas. Also included are Cutoff Creek and Deep Bayou.

Of the 359.4 miles of stream assessed, all meet the primary contact use, secondary contact use, drinking supply use, and the agricultural and industrial use categories. Two

hundred and ninety-nine and seven tenths miles meet the fish consumption use. Mercury levels preclude fish consumption in 59.7 miles of the lower Bayou Bartholomew and Cutoff Creek below Seven Devils WMA. This includes 16.8 miles of Cutoff Creek and 42.9 miles of the Bayou Bartholomew. The source of mercury contamination is not known, although similar problems exist in other watersheds throughout southern Arkansas.

The aquatic life use is only fully supported in Cutoff Creek. It is not supported in the entire length of the Bayou Bartholomew in Arkansas according to ADEQ (2002). Aquatic life use is also not supported in Deep Bayou. The aquatic life use is not supported due to siltation and turbidity (Layher and Phillips 2001; ADEQ 2002). Silt loads and turbidity are consistently high in these streams (ADEQ 2002). ADEQ's 2004 305(b) report indicates that the entire length of the Bayou Bartholomew still does not meet aquatic life uses.

The Arkansas Department of Environmental Quality has operated monitoring stations on the Bayou Bartholomew for some time. Various types of monitoring activities have occurred. Sampling stations for water quality are given in Figure 10. Long term monitoring sites have been in operation near Ladd, Arkansas (OUA33) and near Jones, Louisiana (OUA13). Each of these sites contains over 200 records for turbidity and total dissolved solids collected between 1989 and 1999. Generally these stations reflect values recorded by inspectors on a monthly basis. Other stations are sampled bimonthly for a two year period as part of a roving network implemented by ADEQ. These sites then remain un-sampled for a ten year period when the roving system again returns to the watershed. Sites included in this latter category are BYB01 at Highway 82, BYB02 on Highway 4 near McGehee, and BYB03 at Garrett Bridge in Lincoln County. Two tributaries also are monitored as part of the roving network. These include COC01 and COC02 on Cutoff Creek near Boydell and Monticello respectively,and OUA01151, Deep Bayou south of Grady. Some special study sites also are sampled by ADEQ for other information such as fish communities (ADEQ 2001).

Turbidity is one of the major problems in the Bayou Bartholomew. Turbidity is caused by movement of soils from croplands into the stream resulting in siltation as well.

ADEQ (2002) listed the entire length of the Bayou Bartholomew in Arkansas as being impaired. The stream was also listed as remaining impaired on the 303 (d) list prepared by ADEQ for their 2004 305 (b) report which is in preparation at the time of this writing. Ten years of data collected at long term monitoring sites between 1989 and 1999 show a mean turbidity value south of Ladd, AR of 48.52 (n = 224). The range spanned from a value of 1.80 to 620.00 NTU's. Values for turbidity near Jones, LA ranged from 7.50 to 265.00 NTU's with a mean of 50.25. At both sites, turbidity was the only parameter to consistently exceed water quality standards. Values for turbidity at roving network sites were appraised by ADEQ (2001) for years 1994 through 1996. Nine samples were taken for three of the sites and eight for the remaining two sites. Turbidity values ranged from: 12.00 to 58.00 at Highway 82 with a mean of 31.22; 6.10 to 160.00 at Highway 4 with a mean of 52.71; 8.20 to 140.00 at Garrett Bridge with a mean of 64.47. Values exceeding the water quality standard represented 55, 78, and 89 percent of samples respectively. Cutoff Creek samples exceeded the standard 38 percent of the time at Boydell and 50 percent of the time near Monticello. Values were similar with both ranging from around 7.00 NTU's to 85 NTU's.

Researchers bring in a load of fish after electrofishing the bayou's waters.

Fish communities have been sampled two years during the grant period, 2000 and 2001, at seven sites on the Bayou Bartholomew. Data were compared to samples from the same sites using the same methods collected in 1992-94. Additional sampling has occurred in years 2003, 2004, and will be conducted in 2005 at the same seven sites as well as six lower sites which were also sampled in 1992-1994. Improvements in fish communities and diversity have been noted and a separate report has been developed on these assessments (Layher and Phillips 2001).

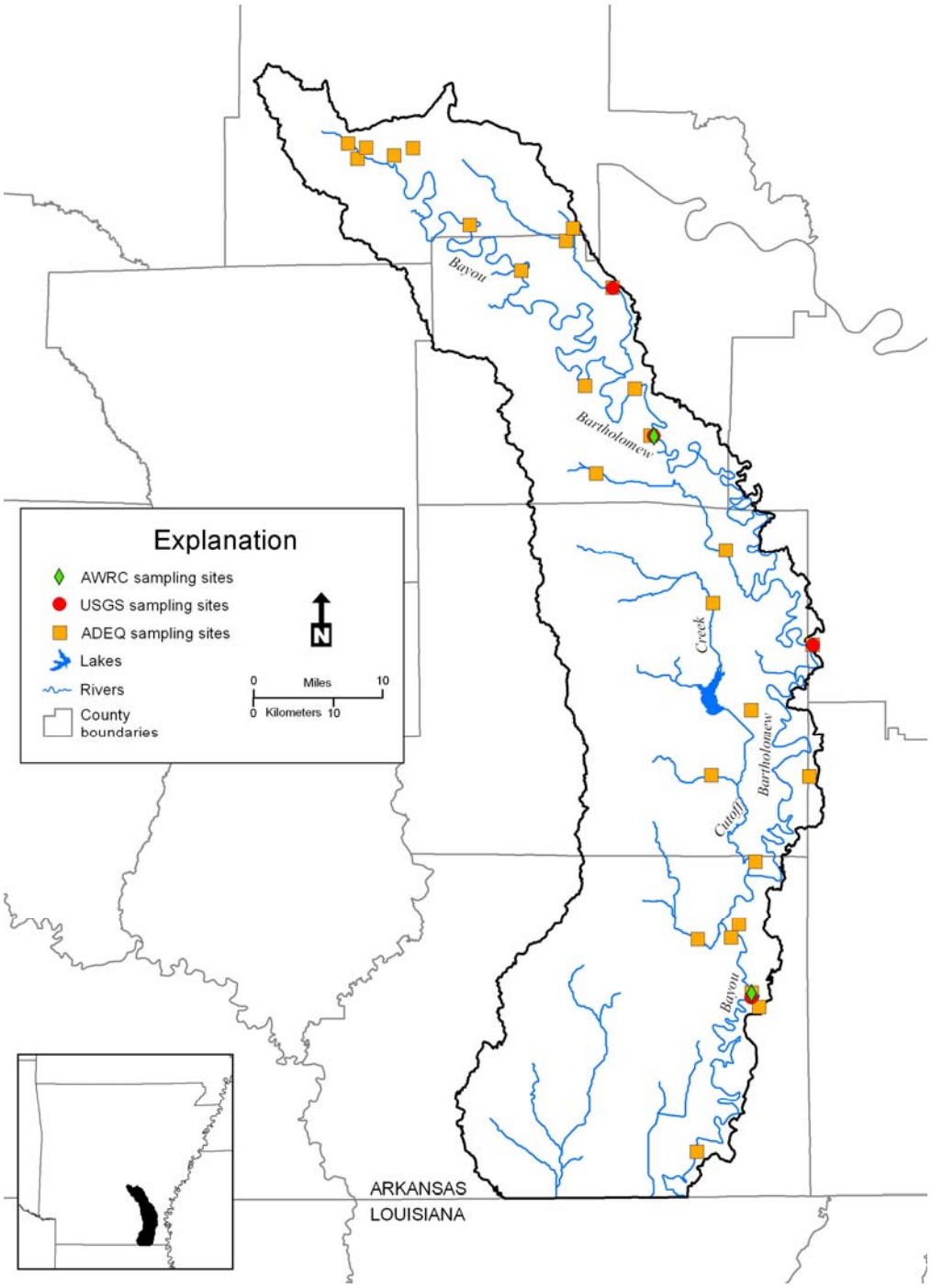


Figure 10. **Monitoring stations located on the Bayou Bartholomew**. Does not include fish sampling stations monitored by Layher BioLogics RTEC, Inc. for the Bayou Bartholomew Alliance (Figure from 2005-2009 NPS Management Program draft).

Chapter 2
What Has Been Done

Bayou Bartholomew Alliance

The Bayou Bartholomew Alliance was created in 1995 by a concerned citizen from Drew County, Dr. Curtis Merrell. His concern stemmed from the fact that while crossing Bayou Bartholomew six times on the way to and from work every day for years, he noticed that the Bayou was choked with trash and the water flowing in its channel was more often than not very turbid. He coordinated a public meeting which was held at the University of Arkansas at Monticello to assess public concern and potential support. A number of state and federal agency personnel were invited to give presentations related to what was known at the time about the Bayou Bartholomew. From this beginning, the Bayou Bartholomew Alliance became incorporated and received an IRS 501(c)3 classification. A board of directors was nominated from the citizens who expressed interest in the stream. Varied interests were represented by board members including farming and landowner representation, business interests, environmental interests, and recreational users.

Dr. Curtis Merrell, founder and President of the BBA visits with George Pugh, landowner and member of the BBA Board of Directors.

One of the first orders of business of the developing organization was to develop a purpose. The goals of the BBA were identified as follows: (1) to improve water quality in Bayou Bartholomew in Jefferson, Lincoln, Chicot, Drew, Desha, and Ashley Counties; (2) to restore and preserve the bayou's natural beauty; (3) to educate the public, especially students, about the esthetic and ecological value of the Bayou and historic significance to the region; (4) to enhance the benefits to fish, wildlife, and public recreation; and (5) to improve overall benefits to landowners adjacent to the bayou.

Early in the proceedings of the organization it was recognized that for significant progress to be made towards the goal of restoring the Bayou Bartholomew, partnerships would have to be made not only with private landowners but with state and federal agencies as well. In order to facilitate communication with these entities, a "technical support group" (TSG) was organized. Included in this group of twenty-three members were representatives from many state and federal agencies as well as private interests such as the forestry industry representatives. Included in the original TSG were representatives from the Arkansas soil and Water Conservation Commission, Arkansas

Game and Fish Commission, Division of Volunteerism, Bayou Bartholomew Alliance, Northeast Delta RC&D of Louisiana, USDA Natural Resources Conservation Service, University of Arkansas Cooperative Extension Service, Environmental Protection Agency, Arkansas Department of Pollution Control and Ecology, U.S. Fish and Wildlife Service, Ducks Unlimited, and the U.S. National Biological Survey. This group continues to meet as necessary to review what is being done in the watershed, by whom, and what new efforts should be made or what direction should be taken. New TSG members are added as interests are identified. Currently, some 60 representatives of various organizations and interests are invited to attend TSG meetings which are also open to the public at large.

One of the first tasks of the TSG was to identify problems being experienced by the Bayou Bartholomew, identify potential causes and sources of these problems, list potential corrective measures for the Bayou Bartholomew, and identify possible funding sources and sources of technical expertise which might assist in implementing corrective measures. The Bayou Bartholomew Alliance in cooperation with the Arkansas Soil and Water Conservation Commission in 1996 published the findings of the TSG in a document titled "Short and Long Term Strategies for Restoring Bayou Bartholomew". This document served as a guide for restoration efforts in the Bayou Bartholomew watershed. In 1999, the plan was updated and published by the Arkansas Soil and Water Conservation Commission as the Bayou Bartholomew Watershed Restoration Action Strategy. The same items which were identified in the previous document as problems were reiterated. Together these two documents have served as a guide for the BBA to accomplish its goals. While reports contain much more detail, Table 1 provides a summary of most of the major accomplishments of the Bayou Bartholomew Alliance following the guidance of the above mentioned plans.

The following is a summary of the problems and potential causes identified by the TSG (in bold) and subsequent actions that were taken to address the problem.

1. **Not surprisingly, the first problem listed by the TSG was sediment which also related to turbidity. Cropland, riparian land uses, stream banks, construction, bed load, silviculture, and county roads were all items listed as areas of possible concern related to this problem.**

Project 99-400, Bayou Bartholomew North grant from the Arkansas Soil and Water Conservation Commission provided the Bayou Bartholomew Alliance with some of the necessary resources to begin working on nonpoint source pollution problems in the Bayou Bartholomew Watershed. The grant provided funds to two county conservation districts, Jefferson and Lincoln, to hire water quality technicians. These technicians were to work within their counties and within the Bayou Bartholomew watershed to accelerate farm planning and implementation of best management practices in an effort to improve water quality in the Bayou Bartholomew watershed. Additionally, these technicians were to work closely with the Bayou Bartholomew Alliance coordinator. Each county conservation district received a contract under this grant which addressed reporting requirements of conservation district accomplishments. Computer hardware and software

were provided to the counties to track progress in conservation planning including the mapping of locations of work in ArcView. This project addressed the upper portion of the watershed, an area encompassing some 253,400 acres above a point on the stream in Lincoln County known as Garrett Bridge. Farm plans were to be developed on some 300 farms out of a total of 572 farms. Some 100 farms in Lincoln County occur below Garrett Bridge in the watershed. This grant provided the beginning for this massive watershed effort. A second 319 grant was applied for to continue the conservation measure work. Reporting has been provided to ARSWCC on a quarterly basis throughout the grant periods. These grants have been instrumental in getting the Bayou Bartholomew Alliance in a respected position within the watershed. Activities of the Alliance continue as a result and outgrowth of this grant which provided the foundation to begin work in the watershed in earnest.

The water quality technicians have worked closely with the BBA Coordinator to identify problem areas along the Bayou. The BBA has received outside grants to purchase trees for planting riparian areas along the bayou to native hardwoods. The BBA provided nearly one and a half million hardwood seedlings to rural landowners during the past few years to accelerate riparian improvement to reduce erosion from adjacent fields.

The County Conservation Districts and District Conservationists with NRCS, along with incentives provided by the Bayou Bartholomew Alliance such as hardwood seedlings, have collectively installed conservation practices on over 29, 012 acres of land. This is equal to an area of 45.33 square miles. In a watershed of over one-million acres, this is only 02.648 percent of the watershed. Considering that nearly all of these practices were installed on farm lands, the amount of farmland in the watershed represents thirty five percent of the watershed area or about 372,718.13 acres, then 7.78 percent of farmlands have been treated. Common practices used include tree plantings CP3), hardwood tree planting (CP3A), permanent wildlife habitat (CP4D), shallow water acres for wildlife (CP9), filter strips CP21), riparian buffers (CP22), and wetland restoration (CP23), all as part of the Conservation Reserve Program. Various programs commonly used in the watershed are listed in Appendix III, Table 1. Amounts of land area enrolled during 319 grant programs administered through the Arkansas Soil and Water Conservation Commission in each practice are given in Appendix III, Tables 2-8. Nearly all of these practices were installed on the Bayou Bartholomew main stem. Some 11,302.2 acres have been enrolled in CRP in Arkansas in the Bayou Bartholomew watershed. Soils where practices were installed were primarily Rilla soils (ASWCC 1999). NRCS and Conservation District employees provided estimates of soil loss prevention provided by CRP practice. It is estimated that 74,252.2 tons of soil per year are now prevented from directly entering the Bayou Bartholomew from these practices alone. Mulching was performed on 484 acres, land leveling on 2,138.3 acres and various EQIP soil management practices on another 9,404.7 acres. If an average of four tons per year of soil were prevented from eroding with these practices, in total this represents nearly 221,614, 400 tons of soil loss prevention per year which translates into an average of 607,162.73 lbs/day from washing off into receiving streams. Acres currently treated within sub-basins are listed in Appendix III, Table 10. We were unable to provide a map depicting where practices are located, however such maps were prepared in each NRCS

County office with their assistance. Using ArcView, sub-basin boundaries were overlaid to calculate acres in practices enrolled within the sub-basins. A request was made to be able to provide this information, to review conservation plans, to calculate load reductions from specific farm plans, and to use this information for water quality modeling purposes and watershed planning. The request to utilize the information in these specific ways was denied at the local, state, and national levels of NRCS as well as the request to include a watershed map depicting distribution of conservation practices.

Several demonstration projects have been completed under this grant. Three demonstration projects were completed in Jefferson County and to date, four in Drew County. These projects were primarily directed at large gulley erosion projects that involved reshaping the fields, developing grassed waterways, and installing drop pipes. Gulley erosion is a major problem along certain areas of the Bayou Bartholomew.

The Ashley County Conservation District received a grant in 2000 which allowed the purchase of a no-till drill. This equipment was rented to area farmers to allow them to increase use of no-till practices and to see if the method worked on their farms. Over 1200 acres of winter pasture was planted each of three years resulting in an average soil saving of 3 tons per acre per year for a total of 10,800 tons of soil prevented from entering the Bayou Bartholomew (Ashley County Conservation District (2003).

2. Nutrients were listed as a possible concern. Potential causes were listed as point sources, agricultural practices, sediment, water from runoff and tailwater from irrigation, and septic systems.

County Conservation Districts and the NRCS have worked with poultry operations to develop nutrient management plans to control poultry litter application and prevent runoff into receiving streams. They have also used EQIP programs to fence livestock from riparian areas and provide out-of-stream watering facilities.

3. Illegal dumping was recognized as a major problem. The lack of dump facilities, lack of recycling programs, lack of waste management services, and lack of education were all cited as contributing factors to this problem.

Numerous cleanups have taken place

These volunteers braved stormy weather to clean up a bridge dump site on the bayou.

using volunteers, county equipment and personnel, and other resources. Over 148 tons of trash has been removed from the stream. Volunteers have brought vehicles, winches and personnel equipment to remove appliances, furniture, and other large items from the stream. The BBA has also used inmates of several area correctional facilities to assist with cleanups and seedling plantings. Clean-ups have occurred at many bridge sites including Oakwood Road, Olive Street, Hazel Street, Pinebergen, two bridges on the Lincoln-Jefferson County line, Yorktown, Cane Creek Lake area, Meroney, Able's Creek Bridge in Drew County, Parkdale in Ashley County and other county bridges. Additionally, many clean-ups have been held in drainage ditches and road ditches in Jefferson County. The county in 2005 has hired an environmental officer to enforce illegal dumping laws and write tickets to those who violate such laws.

A custom designed barge for removing logjams was built and donated to the BBA by SEAARK Marine, Inc. in Monticllo, AR.

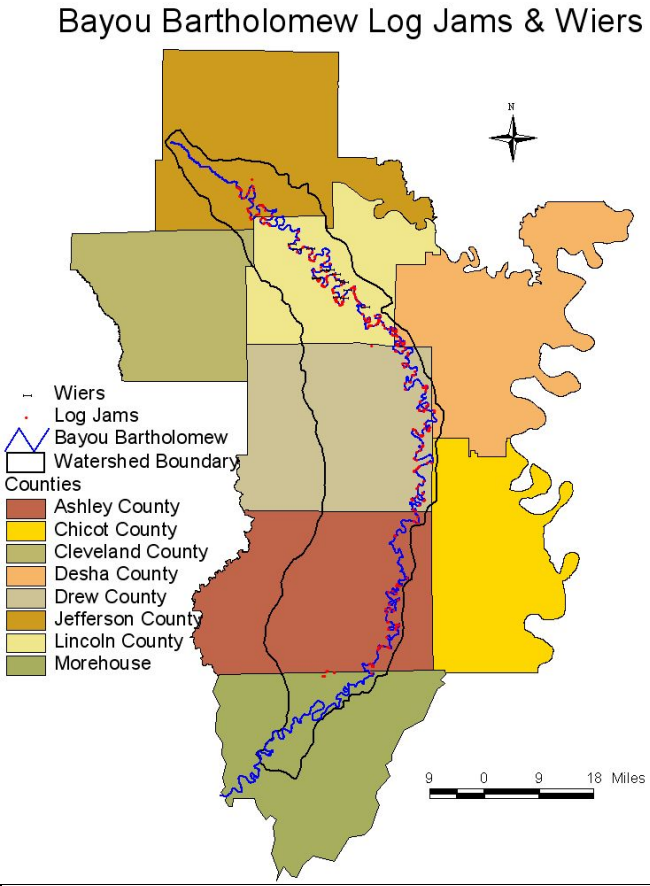


Figure 10. Logjams and weirs were marked using GPS technology while floating the bayou. Logjams have not been mapped in Louisiana.

4. **Logjams were expressed as a concern to both recreational uses of the bayou as well as contributing to channel erosion.**

Logjams were originally thought to be caused by beavers, silviculture, ice storms, agricultural practices, and stream flow.

Utilizing GPS units and ArcView, logjams and weirs in the Bayou Bartholomew were mapped (Figure 10). Logjams have produced serious bank erosion problems in many cases. Over 250 logjams were identified. These jams are the result of land clearing in the 1960's, improper timber harvesting, and natural events. The BBA has worked to "open" these logjams by

removing sections to divert flows into the main channel and to use the material removed to armor banks. To date, some 58 logjams have been treated. SEAARK Marine, Inc. built and donated a barge for removing such logjams to the BBA. This equipment will speed the effort and reduce the costs. Recently, late 2004 the Bayou Bartholomew Improvement District, donated $5,000 to hire extra summer personnel to assist with the effort. A goal of 50 logjams has been established to be opened in the summer of 2005. This will leave approximately 150 jams to be addressed in the future.

5. Instream flow concerns were voiced due to low water levels observed in the Bayou during summer months. Contributing factors associated with dewatering were thought to include water use from surface and groundwater, land management, agricultural/industrial/ municipal practices, urban development/industry, and channelization of tributaries.

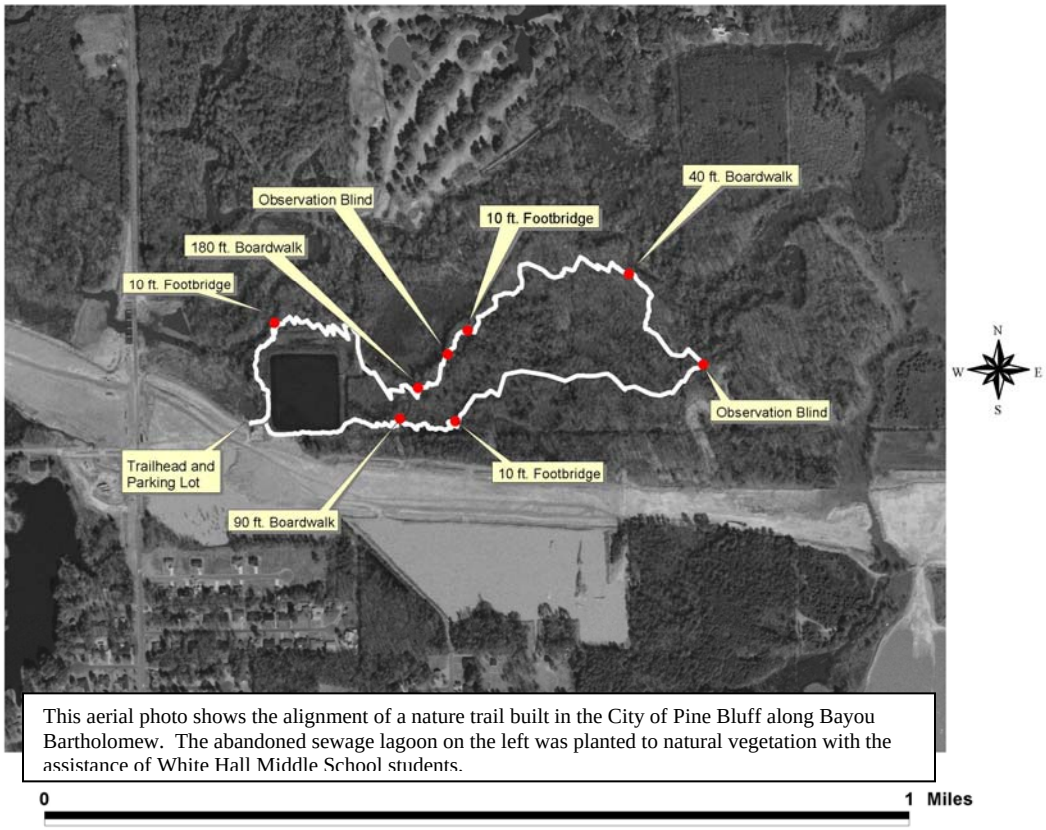
The Arkansas Game and Fish Commission contracted with Layher BioLogics RTEC, Inc. to conduct an instream flow analysis of the Bayou Bartholomew (Layher and Phillips 2000). That study was completed using historic flow information from USGS gauging stations on the stream. The report was completed in May 2000. Recommendations were given by month to maintain historic levels of fish populations or percentages of those populations. To date, no agencies have addressed the need to establish minimum flows on the Bayou Bartholomew though estimates by the University of Arkansas indicate that as much as 86 percent of the surface water during the growing season in diverted for irrigation from the Bayou Bartholomew.

6. **Though encompassing many causes, habitat alteration was a major concern. The following were listed as causes: wetland drainage, land use changes, development, channelization/maintenance, instream flow issues, logging, and agricultural practices.**

The Bayou Bartholomew Alliance has worked closely with the City of Pine Bluff to find ways to protect riparian areas within the City Limits. Most of the flood way is within the Parks and Recreation Department plans for eventual use as a greenway. The BBA has worked with local organizations to conduct cleanups of Byrd Park on the Bayou Bartholomew. The BBA applied for and received a grant from the Arkansas Highway and Transportation Department to develop a nature trail 1.78 miles in length along the Bayou. This will ensure use of the property in a manner that will reduce and prevent nonpoint source pollution. Local donations were acquired in the amount of $25,000 to match the $96,000 trail grant.

The BBA worked with area schools to reclaim an old sewage lagoon along the Bayou Bartholomew. Students planted the lagoon to cypress trees and other vegetation.

Bayou Bartholomew Interpretive Nature Trail Project Site Plan



This aerial photo shows the alignment of a nature trail built in the City of Pine Bluff along Bayou Bartholomew. The abandoned sewage lagoon on the left was planted to natural vegetation with the assistance of White Hall Middle School students.

Seven workshops were held to educate landowners and those working with riparian forest areas as to various alternatives to manage their forest- lands in an environmentally friendly manner. Workshops were held in Star City, Monticello, Hamburg, Pine Bluff, and McGehee. These locations represent all counties within the Bayou Bartholomew Watershed.

Participants heard presentations from the Bayou the Bartholomew Alliance, University of Arkansas-Monticello School of Forestry, the Arkansas Forestry Commission, and the Arkansas Forestry Education Foundation.

Approximately 134 people attended the 2001 workshops (in Pine Bluff 60 people were counted but only 34 signed in), and 90 people attended the 2003 workshops. Landowners were in attendance at all workshops and represent the majority of participants. Students, United States government personal, realtors, etc. also attended. Landowners ranged from owning 1 to10, 000 acres, representing a large segment of land. The majority of all surveyed participants indicated that the day, time, and location and facilities were more than adequate for the workshop.

Four workshops were held in 2001. Workshop topics (in order of most liked) included Bayou Bartholomew Alliance Welcome, Forest Management, Logging Contracts, Conservation Easements and Tax Benefits, Streamside Management Zones and Best Management Practices, and Landowner Management Options.

Three workshops were held in 2003. Workshop topics (in order of most liked) included Estate Planning for Forest Owners, Forest Management, Cost Share Programs, Bayou Bartholomew Alliance Welcome, Herbicide application, Best management Practices and Contracts.

Participants consistently voted Wildlife Management, Wetlands Management and Land Management Plans to be topics that they would like to learn about. "Contracts" was the topic consistently voted that they would like least to learn about.

Newsletter announcements (Bayou Bartholomew Alliance) and word of mouth were the most successful methods of advertisement for the workshops. Local newspaper ads and television commercials were also effective methods of advertisement for workshops. The majority of the participants wrote that they enjoyed the entire clinic and would attend future workshops.

Benefits of the workshops included informing landowners of ways to minimize soil disturbance, prevent erosion, and better care for streamside areas during timber harvesting. Alternatives to timber harvest such as conservation easements will also produce benefits to the stream, especially by preventing bank-side disturbances. While the benefits towards reducing nonpoint source pollution are not directly measurable, numerous landowner contacts were made, much information from the workshops was distributed through news articles, and undoubtedly landowners are better informed as to how to manage their riparian lands.
Current projects include the Bayou Bartholomew Watershed Initiative, A program that began in September 2003, and is funded under a US Environmental Protection Agency grant. The program is implemented by Winrock International in partnership with the Louisiana branch of The Nature Conservancy and the Bayou Bartholomew Alliance.

This program is focusing on addressing identified problems within the watershed plan associated with: 1) sedimentation, 2) log jams, 3) habitat alteration, 4) rock weirs, and 5) diverse uses and interest. Other problem areas in the watershed outside the scope of this grant are being addressed through other funding sources. Purposes of the Watershed Initiative grant include the following:

To improve water quality on Bayou Bartholomew through land restoration projects that produce environmental credits, thereby bringing economic benefit to rural landowners in the watershed, as well as introduce private land restoration funding to supplement government funding of environmental restoration in the watershed; and to be able to provide information to landowners to further programs such as conservation easements to assist in preserving natural habitats on the Bayou Bartholomew and tributaries, thereby protecting water quality.
Identify and quantify the potential value of environmental assets in the Bayou Bartholomew watershed.

1.1 Produce a portfolio of potential environmental assets projects to present to investors, including utility companies, land trusts, and foundations.
1.2 Develop delivery mechanisms for transferring revenues from environmental assets to private landowners and credits to investors.
1.3 Provide technical assistance and training to the BBA on how to conceptualize and implement environmental asset projects.

The first subtask is to identify and quantify the potential value of environmental assets in the watershed. Subtasks 1.2--1.4 will be completed during year two.

The specific areas mentioned for crediting under Subtask 1.1 listed in the proposal are divided into 3 classes for the purposes of the analysis:

1. Carbon sequestration for climate change mitigation
2. Terrestrial habitat restoration (forests)
3. Sedimentation reductions/water quality restoration for aquatic habitat restoration

Models are being developed to produce maps that depict credits for all three of these. This GIS modeling methodology will develop ranked scores for each item (carbon, habitat and sedimentation reduction) although aggregate scores will also be produced for overall environmental services. This process is based on weighted linear combination operation (weighted averaging) where certain objectives are given greater or lesser weights by the stakeholders and local decision-makers to identify the areas of highest environmental value for a project.

Using publicly available national datasets, the carbon sequestration potential can be assessed for the afforestation on the watershed's existing agricultural and grazing lands. The associated costs involved in implementing such projects are also being analyzed - including opportunity costs on the lands to be planted. Both of these inputs will create maps of the areas with the highest potential to sequester carbon at the lowest cost over three time periods 20, 40 and 80 years

The carbon sequestration data is being developed from the interpretation of the data contained in the STATSGO database on predominant tree species and their site index and growth potential (http://water.usgs.gov/GIS/metadata/usgswrd/ussoils.html).

By using the predominant tree species, site index and potential yearly growth it is possible to develop growth curves that estimate carbon (or biomass) through time (20, 40 and 80 years). Allometric equations have been prepared by Winrock International

foresters using data gathered during field expeditions in bottomland hardwood stands in the region and a review of the pertinent literature sources.
The grazing management exercises that are being performed are for afforestation practices only. Being such, the afforestation methods will be identical to those performed for the agriculture/afforestation with the exception that they will be concerned with the grasslands and pasture/hay land-use types instead of the row crop/small grain designations used in the agriculture analysis
The total acreage of each crop type is available from the USDA's 1997 agriculture census (http://www.nass.usda.gov/census) at the county level only. Thus, to quantify carbon sequestered in the soil of row crops and small grains, a county-based analysis is being conducted. The carbon quantities will be based on the 1997 county-level statistics and then applied to more spatially explicit land-use types (row crops/small grains). Post & West (2002) provide sufficient data to predict carbon sequestration from no-till conversion for the crops of corn, soybeans and wheat.

The amount of carbon sequestered by each crop type will be further adjusted with the texture of the soil on which the crop is located. Coarse soils sequester soil carbon at a decreased rate relative to medium or fine textured soils. Thus, medium-textured soils will receive the average sequestration measured in Post & West's 2002 report. Coarse soils will receive the average sequestered carbon minus one standard deviation and fine soils will receive the average sequestration carbon plus one standard deviation.

1.4 Develop a GIS-based registry for environmental assets
1.5 Project outreach and knowledge transfer

Task 2. Use existing data from representative reaches of Bayou Bartholomew as the foundational basis for developing a water quality improvement plan to reduce sedimentation. Arkansas Department of Environmental Quality (ADEQ).

2.1 Review existing watershed assessment data.
2.2 Perform erosion inventory on selected sites based on existing assessment data.

Work with the Arkansas Department of Environmental Quality (ADEQ) will take place during year two of the project. ADEQ will acquire, organize and package existing GIS data for the watershed with special attention to datasets not readily available outside the region including data on water quality and flows that will help in classification of streams and ranking of sites for pilot project activity. ADEQ will work with other partners to identify, gather and organize data from local studies and pilot projects that have been implemented in the region for which data are available.

Task 3: Develop a demonstration project to improve water quality through a proactive protection program for threatened freshwater mussel populations in the Bayou Bartholomew Watershed using conservation easements and a modeling program based on using mussels as indicator species of sedimentation.

Objective: Guide the development of a conservation easement program by the Bayou Bartholomew Alliance.

3.1 Identify reaches of the bayou that harbor high relative densities of threatened mussels and high levels of diversity among aquatic components by overlaying spatially explicit records of occurrence with GIS layers that represent the full range of habitat types present in the watershed.

7. Diverse uses and interests were cited as something which needed to be addressed. Uses of the stream included agriculture, public access, hunting, fishing, recreational uses, commercial fishing, point source discharges, and illegal dumping.

During its first year of existence the BBA operated totally on volunteer efforts and small donations. In 1996, the BBA received its first grant funding from the McKnight Foundation through the Winrock International Foundation in the sum of $9,000. The Weyerhauser Family Foundation provided a grant of $25,000 that same year and followed it with grants of $15,000 in 1997 and $10,000 in 1998. These grants provided for operation of the BBA and much effort went into identifying landowners in the watershed and getting the BBA off the ground. In October of 1996 the BBA received a grant from the National Fish and Wildlife Foundation for $25,000. These funds went entirely to purchase hardwood tree seedlings to give to landowners who were putting marginal farmlands back into forests. Additional funds were received from the NFWF in later years to purchase seedlings. Potlatch and International Paper also provided small grants for assisting with educational efforts and to purchase seedlings. Potlatch also provided a number of seedlings for BBA to disperse. Through these efforts the BBA distributed 1.2 million hardwood seedlings to farmers in the watershed free of charge.

The ADEQ provided grants for several years to the BBA which helped to cover operational expenses beginning in 1997. These grants were invaluable to maintain the continuity of work began by the BBA. The Arkansas Soil and Water Commission provided a small grant to print brochures outlining the goals and purposes of the BBA.

In January of 1998 the BBA retained Layher BioLogics RTEC, Inc. to help conduct BBA business. Dr. William Layher was established as the point of contact with that organization. He had sampled the Bayou Bartholomew fish populations for some years for organizations such as the U.S. Fish and Wildlife Service, the National Biological Survey, and the U. S. Geological Survey. Those efforts provided much baseline information to monitor changes occurring to aquatic communities since initiation of efforts by the BBA.

Dr. Layher currently serves as chairman of the Technical Support Group which assists in identifying direction for the Bayou Bartholomew Alliance: integrates various state, federal, and local programs; provides technical expertise to address problems; and identifies potential funding sources. Much of the coordination of volunteers, writing of grant proposals, and implementation of funds is also coordinated by the consulting group.

8. Lack of public access was described as a concern that had to be addressed within the context of private ownership, legal issues, funding for access development, and the identification of willing sellers.

When the Bayou Bartholomew Alliance first began operation the only public access on the Bayou was at Cane Creek State Park where a boat ramp was located. Since then, a boat ramp has been installed at the bridge crossing on Highway 82 in Ashley County west of Montrose, AR. Two other boat ramps are nearing construction. One is located in upper Ashley County on the Little Bayou Wildlife Management Area and the second is located in Pine Bluff on property donated by Wal-Mart.

A nature trail has been constructed in Pine Bluff which has been described previously under item 6, above. Other areas have been given to the Bayou Bartholomew Alliance which may be developed as interpretive nature trails.

9. Improper application of pesticides/herbicides was thought to be an issue of concern. Potential causes included application mistakes/spills, lack of education, equipment, lack of enforcement of regulations, lack of erosion control, improper use of land or pesticides, improper calibration of equipment, improper application equipment, and lack of consultation services.

Use of chemicals in agriculture has been addressed through programs of the Cooperative Extension Service as well as in conservation plans developed by the NRCS and County Conservation Districts. Educational programs, workshops, and news articles have all been used to help educate the public on proper pesticide uses.

10. Chemical barrels were noted in the bayou. It was thought that these represented illegal dumping of either old containers, or possibly, hazardous waste. Reasons for their presence included lack of dump sites, lack of recycling programs, lack of waste management services, and cost factors as well as lack of responsibility of agencies who might assume regulation of such disposal.

Chemical barrels were first noted in the Bayou Bartholomew in 1992. Most of the barrels noted were in upper Ashley County. At the time, no agency would direct anyone on what to do with these barrels. Most barrels were metal and have since decomposed. Occasional plastic barrels are located today and recovered during clean-ups on the Bayou.

11. Rock weirs were cited as obstacles to flow, possible in-channel erosion causes, causes of excess siltation of stream channels, and obstructions to low flows, fish passage, and recreational watercraft.

The NRCS in Jefferson County worked with a landowner to renovate an existing weir to perform in a more environmentally acceptable manner. This project was located on the Jefferson-Lincoln county line. The Bayou Bartholomew Alliance is currently working with a landowner farther downstream to renovate an existing weir nearly 300 meters in length so it will divert flows to the middle of the channel, afford fish passage, and passage by recreational crafts. Additionally the design will prevent bank erosion and erosion of the weir itself which has been a major problem it the past, with the landowner

continually adding fill material to the existing structure. This project is further described under item 6.

12. Though related to instream flow issues, improper management of irrigation water was also a potential concern. This was thought to be caused by lack of education, lack of technical assistance, lack of regulation/enforcement, mismanagement of irrigation and tailwaters, and absence of water management plans.

The Cooperative Extension Service received two 319 grants aimed at disseminating information to crop producers. In a first project beginning in 1998, the agency worked with cotton farmers to document crop production using conservation tillage practices. After documentation of results, tours were conducted to encourage other area farmers in the watershed to adopt such approaches. A second project was initiated in 2000, to promote the voluntary adoption of soil and water conservation practices on croplands with a view toward reducing turbidity in receiving waters. Irrigation management plans were also developed to conserve water resources as part of these demonstration projects.

13. Low dissolved oxygen was observed by some researchers at several sites in the Bayou. Excess nutrients, low instream flow values, and riparian conditions were all thought to be causative factors.

This problem has not been directly addressed however reduction of sediment runoff and nutrient control measures are thought to alleviate this problem. Low dissolved oxygen is still a problem in sections of the Bayou and may be addressed by a future TMDL.

14. Lack of information exchange and education was cited as a problem in addressing issues within the watershed. Lack of funding, organization, common data bases, and cooperation, as well as improper perceptions, education gaps, and diverse interests were all thought to contribute to this factor.

Newspapers at the local and state level have reported on many of the activities of the BBA. Articles have run on grants received, visiting officials from other countries, tree plantings, school student involvement, and rock star promotion of conservation efforts, history items clean-ups and other activities. All of this media effort has provided the Alliance with recognition and credibility in the eyes of local citizens.

The Alliance continues to hold Technical Support Group Meetings to coordinate activities of state, local and federal agencies' activities within the watershed. These meetings are held on an as needed basis to foster good working relations among all of the entities involved in the watershed.

The BBA has been active in participating in many community events such as Sports-o-rama's, fairs, hunter education, etc. The Alliance has provided many presentations to clubs, organizations, schools, church groups and others. Through these efforts the activities of the BBA are fairly well known through out the watershed.

The BBA has published a quarterly newsletter with funds provided through local contributions, industry and outside grants. This newsletter is mailed to over 1,000 individuals in the watershed and is also distributed at local events and activities. The newsletter contains information on the watershed, activities, history, fish and wildlife resources and other topics. It has evolved from a black and white simple publication to one containing colored pictures of watershed resources.

The BBA has developed a website with pertinent information on it as part of another grant. The website, www.accessarkansas.org/bba/, contains past newsletters, maps, photos, board member information, goals of the BBA, teaching modules and other information.

The Alliance developed a number of teaching modules to be used by area science teachers in middle and high schools. Modules contain information, key words, definitions, activities, contacts, and ideas for projects. A workshop was held for teacher training.

Additional grants have been found to conduct other activities ranging from tree planting, logjam removal, and timber management practices for landowners, etc.

Much effort is expended to work with groups such as boy scouts, girl scouts, 4-H clubs, etc. to promote environmental awareness and assist with community service. These efforts have helped promote environmental responsibility and the City of Pine Bluff has begun a recycling center and conducts routine clean-ups of the city.

The BBA has participated with farm tours to promote conservation practices such as no-till farming, mulch till, buffers and other practices. Efforts have been made to work with other organizations such as the Nature Conservancy and Ducks Unlimited to accomplish goals of compatible interests.

The Bayou Bartholomew Alliance received a grant and matching dollars from private individuals to fund the writing of a book, *Bartholomew's Song: a Bayou History*, which was published by Heritage Books, Inc. (DeArmond-Huskey 2001). This book contains much historical information about the Bayou Bartholomew, its watershed, the land use changes that took place, and even the efforts for restoration.

15. Mercury was also considered a problem in the Bayou Bartholomew. Sources were speculated to be either atmospheric or geologic in nature.

A TMDL is currently being prepared for mercury in the Bayou Bartholomew watershed. As sources of mercury contamination have not been identified in the watershed, actions have largely been limited to health advisories and notifications regarding fish consumption in the lower part of the Bayou Bartholomew in southern Ashley County.

Table 1. A Summary of Major Bayou Bartholomew Alliance accomplishments.

1) Worked to insure that the Bayou Bartholomew was listed as an impaired stream and listed in the top ten by the state of Arkansas for water quality restoration. This made both state and federal assistance programs available to landowners who voluntarily enrolled in conservation practices.

2) Have provided nearly 1.5 million hardwood tree seedlings to landowners who enrolled in CRP and WRP programs. Riparian corridors have been established along the Bayou for an estimated 100 miles.

3) Obtained grants to hire personnel in county conservation district offices to accelerate conservation planning on farms under the direction of NRCS District Conservationists.

4) With volunteers, BBA has removed 148 tons of trash from the Bayou Bartholomew.

5) Have disseminated information on the ecological and historical significance of the Bayou Bartholomew by giving 100's of presentations to schools, civic clubs, church groups, and government personnel. We have conducted workshops for teachers and developed teaching modules on topics relative to the bayou for use in science programs.

6) Have obtained grants to construct some eight demonstration projects directed at major soil erosion problems on landowners property.

7) Have obtained funds to restore an old weir to demonstrate how such weirs should be constructed to allow for both fish passage and small watercraft passage and maintain stream function.

8) Have established a conservation easement program to protect existing riparian hardwood forests, thereby giving landowners the opportunity to preserve the forests and still obtain some financial benefit.

9) On donated properties, BBA has constructed a 1.78 mile-long nature trail along the Bayou Bartholomew in Pine Bluff. This allows community use, preserves the stream, prevents erosion, and offers educational opportunities. Some landowners have donated additional property to allow further trail development in the city.

10) Have conducted a series of workshops to educate landowners and timber harvesters as to methods to insure that logging practices have minimal impacts on water quality in the bayou.

11) Have kept the public informed by producing a quarterly newsletter, having articles published in newspapers, and by TV appearances.

12) Formed a Technical Support Group which is composed of representatives from state, federal, and local agencies as well as private industry. All uses of the Bayou Bartholomew's natural resources are represented, from landowners to government to environmental interests. This group provides continuous direction.

Chapter 3 Future Actions Needed

Element 1 - Causes and Sources of Pollution

The ADEQ has recently prepared a 2004 303 (d) listing of streams in Arkansas that are impaired. All segments monitored in the Bayou Bartholomew have been placed in category 4a which lists streams for which a TMDL has been prepared. Using five years of water quality data, 10/1998 through 9/2003, and special survey data, it was determined that the aquatic life use for all Bayou Bartholomew segments remain impaired. Causes of this impairment include silt for all sites. The predominant source is listed as agriculture. Lower stream segments are also impaired by mercury however the cause is listed as unknown. A TMDL has been prepared for mercury (FTN & Associates 2002). In addition, the 2004 303 (d) list, currently awaiting EPA approval, lists four segments of the Bayou as being impaired by total dissolved solids, and three segments impaired because of low dissolved oxygen concentrations. The primary contact recreation designated use is listed as impaired on eight tributary segments because of excessive bacteria concentrations.

FTN Associates, Ltd. (2002) completed the TMDL for turbidity in the Bayou Bartholomew, Arkansas segments. The document assumes that agriculture is the primary source of turbidity. References for identifying that source were cited by FTN Associates, Ltd. (2002) from the Bayou Bartholomew Alliance (1996) and ADEQ (2001a).

The Bayou Bartholomew Alliance also reported that other potential causes of siltation include cropland, riparian disturbance, stream banks, construction, bed load, silviculture, and county roads. The BBA has concluded that stream bank erosion may be a large contributor of siltation and turbidity in the watershed due to the large numbers of logjams. These logjams fill with silt and become plugged by litter and trash, thus blocking stream channels entirely, causing the stream to erode around the logjams and create new channels. Logjams in the Bayou Bartholomew have been mapped with over 250 known to occur in the 269 mile segment of the stream in Arkansas. The primary causes of turbidity listed above have been reiterated throughout a number of state, federal and nonprofit organization reports.

Construction erosion and associated filling of wetlands within the City of Pine Bluff in the past two years has resulted in recent high turbidity levels in the Bayou Bartholomew. Large land areas uncovered without any sediment controls resulted in large movements of clay soils into the Bayou. Other construction activities included the positioning of new sewer lines longitudinally through stream channels causing massive erosion, filling of wetlands, and large silt loads to the Bayou Bartholomew (Layher 2005).

Element 2 - Load Reductions from BMP's and Load Reductions Necessary to Achieve Goals

Turbidity standards for streams in the Gulf Coastal Plain are set at 21 NTU; for Delta streams the standard is 45 if streams are "least-altered" and 75 NTU for channel-altered streams. Several options are needed to reach the goal of meeting water quality standards.

The TMDL for the Bayou Bartholomew watershed indicates that a reduction in turbidity of 29 to 37 percent needs to occur at all stream segments during the period between December and June. Reductions ranging from zero to three percent are required between July and November. The December through June period represents the time period exhibiting the highest rainfall and also when cropland is often bare.

FTN Associates, Ltd. regressed turbidity levels against Total Suspended Solids (TSS) with the idea that the latter could be used as an indicator of for turbidity. Regressions of short term trends were not significant. Long-term relations were used then to model target goals and produced significant results though only around one-half of the variation in turbidity levels were explained by TSS. In has been suggested that much of the turbidity at some sites in the Bayou Bartholomew are caused by clay particles which pass on through membranes of instrumentation used for collecting TSS samples (Wise 2005). Hence a better indicator may be Total Dissolved Solids (TDS) which would include clay particle presence. An attempt to relate turbidity and TDS should be made in the future to establish a better predictor and goal measure.

In the TMDL document, the watershed was divided into 30 sub-basins for model output using the SWAT model. The University of Arkansas has also completed more recent SWAT modeling efforts for the basin. In their analysis, the watershed was divided into seventy-six smaller units approximating 14 digit HUC codes (Appendix II, Figure 1). This analysis produced maps depicting percentile rankings for flow, phosphorous, nitrogen, and sediment (Appendix II, Figures 2-5). A list of sub-basins is provided in Appendix II, Table 1. Rankings for sub-basins for sedimentation are given in Appendix II, Table 2.

Element 3 - Management Measures Needed to Achieve Goals

To date the Bayou Bartholomew Alliance has worked with conservation organizations to re-forest riparian lands along the Bayou Bartholomew main-stem. Sub-watersheds which exhibit significant erosion problems or contributions to sedimentation identified by data, knowledge of conservation personnel, or modeling, should be targeted for BMP installation and focus. An evaluation of sub-watersheds should occur while work begins on those which are known to have significant problems related to soil loss. In the short term, the next three years, two sub-basins have been selected to implement BMP's to reduce turbidity in the Bayou Bartholomew.

Degraded water quality is one of the most obvious problems in the watershed. The major cause of impairment is turbidity and sedimentation (ADPCE 1996). Agricultural

activity is thought to be the major contributor of those pollutants (ASWCC 2002). Nearly one-sixth of the sediment load is thought to emanate from Cousart and Deep Bayou portions of the watershed, watershed 1604 (ASWCC 2002). Turbidity standards are not being met on Jack's Bayou, Cousart Bayou, or Deep Bayou; the former two streams are tributaries of Deep Bayou. Base flow turbidity criteria are also not being met on Overflow Creek in the southern portion of the Bayou (ADEQ 2001). Deep Bayou is located in the upper watershed on the eastern border of the watershed in Jefferson and Lincoln counties. FTN Associates, Ltd. (2002) completed a TMDL for the Bayou Bartholomew in Arkansas. Reductions in turbidity were recommended in all reaches of the watershed analyzed. Necessary reductions were targeted from 29 to 37% during December through June, the period exhibiting the highest historical flows. Both sub-watersheds targeted in this grant were identified as areas of high priority for restoration in the Bayou Bartholomew Wetland Planning Area Report (Layher BioLogics RTEC, Inc. 2001). Recent analysis of conservation efforts in the watershed by Layher BioLogics RTEC, Inc. as part of the development of this "nine-element watershed plan", indicate that little conservation effort has been implemented in the sub-watersheds of Overflow Creek and Deep Bayou. Reducing sedimentation in these sub-watersheds is necessary to restore water quality in the Bayou Bartholomew. Deep Bayou is currently proposed to be listed as impaired. It was not considered impaired earlier and hence was not included in the analysis performed by FTN Associates, Ltd. (2002). Deep Bayou should have water quality standards set like those of Coastal Plain streams as it is a major tributary of Bayou Bartholomew. Currently its water quality standard for turbidity is that of a channel altered ditch and the stream is a major contributor of sediment to the Bayou. Deep Bayou's turbidity standard is 75 NTUs for primary flows and 250 NTUs for storm flows. A turbidity standard for the Bayou Bartholomew which receives flows from Deep Bayou is 21 NTUs for primary flows and 32 NTUs for storm flow events. Water quality standards for Deep Bayou should be equal to those of the receiving stream, the Bayou Bartholomew.

In the short term, over the next three years, eighty percent of efforts in BMP installation will be conducted in these sub-watersheds. It is estimated that some 40 percent of erodable lands will be treated in the two sub-basins resulting in a reduction of 30 percent of the sediment transport from these major tributaries to the Bayou Bartholomew. The Deep Bayou sub-basin contributes nearly 30 percent of the sediment load carried by the Bayou Bartholomew. Reducing this load by 30 percent will thereby reduce Bartholomew sediment loads by nearly 10 percent. In Ashley County, soil loss reduction as a result of 75 new conservation plans in the Overflow Creek sub-basin will result in an estimated savings of 67,500 tons per year. Priority areas were determined using various reports and data identified above. Monitoring activities will be conducted to determine if practices installed in the watershed result in increased aquatic life support capabilities of the system. Data will be analyzed and incorporated into annual reports addressing the success of the project with the assistance of the Technical Support Group. Certain practices installed are thought to have a high degree of sustainability, such as CRP re-forestation. While government contracts may run for 15 years, because most lands enrolled are marginal for crop production, it is commonly felt that the cost of removing established hardwoods on such lands would result in the areas being left in timber until

harvestable in the future which may be 50 to 80 years. Areas enrolled in conservation easements are in perpetuity. Logjam removal is subject to climatic conditions, but once removed it is believed that minimal maintenance would be required to keep the channel open and prevent further in-channel erosion from that source. Specific management measures to be completed in the short term over the next three years are summarized below.

Aerial photos will be examined for evidence of gulley erosion in Deep Bayou. Field inspection of suspected areas will be conducted. Deep Bayou itself will be surveyed to locate additional areas to be targeted and to record any problems contributing to NPS pollution. Data will be recorded using GPS technology and mapped.

Gulley erosion problems identified above will be addressed through a cost share program developed by the Lincoln County Conservation District. Fifteen areas will be selected based on developed criteria and problem identification for cost share assistance.

Technical Assistance will be provided to landowners in the targeted watersheds. Technical assistance will target new conservation plans in the two identified sub-watersheds. As such measures are still needed in other parts of the watershed, 20 % of those activities may be outside of the two targeted sub-watersheds. Areas which would connect established riparian corridors would be targeted for planting to fulfill various needs such as establishing wildlife corridors as well as reducing sedimentation. Before and after estimates of soil loss reduction will be calculated using standard NRCS methods and reported.

Each sub-watershed should be evaluated to determine the location of areas which are not buffered. These areas should be enrolled in appropriate conservation programs such as Conservation Reserve Programs including either grass filter strips or hardwood tree plantings. Landowners should be encouraged to establish riparian buffer strips, stabilize stream- banks, and restore riparian forests.

Technical assistance should be directed at landowners in other sub-watersheds exhibiting the highest rates of erosion or areas that are eroding. Conservation planning should be accelerated in those areas to assist landowners with both technical and monetary resources to address erosion problems. Conservation plans should address BMP's that are known to be most effective in reducing sediment detachment and transport to receiving waters. Such practices might include no-till, ridge till, conservation till, and drop outlets for agricultural lands. Additionally, areas suffering from gulley erosion should be examined to determine the possibility of using drop-pipes and land smoothing to reduce significant gulley erosion.

Riparian protection in areas currently forested should be addressed through the continuation of a conservation easement program to prevent erosion and stream-bank disturbance. Forestry practices which address riparian protection should be encouraged. Fencing of livestock should be encouraged through EQIP programs or others to prevent bank denuding and subsequent erosion.

The continued removal of logjams and illegal dumps should be carried out. It is thought that logjams cause major in-channel erosion. A geomorphic analysis of the impact of logjams on stream bank erosion should b conducted. Litter often plugs logjams and causes more severe bank erosion.

GIS data were used to plot logjams in the Bayou Bartholomew main-stem. Stream bank erosion was thought to be a minor contributor to turbidity by many reports. However, over 250 logjams have been found in the main channel, and each causes significant bank erosion. Total loads from this source have not been calculated but may well equal other causes of turbidity. Local efforts to educate the public, to prevent trash dumping and resolve illegal dumping, is still a concern though much reduced by past efforts.

The conservation easement program of BBA will be continued in an effort to protect lands along the Bayou or its tributaries from development that would result in further NPS pollution. Additionally BBA would continue to provide hardwood seedlings to landowners in an effort to enhance conservation program enlistment.

The Bayou Bartholomew Alliance should support and work with the City of Pine Bluff and other entities in Jefferson County to implement its program related to storm water runoff. Specifically the City of Pine Bluff should adopt regulations directed at reducing turbidity caused by construction runoff. The Bayou Bartholomew Alliance should continue its programs of public outreach and education which are discussed more fully under public participation. The BBA should further explore the possibility of developing an environmental credits program which may provide other avenues for the implementation of BMP's to control sedimentation and erosion.

Element 4 - Technical and Financial Assistance Needed to Achieve Goals

The following describes the monetary requirements to complete each item listed above. Items listed as federal are proposed to come from 319 grant funding as funds are available. Those listed as matching dollars for each task would be derived from foundations, nonprofit organizations, industrial sponsors, local government, private donations, fund raising activities, or in-kind volunteer services. Costs given reflect those dollars needed to fully implement the short-term three year goals. Costs for the next three years would be similar to those identified for the first three years; however different sub-basins may reflect different solutions thus altering estimates. It is anticipated that after fifteen years, the thirty sub-basins representing the most severe contributions of silt and turbidity would be addressed. Work in other sub-basins would be conducted by Conservation Districts and NRCS staff on a routine basis during the course of this project.

Three thousand dollars would be required to produce a QAPP to insure proper sampling techniques and protocols for sampling and data recording and analysis to assess fish

populations and community changes in Deep Bayou, Overflow Creek, and Bayou Bartholomew during the time for which the project is implemented. This QAPP will follow a former QAPP which provided guidance for fish monitoring in Bayou Bartholomew under previous 319 grants.

Fifty-two thousand dollars would be required to sample fish populations at thirteen sites in the Bayou Bartholomew the second and third years of the grant and to sample fish populations for three years in targeted sub-watersheds of Overflow Creek and Deep Bayou. An additional $15,000 could be provided with in-kind services of labor provided by volunteers. Data will be compared to data previously collected at those same sites in the Bayou Bartholomew. Fish sampling stations will also be established on Overflow Creek and Deep Bayou. The sub-watersheds are targeted for restoration and have not been previously sampled. Fish population changes can be used to assess whether or not the aquatic life in these streams are responding to nonpoint source pollution control measures. Electrofishing gear will be obtained from AGFC under a cooperative agreement.

Deep Bayou is a sub-watershed located in the upper northeast east portion of the Bayou Bartholomew watershed in Jefferson and Lincoln Counties. This sub-watershed has been identified as contributing major silt loads to the Bayou Bartholomew. General inspection indicates a large number of eroding banks and gulleys that enter deep Bayou. A detailed inventory of the sub-watershed identifying locations of gulley erosion sites is needed to assist implementation of BMP's. It is estimated that $7,200 would be required to examine aerial photos, conduct field inspection of identified sites, and conduct an instream survey to locate additional problem areas. One thousand two hundred dollars of the total would be provided by in-kind assistance.

To reduce soil erosion and nonpoint source pollution from farmlands draining into Deep Bayou, drop pipe structures will be used to control gulley erosion. The Lincoln County Conservation District will establish a funding priority system to make cost share assistance available to landowners. This program will be implemented with funds derived from both federal and state programs if available. It is estimated that $10,000 federal dollars would need to be matched with $15,000 from state funds.

We estimate that it will require $5,000 to assess the impact of BMP implementation on Deep Bayou utilizing cross-sections of the stream which will be surveyed annually. A minimum of five cross-sections will be established and recorded with GPS units. These sites will also be the locations of fish sampling efforts in Deep Bayou

Cross-sections will be established on Overflow Creek to assess the impact of BMP implementation; cross-sections of the stream will be surveyed annually. A minimum of five cross-sections will be established and recorded with GPS units. These sites will also be the locations of fish sampling efforts in Overflow Creek. This effort will require $5,000.

An estimate based on past grant activities and associated costs indicates that it will require nearly $240,250 in federal funds if available and matching funds and services totaling some $315,000 to full implement items provided under technical assistance. Technical assistance would be provided to farm operators and urban landowners in the Bayou Bartholomew watershed to protect and enhance water quality in receiving streams and wetlands. The Conservation district Water Quality Technicians must receive up-to-date training to develop sound conservation plans and ensure proper techniques are employed.

Specifically in Lincoln County, landowners currently not enrolled in farm programs directed at reducing erosion or preventing nonpoint source pollution will be contacted to be made aware of such opportunities. Conservation plans will be developed on farms which previously have no plans or are in need of updating. Annual status reviews to ensure implementation of with applicable programs will be made. Status reviews are yearly follow-ups of farms that have cost-share practices to check on progress to see if there needs to be any revisions or modification to the Conservation Plan Contract. Annual practice reviews are evaluations of individual conservation practices that landowners and farmers perform to reduce erosion, sedimentation or other concerns pertaining to the bayou or associated habitats and need to be conducted for evaluating compliance with appropriate farm bill programs which the landowner has enrolled in. For example, the following are commonly used annual practices: implementing no-till, seasonal residue management, nutrient management, pasture and hay-land management.

In Jefferson County, conservation plans will be developed on farms which previously have no plans or are in need of updating. Status reviews will also be performed to insure compliance with federal programs. Annual status reviews will also be made. Riparian buffer development and riparian forest plantings will be targeted along existing stream corridors with at least one-half of the effort in the short term being applied to the Deep Bayou sub-watershed.

In Ashley County, conservation planning will be targeted for the Overflow Creek sub-watershed. Status reviews and structural practice reviews will be conducted to insure that BMP's have been properly installed and are functioning as designed.

Opportunities for landowners will be provided through a conservation easement program to protect existing riparian areas which are currently of high quality. Tree seedlings will be provided to landowners as an incentive to enter conservation programs to restore riparian and wetland areas in need of enhancement. Areas needing restoration and donated through easements to BBA will also receive tree seedlings to improve riparian buffers. It is anticipated that if available, $45,000 of federal assistance would be matched with $365,000 of matching funds obtained through foundations, grants, and private donations.

The Bayou Bartholomew Alliance should strive to provide opportunities for the public to participate in efforts to maintain the Bayou, to provide for public input into those activities and to keep the public advised of activities being implemented. As part of this effort, the BBA should coordinate with the City of Pine Bluff, the University of Arkansas

at Pine Bluff, the Cooperative Extension Service in Jefferson County, and the City of White Hall to insure that information and workshops they disseminate and hold for home builders, construction companies, and the general public under their municipal separate storm sewer systems (MS4) contains information targeting the importance of decreasing siltation in the Bayou Bartholomew. The BBA should provide workshops for county road departments to address county road building and maintenance. Additional opportunities would be provided for volunteers to assist with clean-up of illegal dump sites, trash and litter. Log jam removal operations are high profile events which often provide for public participation. This will also help reduce in-channel erosion from this source as previously described. The Bayou Bartholomew Alliance should continue its efforts in working with news media including newspapers, magazines, TV, and radio stations to keep the public abreast of activities and accomplishments. Tours of the Bayou, distribution of the popular BBA newsletter, and presentations to civic groups and schools are also necessary to continue public education and garner support for the restoration of the watershed. All of these activities for a three year period, the short term, are expected to cost nearly $422,850 of which $217,500 would be federal dollars if available.

Element 5 - Public Participation: Public Education and Outreach

Volunteers will be utilized to man display booths, give presentations, conduct clean-ups, help to plant trees, and assist in log jam removals among other activities. Public participation has been crucial in the past to accomplish what has been done (see Chapter 2). Participants may also help to organize newsletter content, maintain website information, conduct fund raising activities, assist with nature trail development, and conduct educational workshops or presentations to various groups. An award and recognition program which gives credit to volunteers should be established to promote public interest and good relations.

Nine major clean-ups of illegal dump sites or sections of the Bayou will be conducted at a rate of three per year for the short term. Sites will be selected based upon observation, prior identification by inventory, or those reported to the BBA coordinator by the public. Clean-ups will be advertised in advance through local newspapers and by notices provided to local civic organizations. Counties will be contacted to solicit trailers, trucks; heavy equipment and land-fill use.

Fifty log jams per year, for a total of 150, will be opened with help from volunteers. Logs removed from such jams will be anchored to the banks for stabilization projects or floated to backwater areas. These efforts will reduce instream channel erosion which is considered by ADEQ, Winrock, TNC, and BBA to be a major contributor to sedimentation in the Bayou Bartholomew.

The BBA should continue its programs of public awareness by conducting clean-up days, writing news articles, giving presentations, setting up displays, conducting tours, maintaining a web site, and distributing newsletters. A major effort would be made to remove logjams causing in-channel erosion using public volunteers for assistance.

The BBA should continue to provide educational workshops to landowners related to BMP's for agriculture and silviculture activities. Presentations to groups such as civic clubs, schools, church groups, hunter education classes and others should continue to keep the public informed of progress, restoration efforts, and what they can do to help achieve goals of the nine element plan. Using volunteers to conduct clean-up efforts, remove logjams, plant trees, build nature trails and assist with other activities will help to insure the public image of the project and build relations with the public for support. The BBA should continue to work with reporters to provide information for news articles, TV shows, radio programs, and other media efforts to promote the nonpoint source plan and project. The BBA should also continue to provide instructional materials to teachers and students in area schools and provide opportunities for student and classroom involvement in various aspects of the project.

The following represent specific goals for the short term related to public education and outreach:

A total of nine news articles will be prepared and distributed to area newspapers by the BBA or local reporters over the three year short term period. These articles will focus on efforts of the BBA or conservation districts to reduce nonpoint source pollution in the watershed.

A total of twenty-four presentations will be made to schools, civic groups, clubs, or other organizations to increase awareness of conservation efforts related to the Bayou Bartholomew watershed. Eight such presentations will be made per year. Topics may include water quality, sedimentation, and habitat restoration, agricultural and silvicultural practices, among others. Displays will be set up at various events of public participation throughout the watershed for a total of 36 display days at the rate of 12 per year.

The public or select groups will be invited to participate in tours of the Bayou or project activities to educate individuals as to the importance of the bayou, inform of the ecology of the watershed, or to demonstrate various BMP's in the watershed. Three such tours will be conducted per year for a total of nine tours during the three year grant period.

The BBA website will be maintained and updated to provide the public with general information about the Bayou as well as to advertise upcoming events such as cleanups, log jam removals, workshops, et cetera. Newsletters will be posted on the website. Newsletters will be produced on a quarterly basis and are currently mailed to over 1,000 individuals, primarily landowners along the Bayou Bartholomew.

Element 6 - Schedule of How to Implement Plan

An overall schedule of the necessary tasks to successfully implement the plan and outputs is summarized in the table at the end of this section. Items in the table reflect specific actions to be taken in the short term, the next three year period of work on restoration of the Bayou Bartholomew. In the long term, after completion of these items, similar efforts would be engaged on two or more sub-basins. This process would be repeated over the long term, fifteen year period, until all sub-basins in the 60^{th} percentile and above

categories for sediment were addressed. Selection of sub-basins for future work would be derived from discussions and evaluation by the Technical Support Group. Evaluation of more sub-basins, at least six, should occur during the short term so that BMP implementation can begin following the period of short term completion. The following discussion reflects the time period associated with each aspect of the plan. Monitoring activities are included in this section as timing of establishing baseline information is critical to adequately judge progress being made toward goals (see also: **Establish Monitoring Requirements to Assess Criteria**).

Fish populations will be sampled at thirteen sites in the Bayou Bartholomew and populations estimated. These sites represent sites previously monitored under former 319 grants. Continuation of monitoring is essential to stay informed of the response of aquatic life to changes in the watershed. These thirteen sites would be sampled during 2006 and 2007. Five sample sites each would be established on Deep Bayou and Overflow Creek. These sub-watersheds have been targeted as needing restoration efforts. These ten additional sites would be sampled in 2005 to assess current conditions before BMP installation, and then in following years, 2006, 2007, and 2008. No previous population data has been collected on Deep Bayou or Overflow Creek. A report will be prepared after the third year to address changes in fish populations and fish species diversity as a result of BMP implementation in the respective steams' watersheds.

During the first six months of the plan, we will examine existing aerial photos of the Deep Bayou sub-basin to determine sites of soil erosion from gulley development. A field inspection of identified sites will be performed to determine severity of the problem in each location. We propose to conduct a survey of Deep Bayou from the stream itself by watercraft to pinpoint any other gulley erosion locations, eroding banks, illegal dumps, etc., not identified in previous subtasks.

The Lincoln County Conservation District will develop a funding priority system for landowners who apply for cost share assistance to rectify gulley erosion problems. The priority system will be reviewed by ASWCC for approval. Fifteen gulley erosion sites will be selected to receive assistance for installing drop pipes or related conservation practices to solve gulley erosion problems contributing to silt loads in Deep Bayou. Measures implemented at sites will be installed at the rate of five or more per year until the goal of fifteen is reached. In an effort to identify reduced siltation in Deep Bayou, we will establish the locations of cross-section placement. Cross-sections will be surveyed at the beginning of the project in 2005 and annually in 2006, 2007, and 2008. Twenty contacts will be made with landowners each year over a three-year period for a total of 60 contacts in an effort to enroll their properties in conservation programs. Conservation plans will be developed at a rate of twenty per year for a total of 60 plans after three years of plan implementation. Annual status reviews to ensure implementation of with applicable programs will be made on 40 farm plans per year for the three-year period for a total of 120 reviews

Annual practice reviews will be conducted on 20 farm tracts per year for a total of 60 farm tracts in Jefferson County. Thirty conservation plans will be developed per year for

the three-year period for a total of 90 plans. Annual status reviews will be performed on 200 farm tracts over a three year period, 70 each of the first two years and 60 the third year to ensure implementation with applicable programs. Another goal is to develop 900 acres of riparian buffers and 1200 acres of additional forested areas in the watershed. One-half of these acres will be located in the Deep Bayou sub-watershed area. A target of 300 acres of riparian buffers for each of the three years and 400 acres of re-forestation per year are established.

Conservation plans will be developed on farms in Ashley County which previously have no plans or are in need of updating. Twenty-such plans will be developed per year for the three-year period. Of 60 plans developed, at least fifty will be within the Overflow Creek sub-watershed located in the southwestern portion of the Bayou Bartholomew Watershed. Annual status reviews to ensure implementation of with applicable programs will be made on 20 farm plans per year for the three-year period for a total of 60. These status reviews are yearly follow-ups of farms that have cost-share practices to check on progress to see if there needs to be any revisions or modification to the Conservation Plan Contract. Structural practice reviews to ensure compliance with specifications will be made on 10 such implemented structures per year for the three-year period. These reviews are necessary to ensure that BMP's have been implemented properly and are functioning as designed. In Ashley County, cross-sections on Overflow Creek will be surveyed at the beginning of the project in 2005 and annually in 2006, 2007, and 2008.

The BBA will continue to promote and advertise its Conservation Easement Program. This program will target the protection of unique riparian areas that are in need of preservation. Currently small logging practices continue to denude stream banks in the basin. Five easements per year will be enrolled for a total of 15.

The BBA will continue to provide hardwood tree seedlings to landowners in the watershed provided that such seedlings will be used to restore riparian and wetland areas draining into the Bayou Bartholomew watershed. Areas selected will be prioritized from information acquired in the inventory of areas in need of restoration and information from Conservation Districts. Tree plantings will target a goal of 60,000 seedlings for year two and year three of the plan. The schedule of implementation for items related to public participation and related to public education and outreach can be found under the appropriate titles.

The following table identifies major items that need to be addressed to implement the short term plan presented herein. It includes BMP implementation, education and outreach efforts, and monitoring.

Description	Start Date	Completion Date
Fish Sampling QAPP Development	07/01/06	09/01/06
Fish Population Sampling	07/01/06	10/01/09
Fish Sampling Report	10/01/06	10/30/09
Aerial Photo Examination for Deep Bayou	07/01/06	08/30/06
Field Examination of Gulley Erosion Sites	07/30/06	10/30/06
Survey of Deep Bayou from Stream	07/01/06	08/30/06
Develop Funding Priority System	07/01/06	09/30/06
Conservation Measures within the Deep Bayou Sub-watershed	07/01/06	07/30/09
Determine Locations of Cross-Section Placement on Deep Bayou	07/01/06	07/30/06
Survey Cross-Sections at the Beginning of the Project in 2005 and Annually in 2006, 2007, and 2008	07/01/06	08/30/09
Determine Locations of Cross-Section Placement on Overflow Creek	07/01/06	07/30/06
Survey Cross-Sections at the Beginning of the Project in 2005 and Annually in 2006, 2007, and 2008	07/01/06	08/30/09
Landowners Contacts, Lincoln County (60)	07/01/06	07/01/09
Conservation Plans, Lincoln County (60)	07/01/06	07/30/09
Status Reviews, Lincoln County (120)	07/01/06	07/30/09
Annual Practice Reviews, Lincoln County (60)	07/01/06	07/30/09
Conservation Plans, Jefferson County (90)	07/01/06	07/30/09
Annual Reviews, Jefferson County (200)	07/01/06	07/30/09
Riparian Buffer and Re-forestation, Jefferson County (900 acres and 1200 acres)	07/01/06	07/30/09
Conservation Plans, Ashley County (75)	07/01/06	07/30/09
Status Reviews, Ashley County (90)	07/01/06	07/30/09
Structural Practice Reviews, Ashley County (30)	07/01/06	07/30/09
Conservation Easement Program (15)	07/01/06	09/30/09
Riparian Tree Planting (60,000 seedlings)	07/01/06	07/30/09
Clean-up, Hard Hat Days (9)	07/01/06	08/30/09
Log Jam Removal (150)	07/01/06	09/30/09
News Articles (9)	07/01/06	09/30/09
Presentations (24 talks-36 display days)	07/01/06	09/30/09
Public Bayou Tours (9)	07/01/06	09/30/09
Newsletter and Website (quarterly)	07/01/06	09/30/09

Element 7 - Milestone Recognition and Re-evaluation Process

The number of specific items to be implemented each year of the plan can be found in the **Schedule of How to Implement the Plan** section. The implementation of BMP's can easily be monitored to see if the project is on schedule and number of BMP's implemented at any point in time is what was established as goals. The Technical Support Group should meet at least twice a year to evaluate progress and insure that the plan is on track and that milestones were reached as identified within the plan. Items listed under **Measures of Success and Performance** will be reviewed by the Technical Support Group at each meeting to insure that re-evaluation and milestone recognition is both timely and continuous; and also to plan which sub-watersheds should be targeted for succeeding years.

Measures of Success and Performance:

Measures of success can be used to determine if progress is being made toward overall plan goals. Appropriate data will be collected to determine whether goals have been met or are on schedule to be met by quarterly reporting on those items listed under **Schedule of Plan Implementation**. Such data will be viewed periodically throughout the project to ensure that goals are being met and that yearly milestones are achieved. The milestones for successive years beyond the short term will be laid out in detail by the TSG as new sub-basins are selected for focus. The BBA Technical Support Group will meet twice each year to review progress related to the nine element plan. The following items correspond to measures which are to be implemented to successfully carry out this nine element plan or to track progress of certain aspects of the plan. The completion of these items within the timetable presented above will insure that the plan is being implemented in a manner to accomplish the overall goals presented.

1) Approved QAPP Plan.
2) Fish field data sampling forms.
3) Final Fish population report.
4) Inventory data sheets for Deep Bayou.
5) Funding priority system document for cost-share projects in Deep Bayou sub-basin.
6) Plans and bids and final invoices for projects completed.
7) Map depicting locations of gulley erosion areas in Deep Bayou.
8) Map depicting cross-section placement in Deep Bayou.
9) Cross-section survey data sheets and profiles.
10) Map depicting cross-section placement for Overflow Creek.
11) Cross-section survey data sheets and profiles for Overflow Creek.
12) Excel file of locations, acres, practices, slope, and soil types for all conservation plans and practices planned and implemented with respective dates and before and after estimates of soil loss using standard NRCS methods.
13) Shape files for all plans and practices.
14) Excel file with locations for all reviews completed.
15) Maps depicting locations of trees planted.
16) Maps depicting areas enrolled in conservation easements.

17) Tables showing acreages to be enrolled in activities 1 and 2.
18) Lists of clean-up locations, dates, participants, quantity.
19) Map depicting locations of log jam removals.
20) Copies of news articles.
21) Lists of presentations, display days, workshops, and tours with date, location, event, participants if applicable.
22) Lists of location, date, participants, for tours.
23) Copies of newsletters.

Element 8 - Identification of Performance Criteria

The overall goal of the project is to fully meet all designated uses of the Bayou Bartholomew and tributaries within fifteen years from the time of implementation of this nine element plan. The following criteria are established to provide indications that advancement toward the overall goal of the project is being attained:

1. Fish monitoring at sites in stream segments targeted for improvement show increases in numbers of sight feeders, community structure, diversity, and species richness without evidence of decline in improved conditions from year to year.;
2. Fishery uses of the stream are improving as noted by increased use of the stream for angling purposes as indicated by creel surveys.
3. Examine water quality monitoring data to identify trends in numbers of samples which exceed turbidity standards. Also examine water quality data to identify reductions in Total Suspended Solids and Total Dissolved Solids.
4. Public support and volunteer efforts for the project increase by ten percent per year.

Element 9 - Establish Monitoring Requirements to Assess Criteria

Cross-sections will be surveyed on Overflow Creek at the beginning of the project and yearly thereafter for three years determine impacts of conservation efforts in the sub-watershed.

Cross-sections will be surveyed on Deep Bayou at the beginning of the project and yearly thereafter for three years to determine impacts of conservation efforts in the sub-watershed.
A QAPP will be prepared by Layher BioLogics RTEC, Inc. on behalf of the Bayou Bartholomew Alliance for conducting fish sampling on Deep Bayou, Overflow Creek, and the Bayou Bartholomew.

Fish sampling will be completed on the streams named above as per guidance outlined in an approved QAPP As described in sections above, the fish community should be assessed at least every other year in the Bayou Bartholomew main channel as in previous studies. Implemented BMP's may just be beginning to show effects on fish communities which may lag one to three years behind improved water quality due to reproductive requirements and recruitment of juveniles into the populations. Sub-basin streams should

be monitored for fish population changes by selecting at least five sites within the sub-basin primary stream for sampling at the beginning of projects affecting that sub-basin. Sampling should occur at those sites for at least three years during implementation of BMP's to observe changes in standing stocks, fish diversity, and occurrence of species which may have previously eliminated from the sub-basin due to siltation and/or turbidity. . A final report will be prepared assessing the data obtained from fish sampling activities to determine if aquatic life support of the targeted streams has improved or is being met due to project activities.

Monitoring requirements in the watershed will assist in the determination of whether or not overall goals of the plan are being achieved. ADEQ's monitoring program at its permanent and roving sites should be continued. Sites described as roving however should be sampled more frequently than every 8 to 10 years for a two year period. These roving sites should be sampled each year for the duration of the project to track water quality changes throughout the basin. One additional monitoring site should be established on Deep Bayou. This basin is thought to contribute a major silt load to the Bayou Bartholomew. It is one of the first two sub-basins which are to be addressed in this plan.

Creel surveys and surveys of recreational users of the Bayou Bartholomew should be conducted to monitor changes in public use of the waterway. Increased usage may be viewed as emanating from improved conditions and public perception of the Bayou Bartholomew's water quality. This public perception would be an indicator of improvement or deterioration of the waters of the watershed.

Project Coordination:

As no single entity has the authority to implement all measures of this nine element plan, the Bayou Bartholomew Alliance will be responsible for overall implementation and plan coordination. The project would be a joint effort of the Ashley, Lincoln, Drew, and Jefferson County Conservation Districts and the Bayou Bartholomew Alliance along with assistance from Technical Support Group member organizations. The County Conservation Districts and the BBA are responsible for completing all project activities related to the installation of BMP's on agricultural lands. The Bayou Bartholomew Alliance will be responsible for overall project management and implementation with the Conservation Districts being assigned specific roles under a memorandum of agreement with the BBA and NRCS. This agreement will include provisions to insure that reporting is done in a manner that will facilitate the documenting of progress.

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Appendix I

Fish, Wildlife and Plants in the Bayou Bartholomew Watershed

Table 1. Organisms known to occur in the Bayou Bartholomew Watershed as compiled by The Nature Conservancy (2004).

Scientific Name	Common Name	Scientific Name	Common Name
Amphibians			
Acris crepitans	Northern Cricket Frog	Necturus maculosus	Mudpuppy
Ambystoma maculatum	Spotted Salamander	Notophthalmus viridescens	Eastern Newt
Ambystoma opacum	Marbled Salamander	Plethodon glutinosus	Slimy Salamander
Ambystoma talpoideum	Mole Salamander	Pseudacris crucifer	Spring Peeper
Ambystoma texanum	Smallmouth Salamander	Pseudacris feriarum	Upland Chorus Frog
Amphiuma tridactylum	Three-toed Amphiuma	Rana areolata	Crawfish Frog
Bufo americanus	American Toad	Rana catesbeiana	Bullfrog
Bufo valliceps	Gulf Coast Toad	Rana clamitans	Green Frog
Bufo woodhousii	Woodhouse's Toad	Rana palustris	Pickerel Frog
Eurycea quadridigitata	Dwarf Salamander	Rana utricularia	Southern Leopard Frog
Gastrophryne carolinensis	Eastern Narrowmouth Toad	Scaphiopus holbrookii hurterii	Eastern Spadefoot
Hyla chrysoscelis/ versicolor	Cope's Gray Treefrog/Gray Treefrog	Siren intermedia	Lesser Siren
Hyla cinerea	Green Treefrog		
Birds			
Accipiter cooperii	Cooper's Hawk	Cathartes aura	Turkey Vulture
Accipiter striatus	Sharp-shinned Hawk	Catharus guttatus	Hermit Thrush
Agelaius phoeniceus	Red-winged Blackbird	Catharus minimus	Gray-cheeked Thrush
Aimophila aestivalis	Bachman's Sparrow	Catoptrophorus semipalmatus	Willet
Aix sponosa	Wood Duck	Certhia americana	Brown Creeper
Ammospiza leconteii	Le Conte's Sparrow	Ceryle alcyon	Belted Kingfisher
Anas platyrhynchos	Mallard	Chaetura pelagica	Chimney Swift
Anhinga anhinga	Anhinga	Charadrius melodus	Piping Plover
Archilochus colubris	Ruby-throated Hummingbird	Charadrius semipalmatus	Semipalmated Plover
Ardea herodias	Great Blue Heron	Charadrius vociferus	Killdeer
Asio flammeus	Short-eared Owl	Chordeiles minor	Common Nighthawk
Asio otus	Long-eared Owl	Circus cyaneus	Northern Harrier
Athene cunicularia	Burrowing Owl	Cistothorus platensis	Sedge Wren
Bombycilla cedrorum	Cedar Waxwing	Coccyzus americanus	Yellow-billed Cuckoo
Branta canadensis	Canada Goose	Colaptes auratus	Northern (Yellow-shafted) Flicker
Bubo virginianus	Great Horned Owl	Colinus virginianus	Northern Bobwhite
Bulbulcus ibis	Cattle Egret	Columba livia	Rock Dove
Buteo jamaicensis	Red-tailed Hawk	Contopus virens	Eastern Wood-Pewee
Buteo lagopus	Rough legged Hawk	Coragyps atratus	Black Vulture
Buteo lineatus	Red-shouldered	Corvus brachyrhynchol	American Crow

	Hawk		
Buteo platypterus	Broad-winged Hawk	Corvus ossifragus	Fish Crow
Buteo regalis	Ferruginous Hawk	Cotumicops noveboracensis	Yellow Rail
Butorides striatus	Green-backed Heron	Cyanocitta cristata	Blue Jay
Calcarius lapponicus	Lapland Longspur	Hesperiphona vespertina	Evening Grosbeak
Calcarius pictus	Smith's Longspur	Himantopus mexicanus	Black-necked Stilt
Caprimulgus carolinensis	Chuck-will's-widow	Hirundo pyrrhonota	Cliff Swollow
Caprimulgus vociferus	Whip-poor-will	Hirundo rustica	Barn Swollow
Cardinalis cardinalis	Northern Cardinal	Hylocichla mustelina	Wood Thrush
Carduelis pinus	Pine Siskin	Icteria virens	Yellow-breasted Chat
Carduelis tristis	American Goldfinch	Icterus baltimore	Baltimore Oriole
Carpodacus mexicanus	House Finch	Icterus spurinus	Orchard Oriole
Carpodacus purpureus	Purple Finch	Ictinia mississippiensis	Mississippi Kite
Casmerodius albus	Great Egret	Junco hyemalis	Dark-eyed Junco
Dendroica cerulea	Cerulean Warbler	Lanius ludovicianus	Loggerhead Shrike
Dendroica coronata	Yellow-rumped (Myrtle) Warbler	Limnothlypis swainsonii	Swainson's Warbler
Dendroica discolor	Prairie Warbler	Lophodytes cucullatus	Hooded Merganser
Dendroica dominica	Yellow-throated Warbler	Loxia curvirostra	Red Crossbill
Dendroica magnolia	Magnolia Warbler	Lxobrychus axilis	Least Bittern
Dendroica pensylvanica	Chestnut-sided Warbler	Melanerpes carolinus	Red-bellied Woodpecker
Dendroica petechia	Yellow Warbler	Melanerpes erythrocephalus	Red-headed Woodpecker
Dendroica pinus	Pine Warbler	Meleagris gallopavo	Wild Turkey
Dendroica virens	Black-throated Green Warbler	Melospiza georgiana	Swamp Sparrow
Dryocopus pilestus	Pileated Woodpecker	Melospiza lincolnii	Lincoln's Sparrow
Dumetella carolinensis	Gray Catbird	Melospiza melodia	Song Sparrow
Egretta caerulea	Little Blue Heron	Mimus polyglottos	Northern Mockingbird
Egretta thula	Snowy Egret	Mniotilta varia	Black-and-white Warbler
Elanoises forficatus	American Swallow-tailed Kite	Molothrus ater	Brown-headed Cowbird
Elanus caeruleus	Black-shouldered Kite	Myiarchus crinitus	Great Crested Flycatcher
Empidonas virescens	Acadian Flycatcher	Nyctanassa violacea	Yellow-crowned Night Heron
Eremophila alpestris	Horned Lark	Nycticorax nyctiocorax	Black-crowned Night Heron
Euphagus carolinus	Rusty Blackbird	Oporornis formosus	Kentucky Warbler
Euphagus cyanocephalus	Brewer's Blackbird	Otus asio	Eastern Screech-Owl
Falco columbarius	Merlin	Pandion haliaetus	Osprey
Falco peregrinus	Peregrine Falcon	Parula americana	Northern Parula
Falco sparverius	American Kestrel	Parus bicolor	Tufted Titmouse
Fulica americana	American Coot	Parus carolinensis	Carolina Chickadee
Gallinago gallinago	Common Snipe	Passer domesticus	House Sparrow
Gallinula chloropus	Common Moorhen	Passerella iliaca	Fox Sparrow

Geothlypis trichas	Common Yellothroat	Passerina ciris	Painted Bunting
Ghondestes grammacus	Lark Sparrow	Passerina cyanea	Indigo Bunting
Grus canadensis	Sandhill Crane	Phalacrocorax auritus	Double-crested Cormorant
Guiraca caerulea	Blue Grosbeak	Pheucticus melanocephalus	Black-headed Grosbeak
Haliaeetus leucocephalus	Bald Eagle	Picoides borealis	Red-cockaded Woodpecker
Helmitheros vermivorus	Worm-eating Warbler	Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker	Spizella pusilla	Field Sparrow
Pipilo erythrophthalmus	Rufous-sided Towhee	Stelgidopterys serripennis	Northern Rough-winged Swallow
Piranga rubra	Summer Tanager	Strix varia	Barred Owl
Pluvialis dominica	American Golden Plover	Sturnella magna	Eastern Meadowlark
Pluvialis squatarola	Black-bellied Plover	Sturnella neglecta	Western Meadowlark
Podilymbus podiceps	Pied-billed Grebe	Sturnus vulgaris	European Starling
Polioptila caerulea	Blue-gray Gnatcatcher	Thryomanes bewickii	Bewick's Wren
Pooecetes gramineus	Vesper Sparrow	Thryothorus ludovicianus	Carolina Wren
Porphyrula martinica	Purple Gallinule	Tirdis migratorius	American Robin
Porzana carolina	Sora	Tringa flavipes	Lesser Yellowlegs
Prianga olivacea	Scarlet Tanager	Tringa melanoleuca	Greater Yellowlegs
Progne subis	Purple Martin	Troglodytes aedon	House Wren
Protonotaria citrea	Prothonotary Warbler	Troglodytes troglodytes	Winter Wren
Pyrocephalus rubinus	Vermilion Flycatcher	Tyrannus forficatus	Scissor-tailed Flycatcher
Quiscalus quiscula	Common Grackle	Tyrannus tyrannus	Eastern Kingbird
Rallus elegans	King Rail	Tyto alba	Common Barn-Owl
Rallus limicola	Virginia Rail	Vermivora celata	Orange-crowned Warbler
Recurvirostra americana	American Avocet	Vermivora peregrina	Tennessee Warbler
Regulus calendula	Ruby-crowned Kinglet	Vireo bellii	Bell's Vireo
Regulus satrapa	Golden-crowned Kinglet	Vireo flavifrons	Yellow-throated Vireo
Sayomis phoebe	Eastern Phoebe	Vireo gilvus	Warbling Vireo
Scolopax minor	American Woodcock	Vireo griseus	White-eyed Vireo
Seiurus motacilla	Louisiana Waterthrush	Vireo olivaceus	Red-eyed Vireo
Setophaga ruticilla	American Redstart	Vireo philadelphicus	Philadelphia Vireo
Sialia sialis	Eastern Bluebird	Vireo solitarius	Solitary Vireo
Sitta canadensis	Red-breasted Nuthatch	Wilsonia citrina	Hooded Warbler
Sitta carolinensis	White-breasted Nuthatch	Xanthocephalus xanthocephalus	Yellow-headed Blackbird
Sitta pusilla	Brown-headed Nuthatch	Zenaida macroura	Mourning Dove
Sphyrapicus varius	Yellow-bellied Sapsucker	Zonotrichia albicollis	White-throated Sparrow

Spiza americana	Dickcissel	Zonotrichia leucophrys	White-crowned Sparrow
Spizella passerina	Chipping Sparrow	Zonotrichia querula	Harris' Sparrow

Fishes

Alosa chrysochloris	Skipjack Herring	Carpiodes velifer	Highfin Carpsucker
Ameiurus melas	Black Bullhead	Centrarchus macropterus	Flier
Ameiurus natalis	Yellow Bullhead	Crystallaria asprella	Crystal Darter
Ameriurus nebulosus	Brown Bullhead	Ctenopharyngodon idella	Grass Carp
Amia calva	Bowfin	Cycleptus elongatus	Blue Sucker
Ammocrypta clara	Western Sand Darter	Cyprinella lutrensis	Red Shiner
Ammocrypta vivax	Scaly Sand Darter	Cyprinella venusta	Blacktail Shiner
Anguilla rostrata	American Eel	Cyprinella whipplei	Steelcolor Shiner
Aphredoderus sayanus	Pirate Perch	Cyprinus carpio	Common Carp
Aplodinotus grunniens	Freshwater Drum	Dorosoma cepedianum	Gizzard Shad
Carpiodes carpio	River Carpsucker	Dorosoma petenense	Threadfin Shad
Carpiodes cyprinus	Quillback	Elassoma zonatum	Banded Pygmy Sunfish
Erimyzon oblongus	Creek Chubsucker	Lepomis miniatus	Redspotted Sunfish
Erimyzon sucetta	Lake Chubsucker	Lepomis symmetricus	Bantam Sunfish
Esox americanus	Grass Pickerel	Luxilus chrysocephalus	Striped Shiner
Esox niger	Chain Pickerel	Lythrurus fumeus	Ribbon Shiner
Etheostoma asprigene	Mud Darter	Lythrurus umbratilis	Redfin Shiner
Etheostoma chlorosomum	Bluntnose Darter	Macrhybopsis aestivalis	Speckled Chub
Etheostoma fusiforme	Swamp Darter	Macrhybopsis storeriana	Silver Chub
Etheostoma gracile	Slough Darter	Menidia beryllina	Inland Silverside
Etheostoma histrio	Harlequin Darter	Micropterus punctulatus	Spotted Bass
Etheostoma nigrum	Johhny Darter	Micropterus salmoides	Largemouth Bass
Etheostoma parvipinne	Goldstripe Darter	Minytrema melanops	Spotted Sucker
Etheostoma proeliare	Cypress Darter	Morone chrysops	White Bass
Etheostoma stigmaeum	Speckled Darter	Morone mississippiensis	Yellow Bass
Etheostoma swaini	Gulf Darter	Moxostoma carinatum	River Redhorse
Etheostoma whipplei	Redfin Darter	Moxostoma erythrurum	Golden Redhorse
Fundulus blairae	Blair's Starhead Topminnow	Moxostoma poecilurum	Blacktail Redhorse
Fundulus catenatus	Northern Studfish	Notemigonus crysoleucas	Golden Shiner
Fundulus chrysotus	Golden Topminnow	Notropis amnis	Pallid Shiner
Fundulus dispar	Northern Starhead Topminnow	Notropis atherinoides	Emerald Shiner
Fundulus notatus	Blackstripe Topminnow	Notropis boops	Bigeye Shiner
Fundulus notti	Bayou Topminnow	Notropis buchanani	Ghost Shiner
Fundulus olivaceus	Blackspotted Topminnow	Notropis chalybaeus	Ironcolor Shiner
Gambusia affinis	Mosquitofish	Notropis hubbsi	Bluehead Shiner
Hiodon alosoides	Goldeye	Notropis maculatus	Taillight Shiner
Hiodon tergisus	Mooneye	Notropis stramineus	Sand Shiner
Hybognathus hayi	Cypress Minnow	Notropis texanus	Weed Shiner
Hybognathus nuchalis	Mississippi Silvery Minnow	Notropis volucellus	Mimic Shiner

Ichthyomyzon castaneus	Chestnut Lamprey	Noturus gyrinus	Tadpole Madtom
Ictalurus furcatus	Blue Catfish	Noturus nocturnus	Freckled Madtom
Ictalurus punctatus	Channel Catfish	Noturus phaeus	Brown Madtom
Ictiobus bubalus	Smallmouth Buffalo	Opsopoeodus emiliae	Pugnose Minnow
Ictiobus cyprinellus	Bigmouth Buffalo	Percina caprodes	Log Perch
Ictiobus niger	Black Buffalo	Percina copelandi	Channel Darter
Labidesthes sicculus	Brook Silverside	Percina maculata	Blackside Darter
Lepisosteus ocualtus	Spotted Gar	Percina sciera	Dusky Darter
Lepisosteus osseus	Longnose Gar	Percina shumardi	River Darter
Lepisosteus platostomus	Shortnose Gar	Percina uranidea	Stargazing Darter
Lepisosteus spatula	Alligator Gar[1]	Percina vigil	Saddleback Darter
Lepomis cyanellus	Green Sunfish	Pimephales notatus	Bluntnose Minnow
Lepomis gulosus	Warmouth	Pimephales promelas	Fathead Minnow
Lepomis humilis	Orangespsotted Sunfish	Pimephales tenellus	Slim Minnow
Lepomis macrochirus	Bluegill	Pimephales vigilax	Bullhead Minnow
Lepomis marginatus	Dollar Sunfish	Polyodon spathula	Paddlefish[1]
Lepomis megalotis	Longear Sunfish	Pomoxis annularis	White Crappie
Lepomis microlophus	Redear Sunfish	Pomoxis nigromaculatus	Black Crappie
Pylodictis olivaris	Flathead Catfish	Stizostedion vitreum	Walleye
Semotilis atromaculatus	Creek Chub		

Invertebrates

Amblema plicata	Threeridge	Plecotomerus dombeyanus	Bankclimber
Anodonata suborbiculata	Flat Floater	Pleirocera c. canaliculatum	Silty Hornsnail
Arcidends confragosus	Rock-pocketbook	Pleurobema rubrum	Pyramid Pigtoe
Campeloma decisum	a snail	Potamilus purpuratus	Bleufer
Corbicula fluminea	Asiatic Clam	Ptychobranchus occidentalis	Ouachita Kidneyshell
Cyprogenia aberti	Western Fanshell	Pyganodon grandis	Giant Floater
Ellipsaria lineolata	Butterfly	Quadrula apiculata	Southern Mapleleaf
Elliptio dilatata	Spike	Quadrula cylindrica	Rabbitsfoot
Fusconaia ebena	Ebony Shell	Quadrula metanerva	Monkeyface
Fusconaia flava	Wabash Pigtoe	Quadrula nodulata	Wartyback
Lacanus elaphus	Giang Stag Beetle	Quadrula pustulosa mortoni	Western Pimpleback
Lampsilis abrupta	Pink Mucket	Quadrula pustulosa pustulosa	Pimpleback
Lampsilis cardium	Plain Pocketbook	Quadrula quadrula	Mapleleaf
Lampsilis hydiana	Louisiana Fatmucket	Toxolasma parvus	Lilliput
Lampsilis satur	Sandbank Pocketbook	Toxolasma texasensis	Texas Lilliput
Lampsilis siliquoidea	Fatmucket	Tritogonia verrucosa	Pistolgrip
Lampsilis teres	Yellow Sandshell	Truncilla donaciformis	Fawnsfoot
Leptodea fragilis	Fragile Papershell	Truncilla truncata	Deertoe
Ligumia recta	Black Sandshell	Uniomerus declivis	Tapered Pondhorn

Ligumia subrostrata	Pondmussel	Uniomerus tetralasmus	Pondhorn
Megalonaias nervosa	Washboard	Utterbackia imbecillis	Paper Pondshell
Obliquaria reflexa	Threehorned Wortyback	Villosa lienosa	Little Spectaclecase
Obovaria olivaria	Hickorynut	Viviparus subpurpureus	a snail

Mammals

Bison bison	Bison (*bouef savauge)*	Lasiurus seminolus	Seminole Bat
Blarina brevicauda	Short-Tailed Shrew	Lutra canadensis	Neartic River Otter
Canis latrans	Coyote	Lynx rufus	Bobcat
Canis rufus	Red Wolf	Mephitis mephitis	Striped Skunk
Castor canadensis	American Beaver	Microtus pinetorum	Woodland Vole
Cryptotis parva	Least Shrew	Mus musculus	House Mouse
Dasypus novemcintus	Nine-Banded Armadillo	Mustela frenata	Long-Tailed Weasel
Didelphis virginiana	Virginia opossum	Mustela vison	North American Mink
Eptesicus fuscus	Big Brown Bat	Myocaster coypus	Nutria
Euarctos americanus luteolus	Louisiana Black Bear	Myotis austroriparius	Southeastern Myotis (Mouse-eared Bat)
Felis concolor coryi	Panther	Neotoma floridiana	Eastern Wood Rat
Geomys bursarius breviceps	Mer Rouge Plains Pocket Gopher	Nycticeius humeralis	Evening Bat
Glaucomys volans	Southern Flying Squirrel	Ochrotomys nuttalli	Golden Mouse
Homo sapiens	Man	Odocoileus virginianus	White-Tailed Deer
Lasiurus borealis	Red Bat	Oryxomys palustris	Marsh Rice Rat
Lasiurus cinereus	Hoary Bat	Peromyscus gossypinus	Cotton Mouse
Peromyscus leucopus	White-Footed Mouse	Sciurus carolinensis	Gray Squirrel
Pipistrellus subflavus	Eastern Pipistrelle Bat	Sciurus niger	Fox Squirrel
Plecotus rafinesquii	Rafinesque's Big-Eared Bat	Sigmodon hispidus	Hispid Cotton Rat
Procyon lotor	Northern Racoon	Sylvilagus aquaticus	Swamp Rabbit
Rattus norvegicus	Norway Rat	Sylvilagus floridanus	Eastern Cottontail Rabbit
Rattus rattus	Roof Rat	Tadarida brasiliensis	Brazilian Free-Tailed Bat
Reithrodontomys fulvescens	Fulvous Harvest Mouse	Urocyon cinereoargenteus	Gray Fox
Scalopus aquaticus	Eastern Mole	Vulpes fulva	Red Fox

Reptiles

Agkistrodon contortix	Copperhead	Macroclemys temminckii	Alligator Snapping Turtle
Agkistrodon piscivorus	Cottonmouth	Masticophis flagellum	Coachwhip
Alligator mississippiensis	American Alligator	Micrurus fulvius	Eastern Coral Snake
Caretta caretta	Loggerhead	Nerodia cyclopion	Green Water Snake
Carphophis amoenus	Worm Snake	Nerodia erythrogaster	Plainbelly Water Snake
Cemophora coccinea	Scarlet Snake	Nerodia fasciata	Southern Water Snake
Chelydra serpentina	Common Snapping Turtle	Nerodia rhombifer	Diamondback Water Snake

Chrysemys picta	Painted Turtle	Opheodrys aestivus	Rough Green Snake
Cnemidophorus sexlineatus	Six-lined Racerunner	Ophisaurus attenuatus	Slender Glass Lizard
Coluber constrictor anthicus	Buttermilk Racer	Pseudemys concinna	River Cooter
Crotalus horridus	Timber Rattlesnake	Regina grahamii	Graham's Crayfish Snake
Deirochelys reticularia miaria	Western Chicken Turtle	Regina rigida	Glossy Crayfish Snake
Diadophis punctatus	Ringneck Snake	Regina rigida sinicola	Gulf Crayfish Snake
Dierochelys reticularia	Chicken Turtle	Sceloporus undulatus	Fence Lizard
Elaphe guttata	Corn Snake	Scincella lateralis	Ground Skink
Elaphe obsolata	Rat Snake	Sistrurus miliarius	Pigmy Rattleshake
Eumeces anthracinus	Coal Skink	Sternotherus carinatus	Razorback Musk Turtle
Eumeces fasciatus	Five-lined Skink	Sternotherus odoratus	Common Musk Turtle
Eumeces laticeps	Broadhead Skink	Storeria dekayi	Brown Snake
Eumeces septentrionalis	Southern Prairie Skink	Storeria occipitomaculata	Redbelly Snake
Farancia abacura	Mud Snake	Tantilla gracilis	Flathead Snake
Graptemys kohnii	Mississippi Map Turtle	Terrapene carolina	Eastern Box Turtle
Graptemys pseudogeographica	False Map Turtle	Thamnophis proximus	Western Ribbon Snake
Heterodon platirhinos	Eastern Hognose Snake	Thamnophis sirtalis	Common Garter Snake
Kinosternon subrubrum	Eastern Mud Turtle	Trachemys scripta	Slider
Lampropeltis getula	Common Kingsnake	Trionyx mutica	Smooth Softshell
Lampropeltis triangulum	Milk Snake	Trionyx spiniferus	Spiny Softshell
Lampropeltis Triangulum amaura	Louisiana Milk Snake	Virginia striatula	Rough Earth Snake
Macrochelys temminckii	Alligator Snapping Turtle		

Plants

Acer negundo	Box elder	Juglans nigra	Black walnut
Acer rubrum	Red Maple	Liquidambar styricaflua	Sweet gum
Acer saccharum	Silver Maple	Lonicera spp.	Honey suckle
Acer saccharum var.floridanum	Sugar maple	Magnolia virginiana	Southern Magnolia
Agalinis homalantha	San Antonio False-Foxglove	Mallus pumila	Apple
Aletris aurea	Golden Colicroot	Morus rubra	Mulberry
Aralia spinosa	Devils walking stick	Nyssa sylvatica	Black gum
Arundinaria gigantea	Switch Cane	Oenothera pilosella ssp.	Prairie Evening Primrose
Asclepias obovata	Obovate Milkweed	Ophioglossum nudicaule	Least Adder's-Tongue Fern
Asimina triloba	Pawpaw	Ostrya virginiana	Ironwood
Aster pratensis	An Aster	Pinus echinata	Short leaf pine
Berchimia scandens	Rattan vine	Pinus taeda	Loblloly
Bidens bipinnata	Spanish needles	Planera aquatica	Wafer ash

Calopogon oklahomensis	Bearded Grass-Pink	Plantus occidentalis	Sycamore
Carex striatula	A Sedge	Platanthera flava	Southern Rein-Orchid
Carpinus caroliniana	Hop hornbeam	Populus deltoides	Cottonwood
Carya aquatica	Water hickory	Populus heterophylla	Swamp Cottonwood
Carya cordiformis	Pignut hickory	Prenanthes barbata	Barbed Rattlesnake Root
Carya illinoensis	Sweet pecan	Prunus persica	Peach of Persia
Carya ovata	Scale bark hickory	Prunus serotina	Black cherry
Carya spp.	Hickory	Prunus umbellata	Wild peach
Carya texana	Black hickory	Quercus alba	White oak
Castanea pumila	Chinquapin	Quercus falcata	Southern red oak
Catalpa bignioides	Indian Cigar tree	Quercus laurilifolia	Laurel oak
Catalpa speciosa	Catalpa	Quercus lyrata	Overcup oak
Celtis laevigata	Hackberry	Quercus marilandica	Blackjack oak
Celtis occidentalis	Sugar berry	Quercus michauxii	Cow oak
Chamaelirium luteum	Devil's-Bit	Quercus muehlenbergii	Arkansas oak
Coelorachis rugosa	Wrinkled Jointtail	Quercus nigra	Water oak
Cornus florida	Dogwood	Quercus pagoda	Cherry bark oak
Crataegus spp.	Hawthorne	Quercus pellos	Pin oak
Crypripedium kentukiense	Southern Lady's Slipper	Quercus rubra	Red Oak
Diospyros virginiana	Persimmon	Quercus schumardii	Shumard oak
Eupatorium hyssopifolium	Hyssopleaf Thoroughwort	Quercus stellata	Post oak
Fagus grandifolia	Beech	Quercus texana	Striped oak
Forestiera acuminata	Swamp Privet	Quercus velutina	Black oak
Fraxinus americana	White ash	Robinia pseudoacacia	Black locust
Fraxinus spp.	Ash	Rubus spp.	Black berry / Dew berry
Fuirena bushii	Umbrella Grass	Sabal minor	Dwarf palmetto
Gleditsia aquatica	Wafer ash	Salix nigra	Black willow
Gleditsia triacanthos	Honey locust	Sambucus canadensis	Elderberry
Hamamelis virginiana	Witch Hazel	Sassafras albidium	Sassafras
Hypericum nudiflorum	Pretty St. John's Wort	Scleria pauciflora	Fewflower Nutrush
Ilex decidua	Deciduous Holly	Silene virginica	Fire Pink
Ilex opaca	American holly	Sindera benzoin	Spice wood
Smilax spp.	Green briar	Triosteum angustifolium	Yellowleaf Tinker's-weed
Solidago flexicaulis	Goldenrod	Ulmus rubra	Red elm
Symplocos tinctoria	Horse sugar	Ulmus spp.	Elm
Taxodium disticum	Cypress	Uvularia sessifolia	Sessile-leved Bellwort
Tilia Americana	Basswood	Vaccinium spp.	Huckle berry
Tillandsia usneoides	Spanish Moss	Vitus spp.	Red grape/Muscadine
Toxicodron radicans	Poison Ivy		

Table 2. List of fishes found at thirteen sample locations in the Bayou Bartholomew Watershed by Layher (1995) and Layher BioLogics RTEC, Inc. through 2004.

	Common Name
Lepisosteus ocualtus	Spotted Gar
Lepisosteus osseus	Longnose Gar
Lepisosteus platostomus	Shortnose Gar
Amia calva	Bowfin
Dorosoma cepedianum	Gizzard Shad
Dorosoma petenense	Threadfin Shad
Esox americanus	Grass Pickerel
Esox niger	Chain Pickerel
Centrarchus macropterus	Flier
Lepomis cyanellus	Green Sunfish
Lepomis cyanellus x megalotis	Green Sunfish x Longear Sunfish
Lepomis gulosus	Warmouth
Lepomis gulosus x macrochirus	Warmouth x Bluegill
Lepomis humilis	Orangespsotted Sunfish
Lepomis macrochirus	Bluegill
Lepomis macrochirus x megalotis	Bluegill x Longear
Lepomis macrochirus x miniatus	Bluegill x Redspotted Sunfish
Lepomis marginatus	Dollar Sunfish
Lepomis megalotis	Longear Sunfish
Lepomis megalotis x miniatus	Longear Sunfish x Redspotted Sunfish
Lepomis microlophus	Redear Sunfish
Lepomis miniatus	Redspotted Sunfish
Lepomis symmetricus	Bantam Sunfish
Micropterus punctulatus	Spotted Bass
Micropterus salmoides	Largemouth Bass
Pomoxis annularis	White Crappie
Pomoxis nigromaculatus	Black Crappie
Elassoma zonatum	Banded Pygmy Sunfish
Ctenopharyngodon idella	Grass Carp
Cyprinella venusta	Blacktail Shiner
Cyprinella whipplei	Steelcolor Shiner
Cyprinus carpio	Common Carp
Hybognathus hayi	Cypress Minnow
Hybognathus nuchalis	Mississippi Silvery Minnow
Luxilus chrysocephalus	Striped Shiner
Lythrurus fumeus	Ribbon Shiner
Lythrurus umbratilis	Redfin Shiner
Notemigonus crysoleucas	Golden Shiner
Notropis amnis	Pallid Shiner
Notropis atherinoides	Emerald Shiner
Notropis boops	Bigeye Shiner
Notropis buchanani	Ghost Shiner

Table 2 Continued.

Notropis chalybaeus	Ironcolor Shiner
Notropis hubbsi	Bluehead Shiner
Notropis maculatus	Taillight Shiner
Notropis texanus	Weed Shiner
Notropis volucellus	Mimic Shiner
Opsopoeodus emiliae	Pugnose Minnow
Pimephales promelas	Fathead Minnow
Pimephales notatus	Bluntnose Minnow
Pimephales tenellus	Slim Minnow
Pimephales vigilax	Bullhead Minnow
Carpiodes carpio	River Carpsucker
Erimyzon oblongus	Creek Chubsucker
Ictiobus bubalus	Smallmouth Buffalo
Ictiobus cyprinellus	Bigmouth Buffalo
Ictiobus niger	Black Buffalo
Minytrema melanops	Spotted Sucker
Moxostoma carinatum	River Redhorse
Moxostoma erythrurum	Golden Redhorse
Aplodinotus grunniens	Freshwater Drum
Etheostoma fusiforme	Swamp Darter
Etheostoma gracile	Slough Darter
Etheostoma nigrum	Johhny Darter
Etheostoma proeliare	Cypress Darter
Percina maculata	Blackside Darter
Percina sciera	Dusky Darter
Percina shumardi	River Darter
Ameiurus melas	Black Bullhead
Ameiurus natalis	Yellow Bullhead
Ameriurus nebulosus	Brown Bullhead
Ictalurus furcatus	Blue Catfish
Ictalurus punctatus	Channel Catfish
Noturus gyrinus	Tadpole Madtom
Noturus nocturnus	Freckled Madtom
Pylodictis olivaris	Flathead Catfish
Aphredoderus sayanus	Pirate Perch
Fundulus blairae	Blair's Starhead Topminnow
Fundulus catenatus	Northern Studfish
Fundulus chrysotus	Golden Topminnow
Fundulus dispar	Northern Starhead Topminnow
Fundulus notatus	Blackstripe Topminnow
Fundulus olivaceus	Blackspotted Topminnow
Gambusia affinis	Mosquitofish
Labidesthes sicculus	Brook Silverside
Menidia beryllina	Inland Silverside
Morone chrysops	White Bass

Table 3. Sensitive species known to occur in the Bayou Bartholomew Watershed (ANHC 2001).

Animal Species	Plant Species	
Osprey *Pandion haliaetus*	An Aster *Aster pratensis*	Southern Lady's Slipper *Cypripedium kentuckiense*
Bald Eagle *Haliaeetus leucocephalus*	Hyssopleaf Thoroughwort *Eupatorium hyssopifolium*	Yellow-Crested Orchid *Platanthera cristata*
Red-Cockaded Woodpecker *Picoides borealis*	Barbed Rattlesnake Root *Prenanthes barbata*	Southern Rein-Orchid *Platanthera flava*
Taillight Shiner *Notropis maculatus*	Prairie Evening Primrose *Oenothera pilosella sessilis*	Rose Pogonia *Pogonia ophioglossoides*
Bluehead Shiner *Pteronotropis hubbsi*	San Antonio False-Foxglove *Agalinis homalantha*	Wrinkled Jointtail *Coelorachis rugosa*
Goldstripe Darter *Etheostoma parvipinne*	Spanish Moss *Tillandsia usneoides*	Least Adder's Tongue Fern *Ophioglossum nudicaule*
Western Chicken Turtle *Deirochelys reticularia miaria*	A Sedge *Corex striatula*	
Buttermilk Racer *Coluber constrictor anthicus*	Umbrella Grass *Fuirena bushii*	
Louisiana Milk Snake *Lampropeltis triangulum amaura*	Fewflower Nutrush *Scleria pauciflora*	
Green Water Snake *Nerodia cyclopion*	Devil's Bit *Chamaelirium luteum*	
Graham's Crayfish Snake *Regina grahamii*	Tuberous Grass-Pink *Calopogon tuberosus*	
Gulf Crayfish Snake *Regina rigida sinicola*	Bearded Grass-Pink *Calopogon oklahomensis*	

Table 4. Bird species observed along the William (Bill) G. Layher Nature Trail in Pine Bluff, Arkansas.

Common Name	Scientific Name	Common Name	Scientific Name
Grebe, Pied-billed	*Podilymbus podiceps*	Chickadee, Carolina	*Poecile carolinensis*
Cormorant, Double-crested	*Phalacrocorax auritus*	Creeper, Brown	*Certhia americana*
Anhinga, American	*Anhinga anhinga*	Wren, Carolina	*Thryothorus ludovicianus*
Bittern, American	*Botaurus lentiginosus*	Wren, Winter	*Troglodytes troglodytes*
Heron, Great Blue	*Ardea herodias*	Wren, Marsh	*Cistothorus palustris*
Egret, Great	*Ardea alba*	Kinglet, Golden-crowned	*Regulus satrapa*
Heron, Green	*Butorides virescens*	Kinglet, Ruby-crowned	*Regulus calendula*
Goose, Canada	*Branta canadensis*	Gnatcatcher, Blue-gray	*Polioptila caerulea*
Duck, Wood	*Aix sponsa*	Bluebird, Eastern	*Sialia sialis*
Mallard	*Anas platyrhynchos*	Robin, American	*Turdus migratorius*
Merganser, Hooded	*Lophodytes cucullatus*	Thrush, Swainson's	*Catharus ustulatus*
Vulture, Black	*Coragyps atratus*	Thrush, Gray-cheeked	*Catharus minimus*
Vulture, Turkey	*Cathartes aura*	Thrush, Hermit	*Catharus guttatus*
Kite, Mississippi	*Ictinia mississippiensis*	Mockingbird, Northern	*Mimus polyglottos*
Hawk, Sharp-shinned	*Accipiter striatus*	Thrasher, Brown	*Toxostoma rufum*
Hawk, Cooper's	*Accipiter cooperii*	Starling, European	*Sturnus vulgaris*
Hawk, Red-shouldered	*Buteo lineatus*	Waxwing, Cedar	*Bombycilla cedrorum*
Hawk, Red-tailed	*Buteo jamaicensis*	Warbler, Tennessee	*Vermivora peregrina*
Kestrel, American	*Falco sparverius*	Warbler, Nashville	*Vermivora ruficapilla*
Killdeer	*Charadrius vociferus*	Warbler, Orange-crowned	*Vermivora celata*
Dove, Mourning	*Zenaida macroura*	Warbler, Blue-winged	*Vermivora pinus*
Dove, Rock	*Columba livia*	Parula, Northern	*Parula americana*
Cuckoo, Yellow-billed	*Coccyzus americanus*	Warbler, Chestnut-sided	*Dendroica pensylvanica*
Owl, Barred	*Strix varia*	Warbler, Magnolia	*Dendroica magnolia*
Swift, Chimney	*Chaetura pelagica*	Warbler, Blackburnian	*Dendroica fusca*
Hummingbird, Ruby-throated	*Archilochus colubris*	Warbler, Yellow-rumped	*Dendroica coronata*
Kingfisher, Belted	*Ceryle alcyon*	Warbler, Black-throated Green	*Dendroica virens*
Woodpecker, Red-headed	*Melanerpes erythrocepalus*	Warbler, Pine	*Dendroica pinus*
Woodpecker, Red-bellied	*Melanerpes carolinus*	Warbler, Bay-breasted	*Dendroica castanea*
Sapsucker, Yellow-bellied	*Sphyrapicus varius*	Warbler, Yellow-throated	*Dendroica dominica*
Woodpecker, Downy	*Picoides pubescens*	Warbler, Black-and-White	*Miniotilta varia*
Woodpecker, Hairy	*Picoides villosus*	Redstart, American	*Setophaga ruticilla*
Flicker, Northern	*Colaptes auratus*	Warbler, Prothonotary	*Protonotaria citrea*
Woodpecker, Pileated	*Dryocopus pileatus*	Warbler, Worm-eating	*Helmitheros vermivora*
Pewee, Eastern Wood	*Contopus virens*	Ovenbird	*Seiurus aurocapillus*
Phoebe, Eastern	*Sayornis phoebe*	Warbler, Canada	*Wilsonia canadensis*
Flycatcher, Great Crested	*Myiarchus crinitus*	Waterthrush, Northern	*Seiurus noveboracensis*
Kingbird, Eastern	*Tyrannus tyrannus*	Yellowthroat, Common	*Geothlypis trichas*
Vireo, Warbling	*Vireo gilvus*	Warbler, Hooded	*Wilsonia citrina*
Vireo, Philadelphia	*Vireo philadelphicus*	Tanager, Summer	*Piranga rubra*
Vireo, White-eyed	*Vireo griseus*	Cardinal, Northern	*Cardinalis cardinalis*
Vireo, Red-eyed	*Vireo olivaceus*	Grosbeak, Blue	*Passerina caerulea*
Vireo, Blue-headed	*Vireo solitarius*	Grosbeak, Rose-breasted	*Pheucticus ludovicianus*
Jay, Blue	*Cyanocitta cristata*	Bunting, Indigo	*Passerina cyanea*
Crow, American	*Corvus brachyrhynchos*	Towhee, Eastern	*Pipilo erythrophthalmus*
Crow, Fish	*Corvus ossifragus*	Sparrow, White-throated	*Zonotrichia albicollis*

Table 4 Continued

Swallow, Northern Rough-winged	*Stelgidopteryx serripennis*	Sparrow, White-crowned	*Zonotrichia leucophrys*
Swallow, Barn	*Hirundo rustica*	Sparrow, Fox	*Passerella iliaca*
Titmouse, Tufted	*Baeolophus bicolor*	Sparrow, Song	*Melospiza melodia*
Sparrow, Swamp	*Melospiza geogiana*	Oriole, Baltimore	*Icterus galbula*
Junco, Dark-eyed	*Junco hyemalis*	Oriole, Orchard	*Icterus spurius*
Cowbird, Brown-headed	*Molothrus ater*	Finch, House	*Carpodacus mexicanus*
Blackbird, Red-winged	*Agelaius phoeniceus*	Goldfinch, American	*Carduelis tristis*
Grackle, Common	*Quiscalus quiscula*	Sparrow, House	*Passer domesticus*

The following pages are from analysis provided by The Nature Conservancy using collections conducted by Northeastern Louisiana University at Monroe, LA for the TNC. Fish data do not include those sites sampled by the BBA as part of 319 grant projects. The latter study is still under way and scheduled to be completed in 2005.

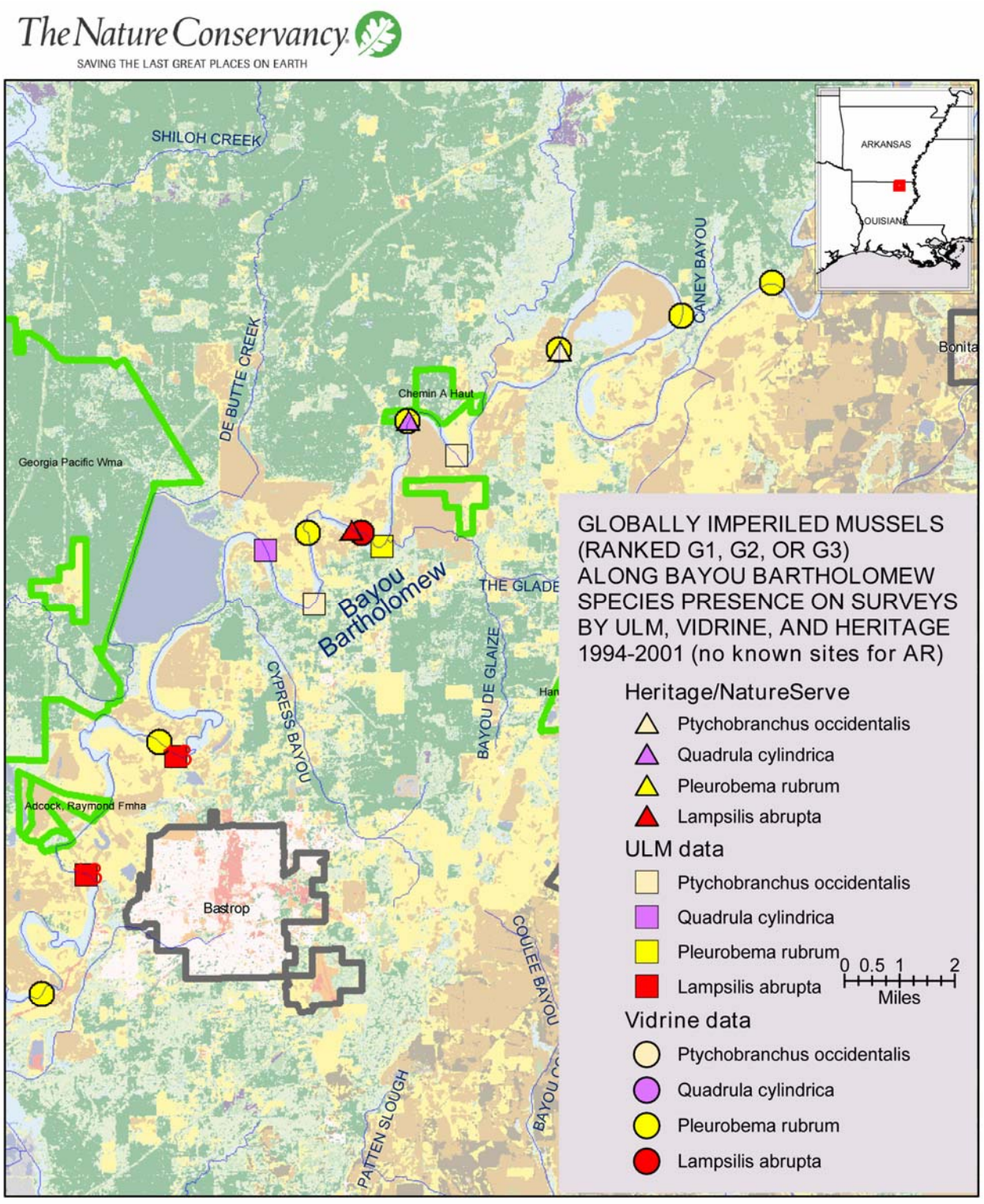

Figure 1. Globally imperiled mussels along Bayou Bartholomew.

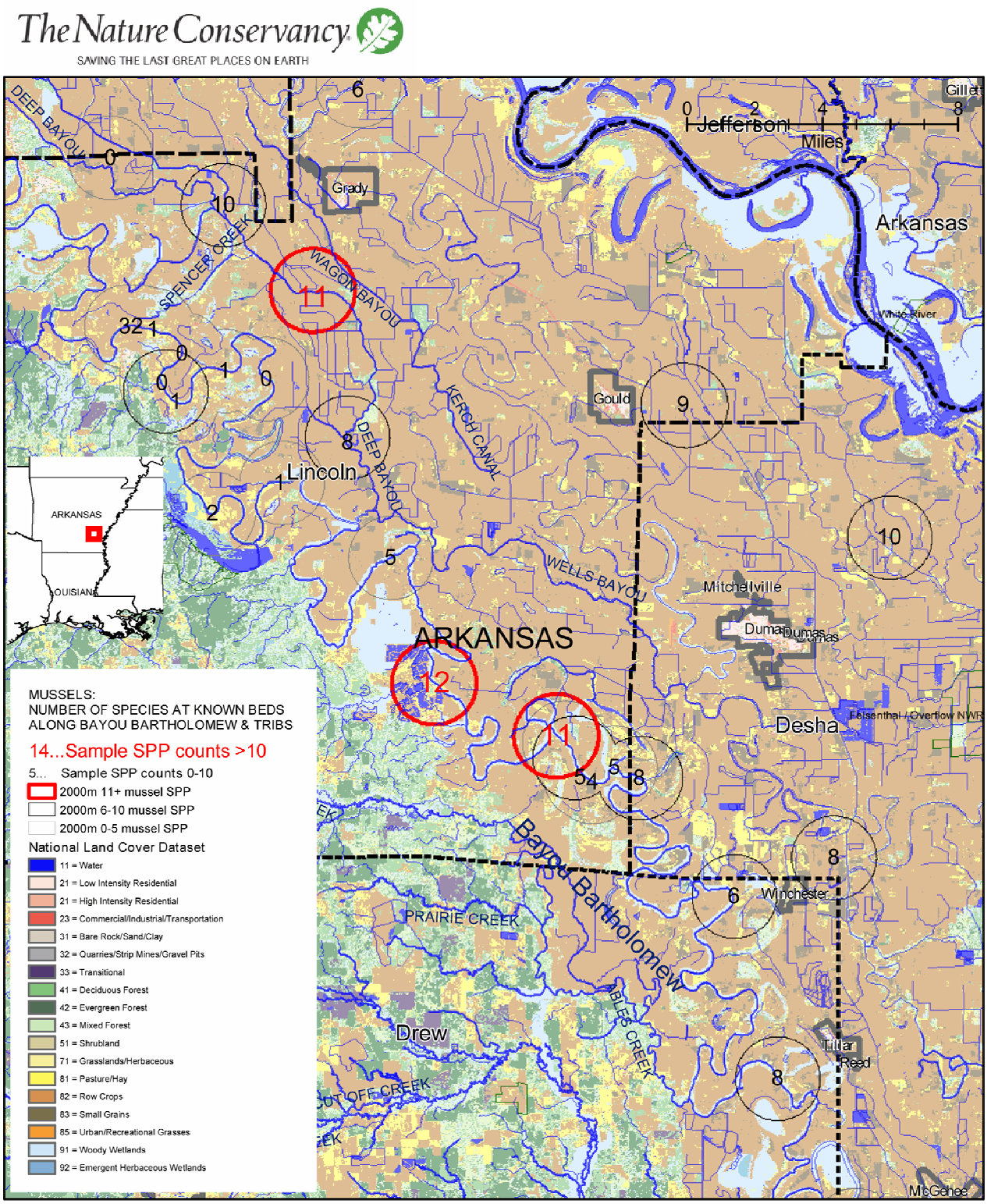

Figure 2. Number of species at mussel beds where species counts are greater than 10.

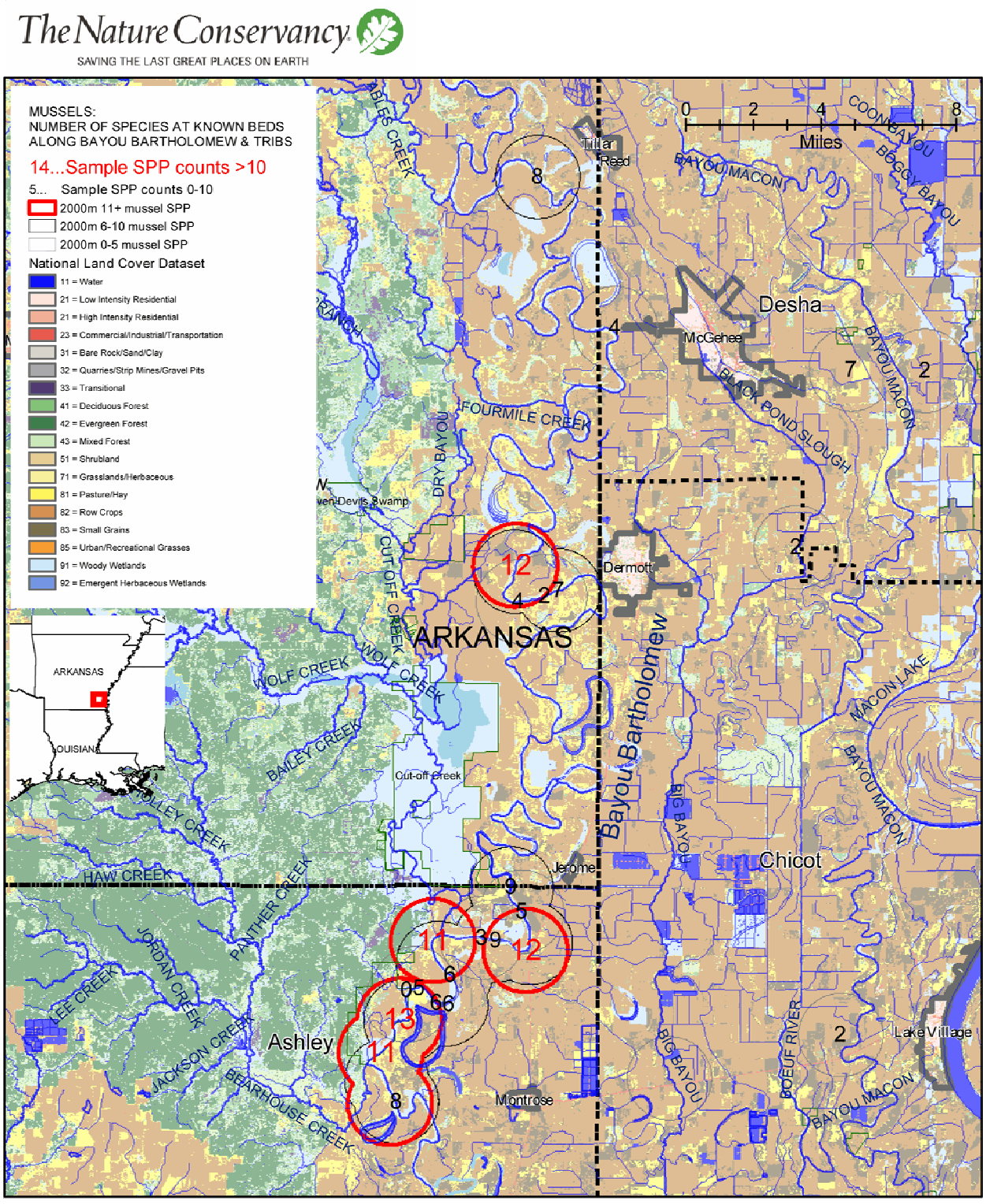

Figure 3. Number of species at mussel beds where species counts are greater than 10.

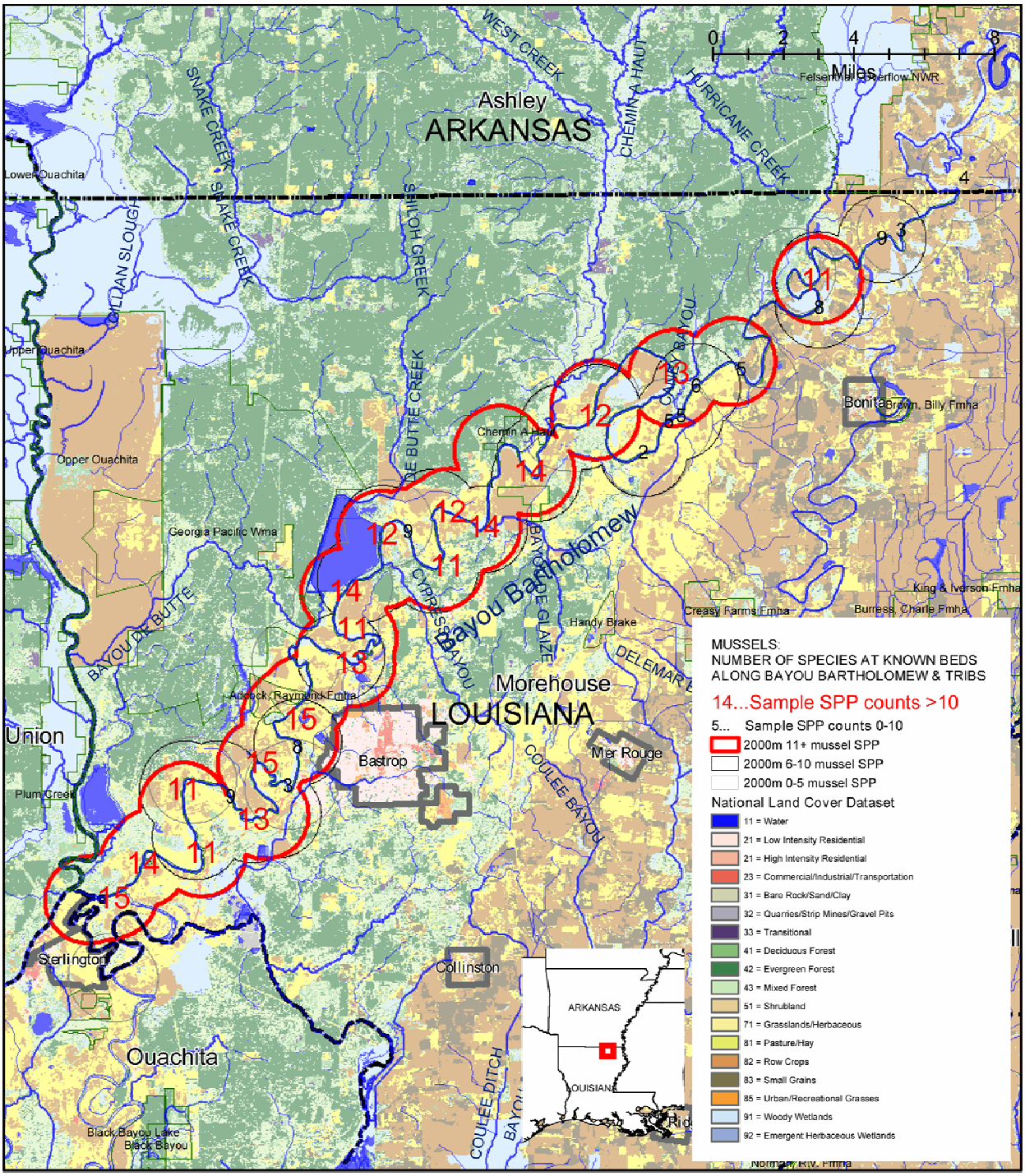

Figure 4. Number of species at mussel beds where species counts are greater than 10.

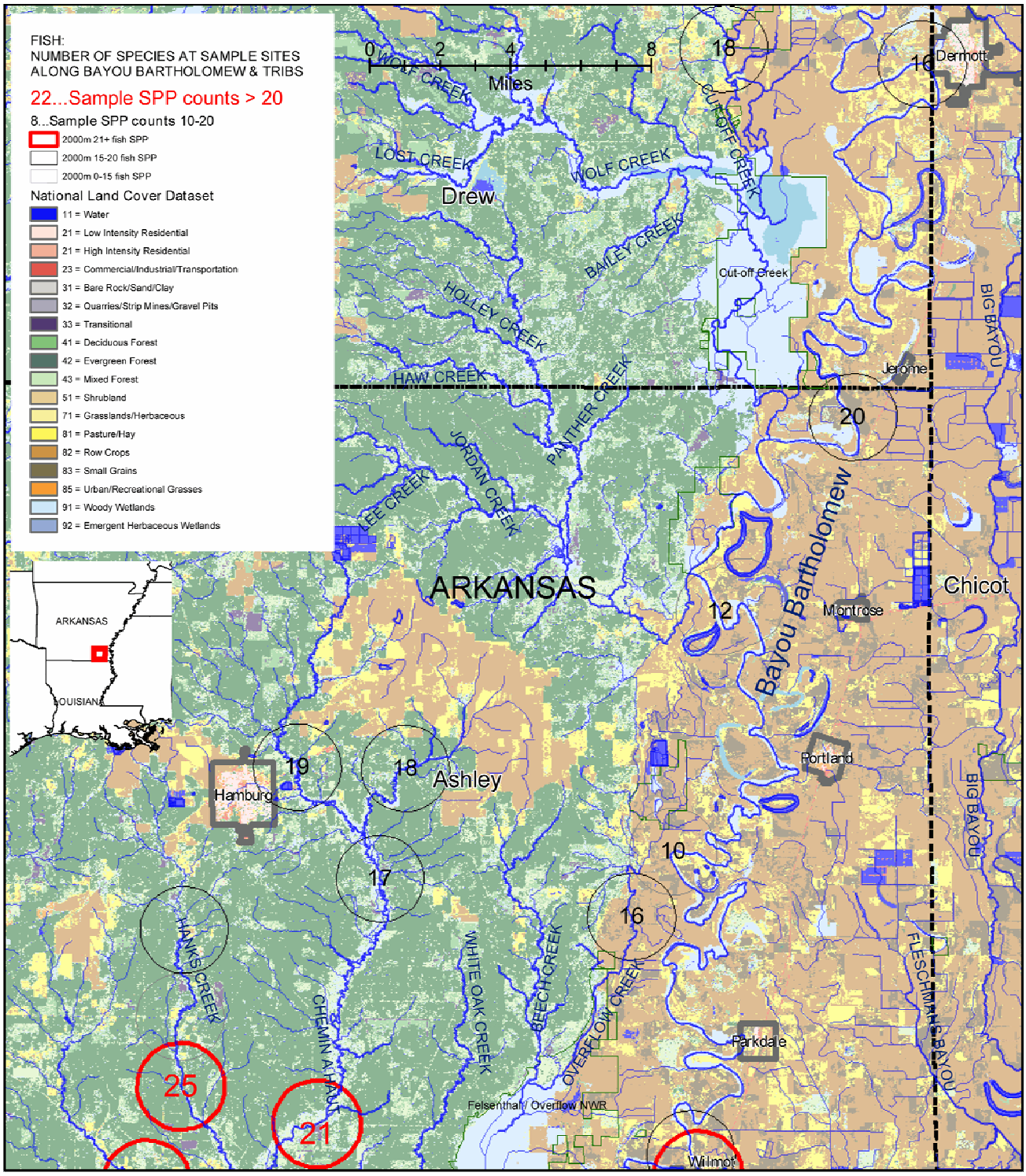

Figure 5. Sites where fish species collected exceeded 20.

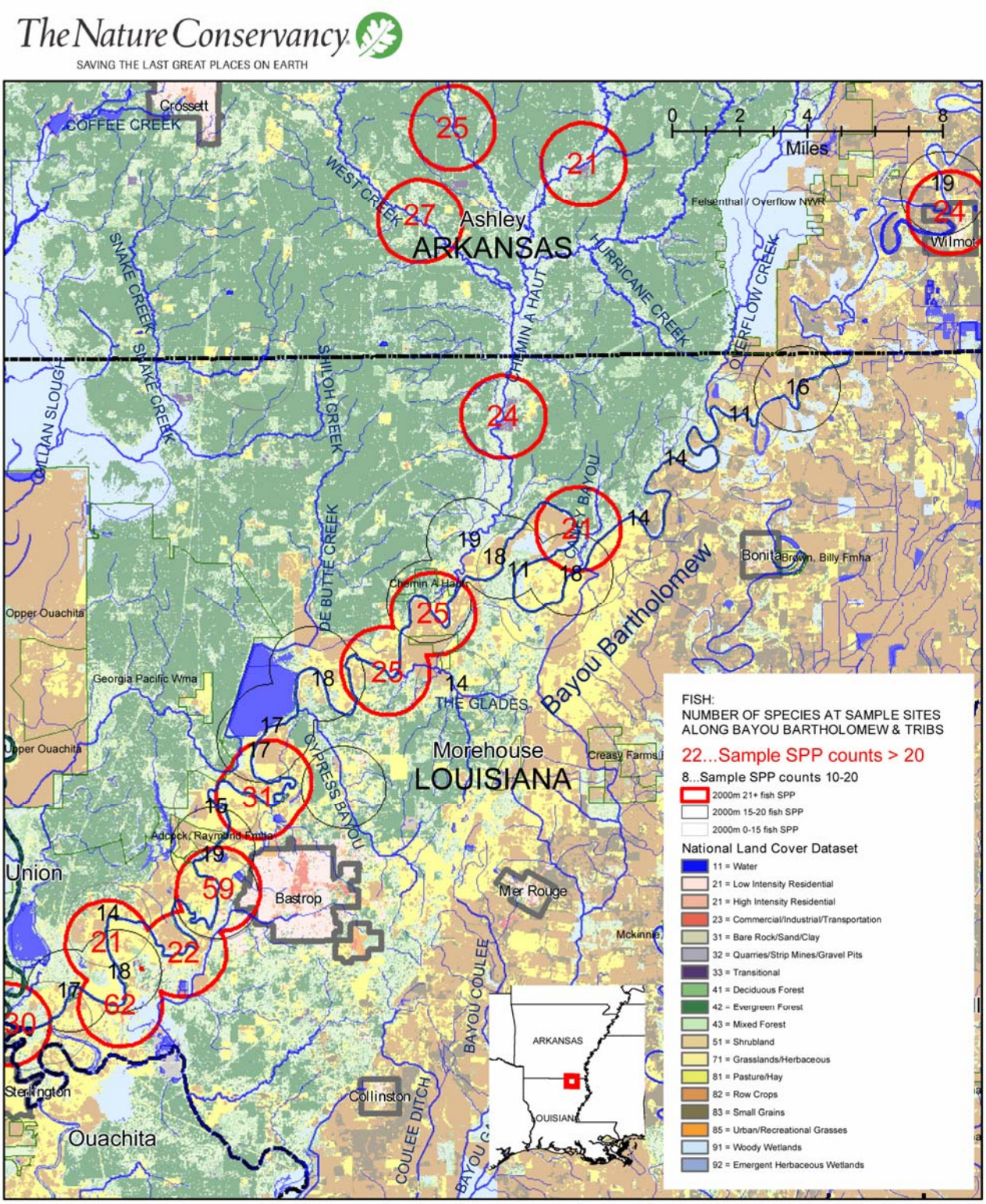

Figure 6. Sites where fish species collected exceeded 20.

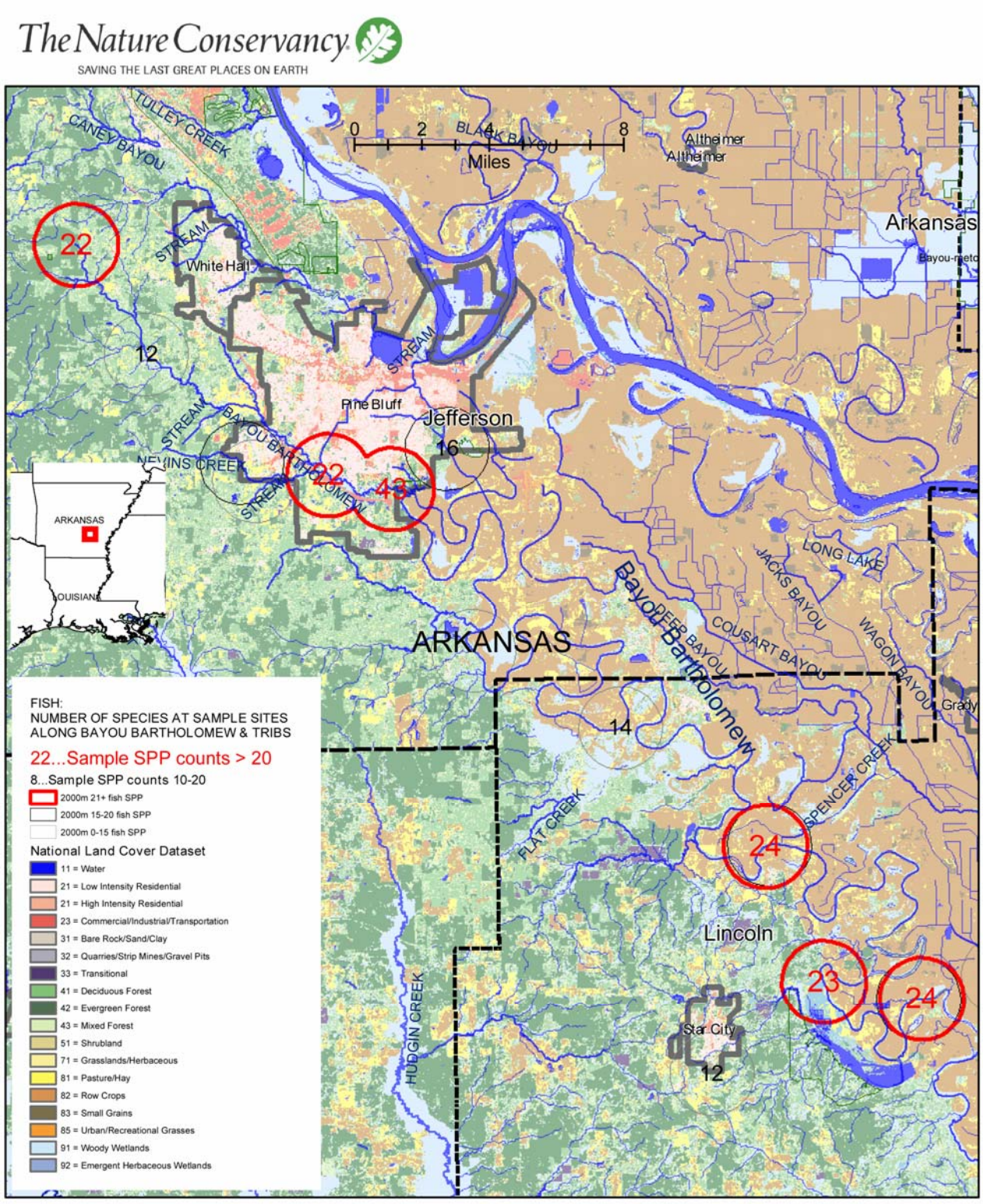

Figure 7. Sites where fish species collected exceeded 20.

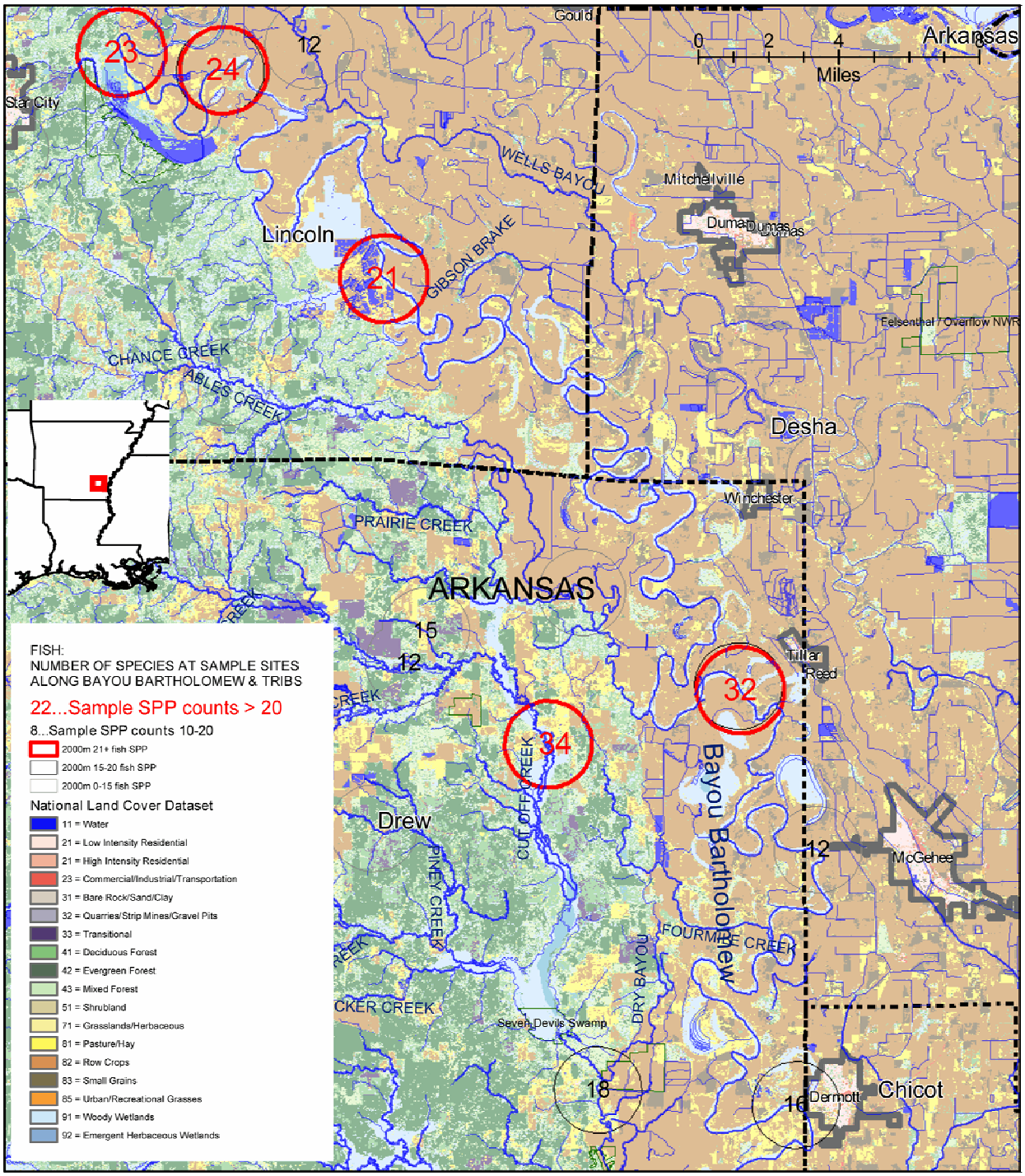

Figure 8. Sites where fish species collected exceeded 20.

Table 5.

Land cover acreages within 400 and 2000 meters from mussel and fish sample sites along Bayou Bartholomew and tributaries
Analysis by Malcolm Mark Swan, The Nature Conservancy, mswan<at>tnc.org, September 2004

MUSSELS

Habitat in 400M-radius buffers around Mussel sample sites — **Sample sites grouped by species richness (number of species)**

ca 1992 National Land Cover Data (NLCD)	Sites with 0-5 spp (N=53)			Sites with 6-10 spp (N=52)			Sites with >10 spp (N=44)		
	HA	**ACRES**	%	**HA**	**ACRES**	%	**HA**	**ACRES**	%
11 Open Water	74	183	**3**	108	267	**0**	104	257	**5**
21 Low Intensity Residential	13	32	**1**	1	2	**0**	1	2	**0**
23 Commercial/Industrial/Transportation	4	10	**0**	12	30	**0**	5	12	**0**
41 Deciduous Forest	111	274	**4**	118	292	**5**	142	351	**7**
42 Evergreen Forest	27	67	**1**	59	146	**2**	78	193	**4**
43 Mixed Forest	66	163	**3**	128	316	**5**	162	400	**8**
81 Pasture/Hay	540	1334	**21**	580	1433	**23**	569	1406	**28**
82 Row Crops	1071	2646	**42**	915	2261	**36**	483	1194	**23**
83 Small Grains	166	410	**7**	85	210	**3**	31	77	**2**
91 Woody Wetlands	449	1110	**18**	527	1302	**21**	481	1189	**23**
TOTAL	**2521**	**6230**	100	**2533**	**6259**	100	**2056**	**5081**	100
81 + 82 + 83 All Agriculture	1777	4391	**70**	1580	3904	**62**	1083	2677	**53**
41 + 42 + 43 + 91 All Forest	1166	1614	**26**	832	2056	**33**	863	2133	**42**

Habitat in 2000M-radius buffers around Mussel sample sites — **Sample sites grouped by species richness (number of species)**

	ca 1992 National Land Cover Data (NLCD)	Sites with 0-5 spp (N=53)			Sites with 6-10 spp (N=52)			Sites with >10 spp (N=44)		
		HA	**ACRES**	%	**HA**	**ACRES**	%	**HA**	**ACRES**	%
11	11 Open Water	1480	3657	**3**	1448	3578	**3**	1718	4246	**6**
21	12 Perennial Ice/Snow	292	722	**1**	209	517	**0**	152	375	**0**
22	22 High Intensity Residential	9	22	**0**	17	43	**0**	13	33	**0**
23	23 Commercial/Industrial/Transportation	75	185	**0**	67	166	**0**	69	171	**0**
31	31 Bare Rock/Sand/Clay							1	3	**0**
33	33 Transitional	1	2	**0**	4	9	**0**	4	10	**0**
41	41 Deciduous Forest	1641	4055	**4**	1726	4266	**4**	1625	4016	**5**
42	42 Evergreen Forest	1923	4752	**4**	2092	5170	**5**	2720	6720	**9**
43	43 Mixed Forest	2409	5953	**5**	2957	7307	**7**	3070	7587	**10**
81	81 Pasture/Hay	7306	18054	**17**	7796	19264	**19**	6969	17220	**22**
82	82 Row Crops	21515	53165	**49**	18734	46292	**44**	10026	24775	**32**
83	83 Small Grains	2897	7159	**7**	2333	5765	**6**	1021	2524	**3**
85	85 Urban/Recreational Grasses	4	10	**0**	16	40	**0**	32	79	**0**
91	91 Woody Wetlands	4310	10650	**10**	4683	11572	**11**	3671	9071	**12**
92	92 Emergent Herbaceous Wetlands	136	336	**0**	15	38	**0**	23	56	**0**
	TOTAL	**43998**	**108722**	100	**42097**	**104027**	100	**31114**	**76886**	100
	81 + 82 + 83 All Agriculture	31718	78378	**72**	28863	71321	**69**	18016	44519	**58**
	41 + 42 + 43 + 91 All Forest	10283	25410	**23**	11458	28315	**27**	11086	27394	**36**

Table 6.

FISH

Habitat in 400M-radius buffers around Fish sample sites — **Sample sites grouped by species richness (number of species)**

ca 1992 National Land Cover Data (NLCD)	Sites with 0-15 spp (N=35)			Sites with 16-20 spp (N=31)			Sites with 21-62 spp (N=27)		
	HA	**ACRES**	%	**HA**	**ACRES**	%	**HA**	**ACRES**	%
11 Open Water	45	110	**3**	72	179	**5**	34	85	**3**
12 Perennial Ice/Snow	11	28	**1**	0	1	**0**	34	84	**3**
21 Low Intensity Residential	10	24	**1**	8	20	**1**	20	50	**2**
22 High Intensity Residential			**0**	1	2	**0**	4	10	**0**
23 Commercial/Industrial/Transportation	3	7	**0**	3	6	**0**	23	58	**2**
41 Deciduous Forest	174	429	**10**	113	280	**7**	102	253	**8**
42 Evergreen Forest	130	322	**8**	114	281	**8**	115	283	**9**
43 Mixed Forest	203	502	**12**	159	393	**11**	96	236	**8**
81 Pasture/Hay	370	913	**22**	334	824	**22**	268	661	**22**
82 Row Crops	384	950	**23**	351	866	**23**	249	614	**20**
83 Small Grains	69	171	**4**	65	161	**4**	14	35	**1**
91 Woody Wetlands	264	653	**16**	294	726	**19**	258	637	**21**
92 Emergent Herbaceous Wetlands	19	48	**1**			**0**	18	45	**1**
TOTAL	**1683**	**4158**	**100**	**1513**	**3740**	**100**	**1235**	**3053**	**100**
81 + 82 + 83 All Agriculture	718	1774	**43**	709	1753	**47**	520	1286	**42**
41 + 42 + 43 + 91 All Forest	771	1906	**46**	680	1680	**45**	571	1410	**46**

Habitat in 2000M-radius buffers around Fish sample sites — **Sample sites grouped by species richness (number of species)**

ca 1992 National Land Cover Data (NLCD)	Sites with 0-15 spp (N=35)			Sites with 16-20 spp (N=31)			Sites with 21-62 spp (N=27)		
	HA	**ACRES**	%	**HA**	**ACRES**	%	**HA**	**ACRES**	%
11 Open Water	746	1843	**2**	1442	3563	**4**	832	2056	**3**
12 Perennial Ice/Snow	401	991	**1**	43	106	**0**	123	304	**0**
21 Low Intensity Residential	567	1401	**2**	870	2150	**3**	830	2051	**3**
22 High Intensity Residential	28	69	**0**	52	128	**0**	96	237	**0**
23 Commercial/Industrial/Transportation	70	173	**0**	159	393	**0**	236	583	**1**
41 Deciduous Forest	3801	9392	**10**	2054	5076	**6**	2349	5805	**8**
42 Evergreen Forest	5212	12879	**14**	5254	12983	**15**	4909	12130	**17**
43 Mixed Forest	4352	10754	**12**	3647	9012	**11**	3501	8651	**12**
71 Grasslands/Herbaceous	6293	15550	**17**	6444	15923	**19**	5290	13072	**18**
82 Row Crops	10777	26631	**29**	9399	23225	**28**	6804	16813	**24**
83 Small Grains	1344	3321	**4**	1270	3138	**4**	549	1357	**2**
91 Woody Wetlands	3506	8664	**9**	3456	8540	**10**	3060	7561	**11**
92 Emergent Herbaceous Wetlands	203	502	**1**				196	484	**1**
TOTAL	**37300**	**92170**	**100**	**34090**	**84237**	**100**	**28775**	**71104**	**100**
81 + 82 + 83 All Agriculture	12121	29952	**32**	10669	26363	**31**	7353	18170	**26**
41 + 42 + 43 + 91 All Forest	16871	41689	**45**	14411	35611	**42**	13819	34147	**48**

Procedure:
1. Mapped mussel and fish sample sites from Vidrine (mussel only), ULM, COE (mussel only), AR Heritage Commission, and LA Heritage Program
2. Grouped mussel and fish collection sites by number of species in 3 species richness groups
3. Created 400-meter (almost 1/4 mile) and 2000-meter (almost 1 mile) buffers around each sample site
   400m was chosen because it nearly captures 40-acre parcels on each side of the stream
   2000m was the largest buffer that could be used without extreme overlap of neighboring buffers.
4. Merged buffers of sample sites comprising each of the 3 species richness groups, creating a Shapefile for each group
5. Dissolved overlapping buffer circles to eliminate duplicate measurement of habitats
6. Ran Tabulate function to calculate area of NLCD habitats within each of the 3 Shapefiles
7. Calculated % = acres / ***TOTAL*** acres in buffer around a group of sites * 100

Result:
Diversity of mussel sites appears strongly related to the forest / agriculture ratio
Diversity of fish sites appears weakly related to the forest / agriculture ratio
Future analysis:
Statistical tests with acreages calculated on a site by site basis
However, variation in sampling methods would preclude validity of the statistical results

NLCD data was produced under the direction of the MRLC Regional Land Cover Characterization Project of the USGS EROS Data Center (EDC), Sioux Falls, SD.
National Land Cover Data (NLCD) was developed from TM data acquired by the Multi-resoultion Land Characterization (MRLC) Consortium.
The MRLC Consortium is a partnership of federal agencies that produce or use land cover data.
Partners include the USGS (National Mapping, Biological Resources, and Water Resources Divisions), USEPA, the U.S. Forest Service, and the National Oceanic and Atmospheric Administration.
Questions about the data set can be directed to the MRLC Regional Team at (605) 594-6114 or mrlc@edcmail.cr.usgs.gov.
http://edcwww.cr.usgs.gov/pub/edcuser/vogel/states

Appendix II

Sub-basins in the Bayou Bartholomew Watershed and S.W.A.T. Model Outputs (University of Arkansas 2002)

Figure 1. Bayou Bartholomew sub-basins and numeric identifiers.

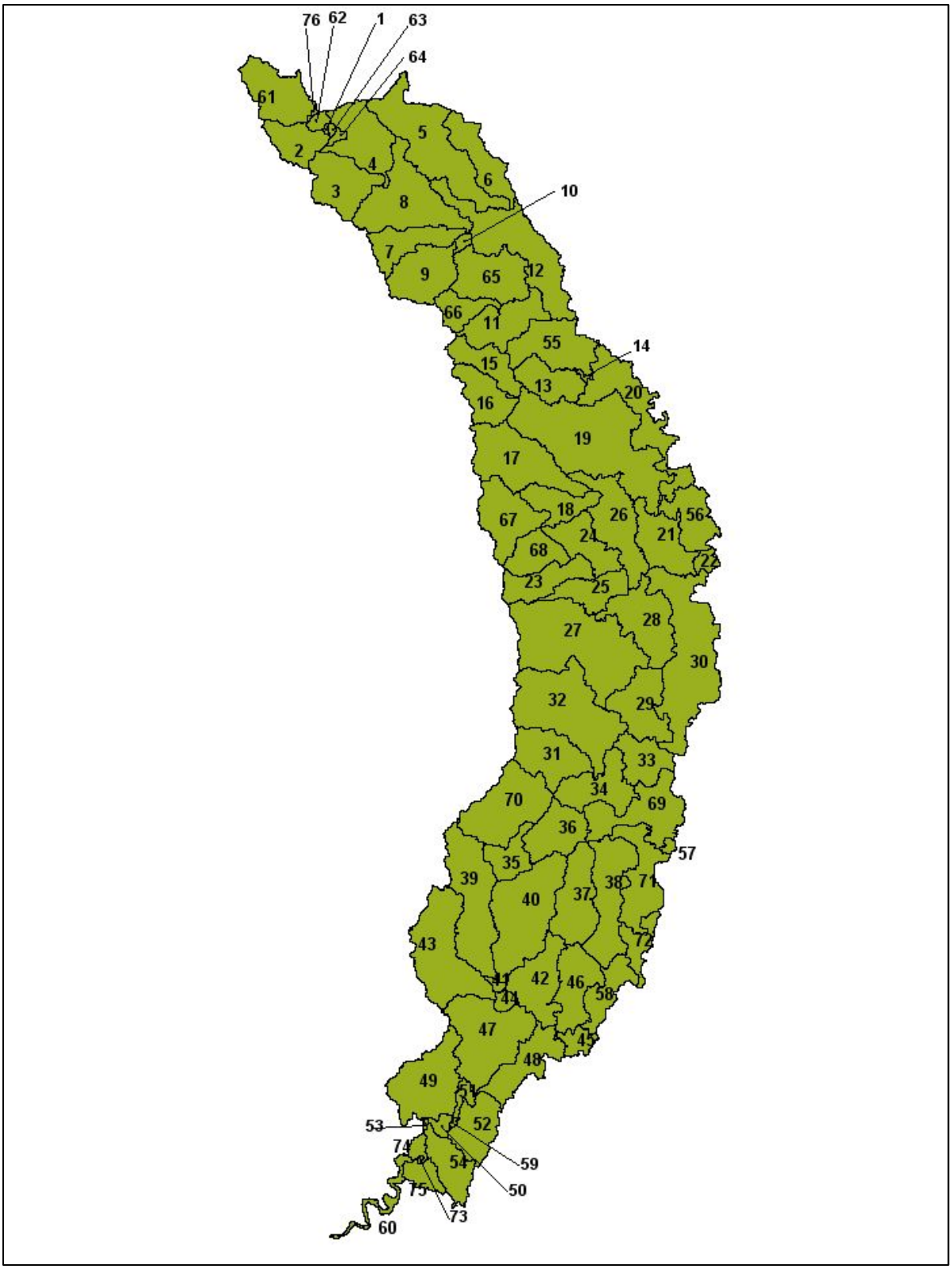

Table 1. Bayou Bartholomew Watershed sub-basin streams and watershed area.

Number	Sub-basin Stream	Area	Number	Sub-basin Stream	Area
1	Bayou Bartholomew	243.966	39	Hanks Creek	27680.931
2	Nevins Creek	10118.480	40	Chem-A-Haut Bayou	31706.928
3	Boggy Bayou	16536.547	41	Chem-A-Haut Bayou	898.916
4	Bayou Bartholomew	17638.287	42	White Oak Creek	16403.556
5	Cousart Bayou	32800.662	43	West Creek	28866.290
6	Jacks Bayou	13252.456	44	Chem-A-Haut Bayou	2024.007
7	Melton Creek	12221.215	45	Bayou Bartholomew	4119.403
8	Bayou Bartholomew	27029.094	46	Overflow Creek	15116.339
9	Turtle Creek	16759.386	47	Chem-A-Haut Bayou	28337.438
10	Bayou Bartholomew	1244.072	48	Bayou Bartholomew	14196.740
11	Bayou Bartholomew	15264.231	49	Pratt Brake	22963.955
12	Spencer Creek	30451.959	50	Bayou Bartholomew	1950.840
13	Flat Creek	11379.454	51	Bayou Bartholomew	2399.631
14	Bayou Bartholomew	421.437	52	Bayou de Glaize	12945.330
15	Ables Creek	10289.501	53	Bayou Bartholomew	297.786
16	Boyd Creek	11655.667	54	Cypress Bayou	11124.590
17	Upper Cutoff Creek	25027.771	55	Bayou Bartholomew	18306.358
18	Lower Cutoff Creek	9892.305	56	Bayou Bartholomew	12496.761
19	Ables Creek	51860.936	57	West Portland Ditch	927.828
20	Bayou Bartholomew	24461.333	58	Bayou Bartholomew	9898.755
21	Dry Bayou	14931.085	59	Bayou Bartholomew	271.321
22	Bayou Bartholomew	2363.825	60	Bayou Bartholomew	4399.175
23	Sandy Creek	12069.097	61	Bayou Bartholomew	16484.507
24	Piney Creek	12172.733	62	Bayou Bartholomew	1707.986
25	Little Cutoff Creek	10655.562	63	Bayou Bartholomew	441.007
26	Cutoff Creek	19993.216	64	Bayou Bartholomew	904.031
27	Wolf /Punch Creeks	44920.020	65	Bayou Bartholomew	18396.650
28	Dry Bayou	19525.300	66	Cane Creek	7354.123

29	Stephens Creek	16234.314	67	Lower Cutoff/Godfrey Creeks	17179.043
30	Bayou Bartholomew	40179.693	68	Adcock Creek	10046.202
31	Little Bearhouse Creek	16620.835	69	Bayou Bartholomew	20556.540
32	Bearhouse Creek	35455.823	70	Chem-A-Haut Bayou	24439.761
33	Little Bayou	10958.462	71	Bayou Bartholomew	16970.660
34	Bearhouse Creek	15037.167	72	Bayou Bartholomew	6635.346
35	Chem-A-Haut Bayou	8289.512	73	Bayou Bartholomew	189.035
36	Haley Creek	13789.759	74	Bayou Bartholomew	2019.559
37	Beech /White Oak Creeks	18148.014	75	Bayou Bartholomew	4908.012
38	Overflow Creek	21822.629	76	Bayou Bartholomew	340.040
			Total		**1087621.185**

Figure 2. Percentile rankings for flow by sub-basin.

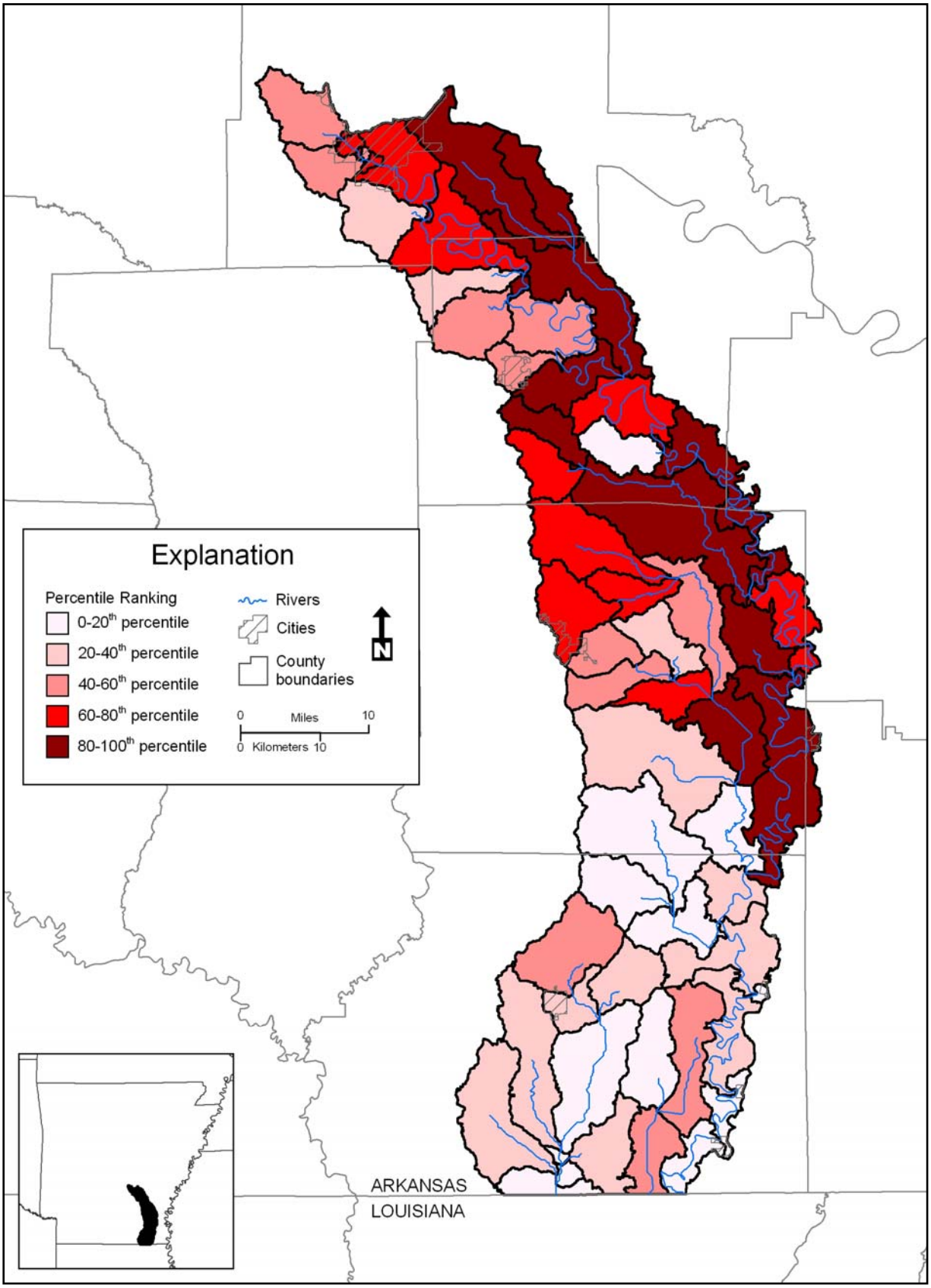

Figure 3. Percentile rankings for total phosphorous by sub-basin.

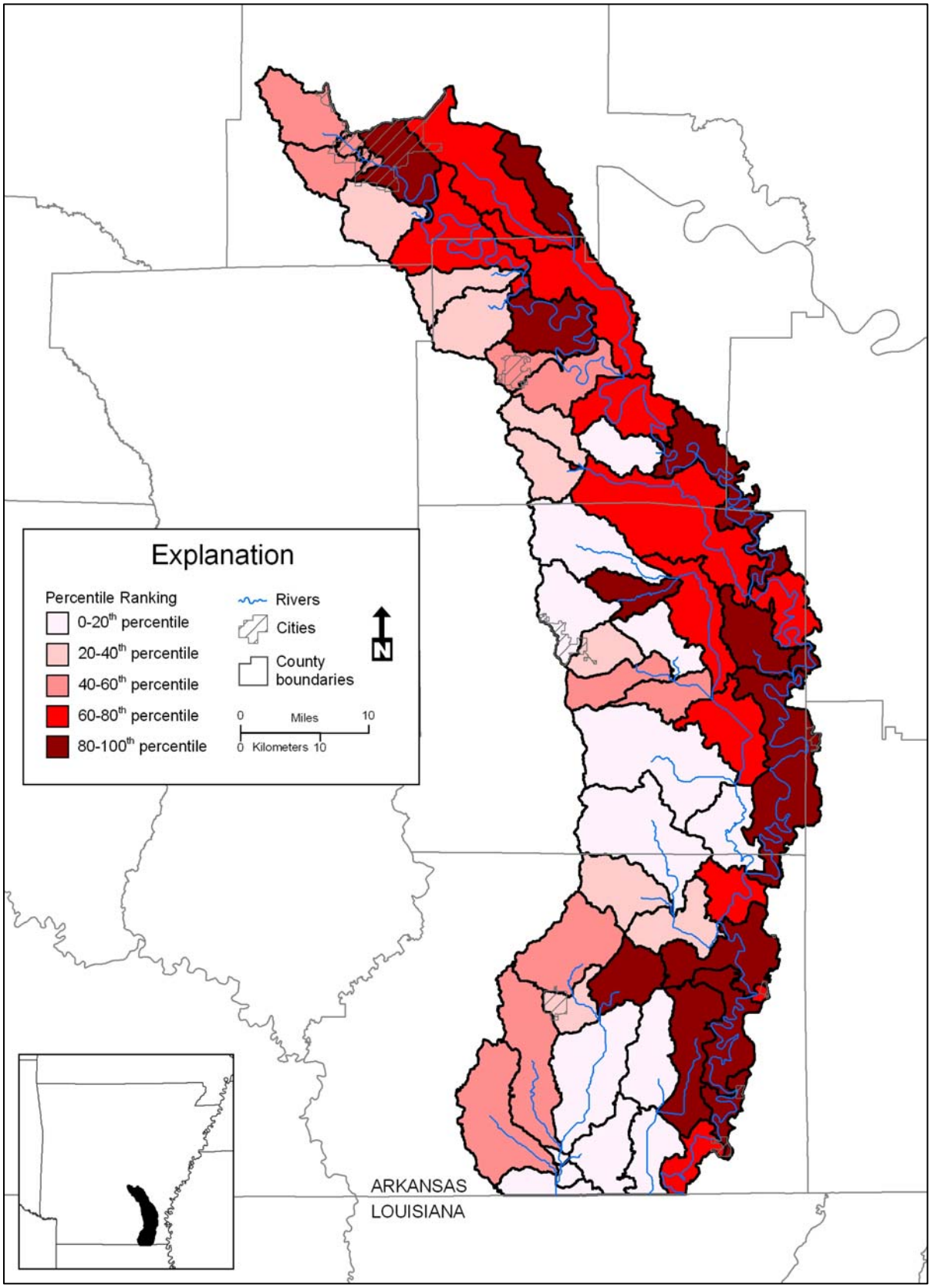

Figure 4. Percentile rankings for total nitrogen by sub-basin.

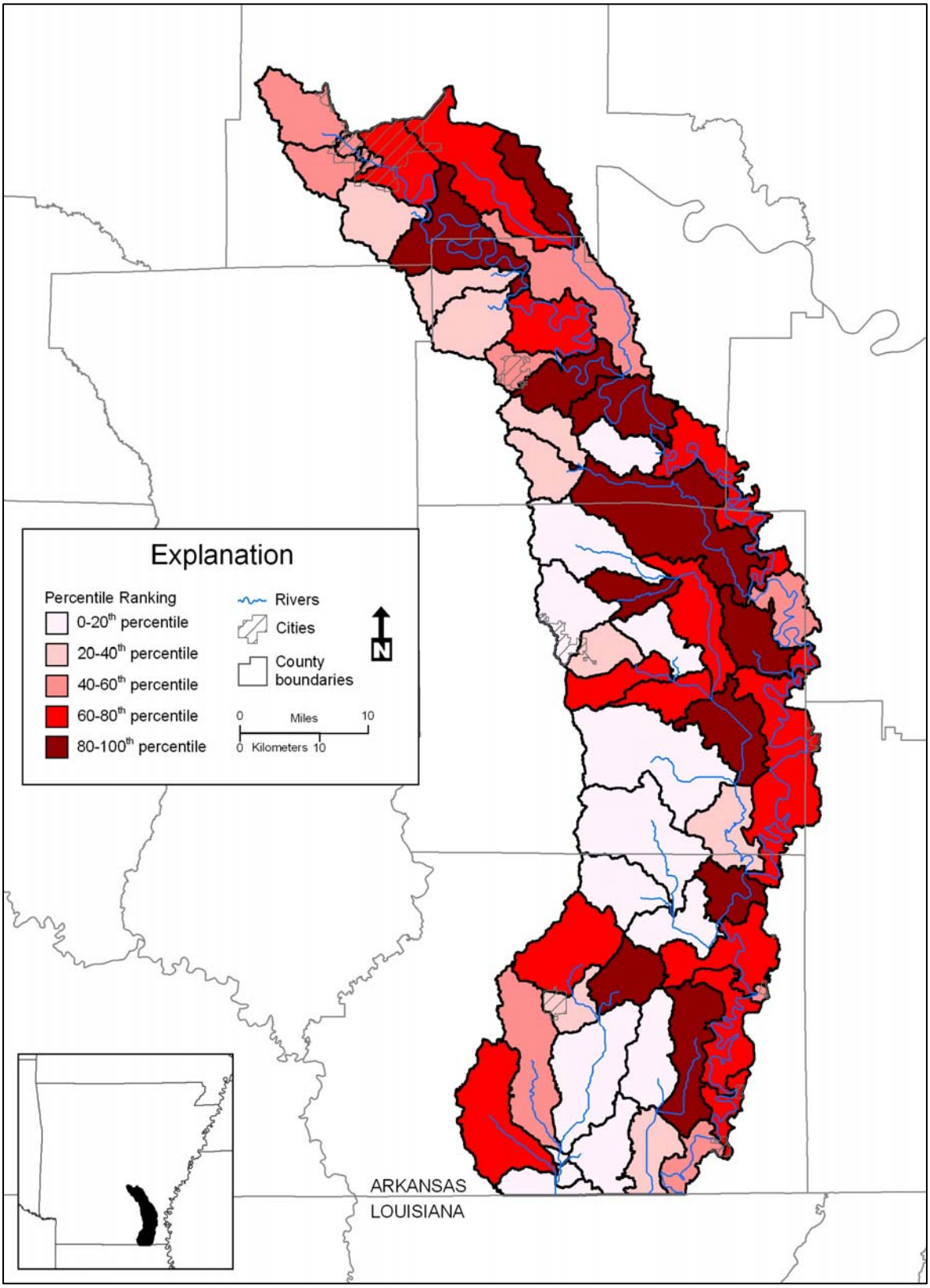

Figure 5. Percentile rankings for sediment by sub-basin.

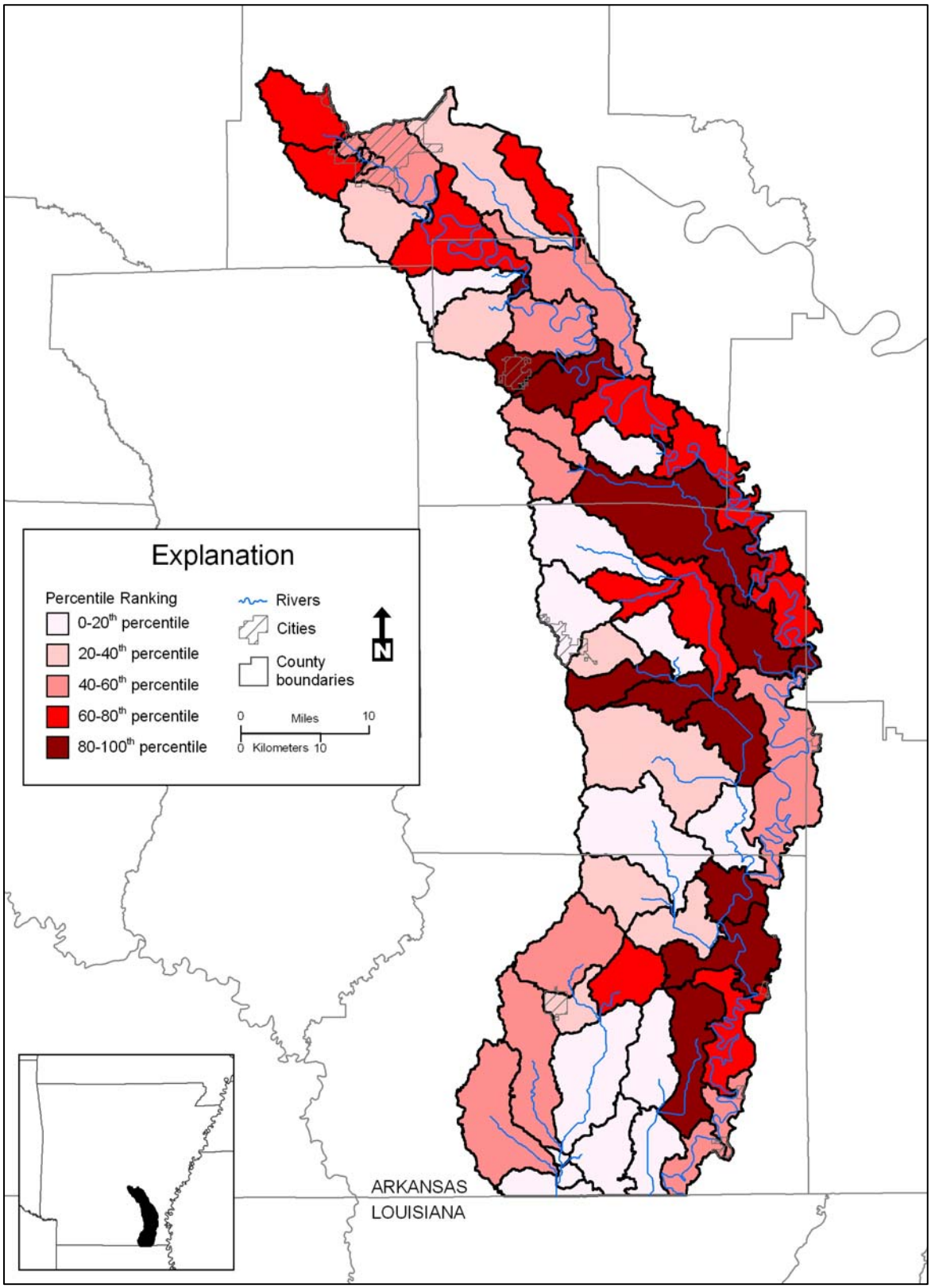

Table 2. Sub-basins within percentile ranges for sediment in the sub-basins

Percentile Rankings				
0-20	20-40	40-60	60-80	80-100
7	3	1	2	10
13	5	4	6	11
17	9	12	8	14
24	27	15	18	19
29	31	16	20	21
32	34	30	26	22
37	35	39	36	23
40	51	43	45	25
41	52	58	50	28
42	53	62	55	33
44	54	63	56	38
46	59	64	57	66
47	60	65	61	69
48	68	70	71	74
49	73	72	76	75
67				

Appendix III

Conservation Practices Installed in the Bayou Bartholomew Watershed

Table 1. Bayou Bartholomew Watershed, Arkansas EQIP Soil Reduction

Year	Erosion Reduction Applied (Acres)	HEL Erosion Reduction Applied (Acres)	Soil Saved from Water Erosion (Tons/Year)	Total Soil Saved (Tons/Year)
2003	2188	0	3799	3799
2002	3976	31	18360	18360
2001	4483	1001	18859	18859
2000	4355	886	13850	13850
1999	0	0	0	0
Total	**15,002**	**1,918**	**54,868**	**54,868**

Table 2. Bayou Bartholomew Watershed, Morehouse Parish, LA EQIP Practices

Year	382 (ft)	528A (ac)	464 (ac)	430AA-HH (ft)	320, 388, 428, 430, 436, 441, 442, 443, 447, 464, 552, 587 (Acres)	595A (Ac)	490 (Ac)	666 (Ac)
2004	2194	397	54	1666	0	0	0	0
2003	0	0	0	0	561	1199	178	156
2002	0	121	0	0	0	3625	108	
2001	0	362	0	0	0	4321	73	574
2000	0	222	24	0	0	4582	0	122
1999	0	222	0	0	0	0	0	0
Total	2194	1324	78	1666	561	13727	359	852

Year	612 (Ac)	645 (Ac)	590 (Ac)	Buffers (391A) (ft)	Wetlands (657,658,659) (Ac)	644 (Ac)	449
2004	0	0	0	0	0	0	0
2003	178	835	1199	0	0	0	0
2002	108	1062	3927	28 (Ac)	166	208	505
2001	185	396	4322	320200	0	1101	0
2000	189	1588	4944	27076	430	0	0
1999	0	922	210	0	0	0	0
Total	660	4803	14602	347276	596	1309	505

Year	Erosion Reduction Applied (Acres)	Soil Saved from Water Erosion (Tons/Year)	Estimated Water Conserved (Acre Inches)	Total Irrigation Water Management (Acres)	Non-AFO Nutrient Management Systems Applied (Acres)
2004					
2003	1710	4929	2597	561	1199
2002	6449	21802	0	505	3927
2001	5155	9564	0	0	0
2000	4661	10473	0	0	0
1999	1104	10502	0	0	0
Total	**19079**	**57270**	**2597**	**1066**	**5126**

Table 3. Miscellaneous Conservation Programs

Watershed County	Practice Acres		
	Wetland Reserve Program	Forest Insentive Program	319 Projects
Ashley	1942.5	140.7	—
Chicot	—	—	—
Cleveland	—	—	—
Desha	—	—	—
Drew	1499.4	—	790
Jefferson	—	—	—
Lincoln	—	—	—
Morehouse	NA	NA	NA
Total	**3441.9**	**140.7**	**790**

Table 4. Conservation Reserve Program

Watershed County	FSA Practices (Acres)							
	CP3A	CP3	CP4D	CP9	CP11	CP21	CP22	CP23
Ashley	2009.2	329.7	2	181.1	151	—	986.4	56.5
Chicot	—	—	—	—	—	—	5.8	—
Cleveland	—	—	—	—	—	—	—	—
Desha	—	—	—	—	—	—	58.1	144.4
Drew	—	—	—	—	—	57.5	1520.0	46.0
Jefferson	508.5	—	—	38.2	—	230.7	1869.5	106.7
Lincoln	1608.8	—	—	—	327.1	18.4	881	165.6
Morehouse	NA	NA	NA	NA	NA	NA	NA	NA
Total	**4126.5**	**329.7**	**2**	**219.3**	**478.1**	**306.6**	**5320.8**	**519.2**

Table 5. Environmental Quality Incentive Program: Nutrient Management

Watershed	NRCS Practices					
County	317 (ea)	313 (ea)	328 (Ac)	382 (ft.)	484 (Ac)	590 (Ac)
Ashley	—	—	360.3	—		408.5
Chicot	—	—	—	—	—	—
Cleveland	—	—	—	—	—	—
Desha	—	—	—	—	—	—
Drew	1	1	—	1800	4.0	—
Jefferson	—	1	3537.7	5350	—	3589.6
Lincoln	—	3	5273	2600	—	3706
Morehouse	NA	NA	NA	NA	NA	NA
Total	**1**	**5**	**9171.0**	**9750**	**4.0**	**7704.1**

Table 6. Environmental Quality Incentive Program: Irrigation Management

Watershed	NRCS Practices								
County	430 (ft)	430DD (ft.)	430FF (ft)	447 (ea)	449 (Ac)	464 (yd^3)	552 (Ac)	587 (ea)	642 (ea)
Ashley	7300	—	—	—	360.3	—	57.8	—	—
Chicot	—	—	—	—	—	—	—	—	—
Cleveland	—	—	—	—	—	—	—	—	—
Desha	—	—	—	—	—	—	—	—	—
Drew	1320	—	900	1	—	180.2	50.0	12	3
Jefferson	—	6157	—	—	1660.1	300.1	—	12	2
Lincoln	6700	—	—	—	2989	1658	—	16	4
Morehouse	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	**15320**	**6157**	**900**	**1**	**5009.4**	**2138.3**	**107.8**	**40**	**9**

Table 7. Environmental Quality Incentive Program: Soil Management

Watershed County	NRCS Practices									
	329A (Ac)	329B (Ac)	344 (Ac)	378 (ea)	391 (Ac)	410 (ea)	490 (Ac)	512 (Ac)	612 (Ac)	638 (ea)
Ashley	—	—	360.3	—	—	—	—	48.2	—	—
Chicot	—	—	—	—	—	—	—	—	—	—
Cleveland	—	—	—	—	—	—	—	—	—	—
Desha	—	—	—	—	—	—	—	—	—	—
Drew	—	—	272.0	3	—	2	—	119.0	—	1
Jefferson	1271.6	106.2	806.1	—	2.0	16	2.0	24.8	2.0	—
Lincoln	639	—	4895	3	444	—	60	350	60	—
Morehouse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	**1915.1**	**106.2**	**6333.4**	**6**	**446.0**	**18**	**62.0**	**542.0**	**62.0**	**1**

Table 8. Environmental Quality Incentive Program: Miscellaneous Practices

Watershed	NRCS Practices (Acres)						
County	314	511	528	533	595	644	645
Ashley	—	—	—	—	408.5	360.3	—
Chicot	—	—	—	—	—	—	—
Cleveland	—	—	—	—	—	—	—
Desha	—	—	—	—	—	—	—
Drew	—	—	—	—	—	—	6.0
Jefferson	8.0	—	25.1	—	382.3	1360.5	8.0
Lincoln	147	25	303	2	1738	2674	16
Morehouse	NA	NA	NA	NA	NA	NA	NA
Total	**155.0**	**25.0**	**328.1**	**2.0**	**3070.8**	**4394.8**	**30.0**

Table 9. Relevant Practice Code Descriptions

Practice Code	Description
313	Waste Storage Facility
314	Brush Management
317	Composting Facility
328	Conservation Crop Rotation
329A	No Till/Strip Till
329B	Mulch Till
344	Residue Management, Seasonal
378	Pond
382	Fence
391	Riparian Forest Buffer
410	Grade Stabilization Structure
430	Irrigation Water Conveyance
430DD	High-Pressure, Underground Plastic, Pipeline
430FF	Steel Piping
447	Irrigation System, Tailwater Recovery
449	Irrigation Water Management
464	Irrigation Land Leveling
484	Mulching
490	Forest Site Preparation
511	Forage Harvest Management
512	Pasture and Hay Planting
528	Prescribed Grazing
533	Pumping Plant
552	Irrigation Regulating Reservoir
587	Structure for Water Control
590	Nutrient Management
595	Pest Management

612	Tree/Shrub Establishment
638	Water and Sediment Control Basin
642	Water Well
644	Wetland Wildlife Habitat Management
645	Upland Wildlife Habitat Management
CP3	Tree Planting
CP3A	Hardwood Tree Planting
CP4D	Permanent Wildlife Habitat Non-easement
CP9	Shallow Water Acres for Wildlife
CP11	Trees or Brush, Already Established
CP21	Filter Strips
CP22	Riparian Buffer
CP23	Wetland Restoration

Table 10. Conservation practices installed in Bayou Bartholomew watershed sub-basins.

Sub-basin Number	Sub-basin Stream	Area (Ha)	WRP Acres	CRP Acres	EQIP Acres	FIP Acres
1	Bayou Bartholomew	100.6200	0.000	0.000	0.000	0.000
2	Nevins Creek	4094.8200	0.000	0.000	0.000	0.000
3	Boggy Bayou	6692.1300	0.000	164.448	7.000	0.000
4	Bayou Bartholomew	7140.8704	0.000	1077.683	883.386	0.000
5	Cousart Bayou	13280.4896	0.000	650.984	2025.710	0.000
6	Jacks Bayou	5363.2800	0.000	75.471	1182.050	0.000
7	Melton Creek	4947.5700	0.000	130.100	158.60	0.000
8	Bayou Bartholomew	10944.9904	0.000	1173.698	1701.443	0.000
9	Tutle Creek	6782.3104	0.000	103.458	109.35	0.000
10	Bayou Bartholomew	503.7300	0.000	68.940	79.95	0.000
11	Bayou Bartholomew	6177.2400	0.000	563.518	425.53	0.000
12	Spencer Creek	12325.5904	0.000	565.890	2144.93	0.000
13	Flat Creek	4606.8300	0.000	8.500	0.000	0.000
14	Bayou Bartholomew	170.5500	0.000	0.000	47.63	0.000
15	Ables Creek	4165.6500	0.000	0.000	303.03	0.000
16	Boyd Creek	4718.8800	0.000	0.000	156.26	0.000
17	Upper Cutoff Creek	10128.4200	0.000	15.500	50.000	0.000
18	Lower Cutoff Creek	4003.2900	0.000	30.500	38.000	0.000
19	Ables Creek	20988.0000	0.000	273.150	21.820	0.000
20	Bayou Bartholomew	9899.1904	0.000	418.040	434.98	0.000
21	Dry Bayou	6042.4200	0.000	32.200	301.000	0.000
22	Bayou Bartholomew	956.6100	154.000	0.000	155.000	0.000
23	Sandy Creek	4887.0900	0.000	0.000	39.000	0.000
24	Piney Creek	4926.1500	0.000	0.000	0.000	0.000
25	Little Cutoff Creek	4313.3400	0.000	0.000	4.000	0.000
26	Cutoff Creek	8091.3600	320.000	45.000	75.000	0.000
27	Wolf Creek/Punch Creek	18180.1792	0.000	63.860	29.000	0.000
28	Dry Bayou	7914.0600	1179.500	594.100	85.000	0.000
29	Stephens Creek	6572.5200	0.000	159.297	0.000	0.000

30	Bayou Bartholomew	16260.2096	200.000	547.800	177.000	0.000
31	Little Bearhouse Creek	6728.6704	0.000	0.000	0.000	0.000
32	Bearhouse Creek	14349.4208	0.000	41.340	0.000	0.000
33	Little Bayou	4436.0100	0.000	115.679	0.000	0.000
34	Bearhouse Creek	6089.8500	0.000	352.907	0.000	0.000
35	Chem-A-Haut Bayou	3358.5300	0.000	0.000	0.000	0.000
36	Haley Creek	5580.5400	0.000	127.300	106.000	140.700
37	Beech Creek/White Oak Creek	7344.2704	0.000	0.000	0.000	0.000
38	Overflow Creek	8831.7000	1653.465	209.600	0.000	0.000
39	Hanks Creek	11202.7504	0.000	0.000	0.000	0.000
40	Chem-A-Haut Bayou	12833.8200	0.000	0.000	0.000	0.000
41	Chem-A-Haut Bayou	364.5000	0.000	0.000	0.000	0.000
42	White Oak Creek	6639.2100	0.000	0.000	0.000	0.000
43	West Creek	11681.8200	0.000	16.000	0.000	0.000
44	Chem-A-Haut Bayou	823.4100	0.000	0.000	0.000	0.000
45	Bayou Bartholomew	1667.0700	0.000	0.000	0.000	0.000
46	Overflow Creek	6119.8200	0.000	6.800	0.000	0.000
47	Chem-A-Haut Bayou	11467.8896	0.000	0.000	0.000	0.000
48	Bayou Bartholomew	5745.8700	0.000	0.000	0.000	0.000
49	Pratt Brake		0.000	0.000	0.000	0.000
50	Bayou Bartholomew	791.1000	0.000	0.000	0.000	0.000
51	Bayou Bartholomew	971.1000	0.000	0.000	0.000	0.000
52	Bayou de Glaize	5238.8100	647.910	0.000	0.000	0.000
53	Bayou Bartholomew	120.6000	0.000	0.000	0.000	0.000
54	Cypress Bayou	4501.9800	0.000	0.000	0.000	0.000
55	Bayou Bartholomew	7408.3504	0.000	61.7300	542.39	0.000
56	Bayou Bartholomew	5070.0600	0.000	83.500	141.000	0.000
57	West Portland Ditch	375.6600	0.000	0.000	0.000	0.000
58	Bayou Bartholomew	4006.5300	0.000	45.900	0.000	0.000
59	Bayou Bartholomew	110.5200	0.000	0.000	0.000	0.000
60	Bayou Bartholomew	1780.2900	0.000	0.000	0.000	0.000
61	Bayou Bartholomew	6671.0700	0.000	0.000	0.000	0.000
62	Bayou Bartholomew	693.9900	0.000	0.000	0.000	0.000

63	Bayou Bartholomew	179.1900	0.000	0.000	0.000	0.000
64	Bayou Bartholomew	369.9900	0.000	0.000	0.000	0.000
65	Bayou Bartholomew	7445.6096	0.000	293.6650	2093.44	0.000
66	Cane Creek	2976.1200	0.000	9.8200	78.55	0.000
67	Lower Cutoff/Godfrey Creeks	6954.6600	0.000	0.000	0.000	0.000
68	Adcock Creek	4065.5700	0.000	0.000	0.000	0.000
69	Bayou Bartholomew	8323.2896	0.000	863.074	409.500	0.000
70	Chem-A-Haut Bayou	9891.7200	0.000	14.900	302.500	0.000
71	Bayou Bartholomew	6867.8096	89.000	1288.736	0.000	0.000
72	Bayou Bartholomew	2685.2400	0.000	27.836	0.000	0.000
73	Bayou Bartholomew	76.5000	0.000	0.000	0.000	0.000
74	Bayou Bartholomew	817.2900	0.000	0.000	0.000	0.000
75	Bayou Bartholomew	1986.2100	0.000	0.000	0.000	0.000
76	Bayou Bartholomew	139.9500	0.000	0.000	0.000	0.000
Total		430962.7512	4243.8750	10320.9240	14308.0490	140.7000

Appendix IV

ADEQ Water Quality Monitoring Stations
And their status on the 2004 303(d) list for Arkansas

Table 1. ADEQ monitoring stations, reaches and status.

NAME	HUC	RCH	PLNG SEG	MILES	MONITORING STATIONS	ASSESS TYPE
B. Bartholomew	8040205	-013	2B	33.9	BYB03	M
B. Bartholomew	8040205	-013	2B	33.9	BYB03	M
Cutoff Creek	8040205	-007	2B	16.8	COC01	M
B. Bartholomew	8040205	-006	2B	82.3	OUA33	M
Deep Bayou	8040205	-005	2B	28.9	OUA151	M
B. Bartholomew	8040205	-002	2B	17.9	OUA154	M
B. Bartholomew	8040205	-002	2B	17.9	OUA154	M
B. Bartholomew	8040205	-001	2B	60.1	OUA13	M
Bearhouse Creek	8040205	-901	2B	24.4	OUA155	M
Harding Creek	8040205	-902	2B	4.6	OUA145	M
Melton's Creek	8040205	-903	2B	8.7	OUA160	M
Jack's Bayou	8040205	-904	2B	6.0	OUA150	M
Cross Bayou	8040205	-905	2B	2.4	OUA152	M
Chemin-A-Haut Cr	8040205	-907	2B	30.5	OUA12	M
B. Bartholomew	8040205	012U	2B	82.7	BYB02	M
B. Bartholomew	8040205	012U	2B	82.7	BYB02	M
B. Bartholomew	8040205	-001	2B	60.1	OUA13	M
B. Bartholomew	8040205	-002	2B	17.9	BYB01	M
B. Bartholomew	8040205	-006	2B	82.3	OUA33	M
Deep Bayou	8040205	-005	2B	28.9	OUA151	M
Cutoff Creek	8040205	-007	2B	16.8	COC01	M
B. Bartholomew	8040205	012U	2B	82.7	BYB02	M
B. Bartholomew	8040205	-013	2B	33.9	BYB03	M
B. Bartholomew	8040205	-012	2B	25	BYB02	M

COMSUMP	AQUATIC LIFE	PRIMARY CONTACT	SECONDARY CONTACT	DRINKING WATER	AGRI & INDUSTRY	SOURCE 1	SOURCE 2	SOURCE 3	SOURCE 4	CAUSE 1	CAUSE 2	CAUSE 3	CAUSE 4	Category	Priority
					N	AG	AG			CL	TDS			5b	L
		N				AG				PA				5d	M
	N					UN				SI				5d	M
	N					AG				DO				5d	M
		N				AG				PA				5d	M
					N	UN				CL				5b	L
	N					AG				DO				5d	M
					N	UN				CL				5b	L
		N				UN				PA				5d	M
			N			UR				PA				5d	M
		N				UN				PA				5d	M
		N				UN				PA				5d	M
		N				UN				PA				5d	M
		N				UN				PA				5b	L
					N	AG	AG			CL	TDS			5b	L
	N					AG				DO				5d	M
	N					AG				SI				4a	2002
N	N					UN	AG			HG	SI			4a	2002/03
	N					AG				SI				4a	2002
	N					AG				SI				4a	2002
N						UN				HG				4a	2003
	N					AG				SI				4a	2002
	N					AG				SI				4a	2002
N	N	S	S	S	S	UN	AG			HG	SI			4a	2002/03