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Alabama Natural Heritage Program℠

Middle Coosa River, Upper Coosa River, Eightmile Creek, and Cotaco Creek Watersheds Nonpoint Source Prioritization Project

Volume 1: Middle and Upper Coosa River Watersheds

A Final Report Prepared for

Alabama Department of Environmental Management

By the

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EXECUTIVE SUMMARY

Non-point source (NPS) pollution has been identified as a major reason for remaining U.S. water quality problems. In addition to impairing water quality, NPS pollution is one of the leading national threats to biodiversity, particularly freshwater aquatic species. Alabama has an incredibly rich biodiversity and consistently ranks among the top 5 states in the nation in total biodiversity. This is largely due to the rich diversity of aquatic species in the state. However, Alabama also has the dubious distinction of ranking among the top states for extinctions and imperiled species. A large number of the extinct and imperiled species are aquatic species that have been lost or declined due to habitat loss and degradation and water quality degradation.

The scope of this project was to locate sensitive areas and habitats for Threatened & Endangered species and identify potential stresses to these areas in the Middle and Upper Coosa River watersheds.

Middle Coosa River Watershed

The Middle Coosa River (MCR) watershed encompasses approximately 6,659 km^2 (2,571 mi^2) in the Coosa River Basin in northeast Alabama. The watershed encompasses the majority of Calhoun, Etowah, St. Clair, and Talladega counties and includes portions of Blount, Cherokee, Clay, Cleburne, De Kalb, Jefferson, and Shelby counties.

ALNHP had 281 occurrences of rare plant and animal species and natural communities documented in the MCR watershed. The rare species documented in the MCR watershed included 73 occurrences of 23 species that are federal or state protected species. There were an additional 43 occurrences of 20 species considered globally imperiled (G1 or G2) by Natural Heritage ranks that are not state or federally protected. There were 101 occurrences of 68 species without state or federal protection considered state imperiled (S1 or S2) but not globally imperiled.

One hundred fifty-eight 100-ha rare species areas were identified in the MCR watershed: 93 "critical", 34 "imperiled", and 31 "rare". The number of occurrences within these areas ranged from 1 to 15, with 66.9% having only 1 rare species documented.

Ten conservation targets were chosen for the MCR watershed: matrix forest communities (oak-hickory-pine forest), riverine system, gray bat (*Myotis grisescens*), riparian vegetation, mountain longleaf pine (*Pinus palustris*) forest communities, red-cockaded woodpecker (*Picoides borealis*), freshwater fish, mussels, and snails of critical conservation concern, southern hognose snake (*Heterodon simus*), caddisflies, and endangered plants.

Twelve managed areas were identified within the MCR watershed. Slightly more than half (51.2%) of rare occurrences documented in the MCR watershed were on managed areas. However, the majority (63.3%) of federal threatened or endangered species occurrences were not in these managed areas. Therefore, maintaining habitat for rare, threatened, and endangered species will require not only appropriate management of public lands, but also outreach to private landowners and potential public-private partnerships for private land management.

Alabama's 2000 Final 303 (d) list of impaired waters included 3 stream reaches in the MCR watershed that do not support their water use classifications: Black Creek, Choccolocco Creek, and Little Wills Creek. Lakes Martin Logan and Neely Henry and the rest of the main stem Coosa River in the MCR watershed also were listed. The main stem of the Coosa River below Logan Martin Dam was included in the listing of Lay Lake. No rare species were within 1 km of the listed stream reach of Black Creek or Neely Henry Lake. However there were 3 occurrences of 2 rare species and 1 occurrence of a natural feature within 1 km of Little Wills Creek and 13 occurrences of 7 rare species within 1 km of Choccolocco Creek, including 1 federal endangered snail and 3 federal

threatened species in Choccolocco Creek. There was 1 rare plant within 1 km of Logan Martin Lake. There was 1 federal endangered snail within 1 km of the Coosa River section included in the Lay Lake listed area.

Upper Coosa River Watershed

The Upper Coosa River (UCR) watershed encompasses approximately 2,202 km^2 (850 mi^2) in the Coosa River Basin in northeast Alabama, and is part of a larger UCR watershed that extends into Georgia. Although the portion of the watershed in Alabama is influenced by water flowing into the watershed from Georgia, this analysis is restricted to the portion of the watershed in Alabama. The watershed encompasses the majority of Cherokee County, and portions of Calhoun, Cleburne, and De Kalb counties.

There were 241 occurrences of rare plant and animal species and natural communities documented in the UCR watershed. The rare species documented in the UCR watershed included 59 occurrences of 13 species that are federal or state protected species, including 1 amphibian, 1 bird, 2 fish, 3 mussels, and 6 vascular plants. There were an additional 77 occurrences of 15 species considered globally imperiled by Natural Heritage ranks (G1 or G2) that are not state or federally protected, and 63 occurrences of 36 species without state or federal protection considered state imperiled (rank S1 or S2) but not globally imperiled.

Eighty-nine 100-ha rare species areas were identified in the UCR watershed, with an additional 4 on the periphery in the MCR watershed: 60 "critical", 23 "imperiled", and 6 "rare". The number of occurrences within these rare species areas ranged from 1 to 17. Nearly half of the areas (46.2%) contained only 1 rare species occurrence.

Seven conservation targets were chosen for the UCR watershed: the matrix forest communities (oak-hickory-pine forest), riverine system, riparian vegetation, freshwater fish, mussels, and snails of critical conservation concern, imperiled salamanders, caddisflies, and plants of conservation concern.

Seven managed areas were identified within the UCR watershed. Slightly more than half (53.3%) of the rare occurrences documented in the UCR watershed were on managed areas. However, less than half (48.2%) of the federal threatened or endangered species occurrences were documented in these managed areas. Therefore, maintaining habitat for rare, threatened, and endangered species will require not only appropriate management of public lands, but also outreach to landowners and potential public-private partnerships for private land management.

Alabama's 2000 Final 303(d) list of impaired waters included 1 stream reach in the UCR watershed that did not support its water use classifications: an unnamed tributary to Weiss Lake in Cherokee County. Weiss Lake, which covers the entire main stem Coosa River in the UCR watershed, also was listed. No rare species were documented within 1 km of the 2 listed stream reaches. However, eleven rare species occurrences were documented within 1 km of Weiss Lake, including the 2 federal endangered species and 2 federal threatened species.

Threats

Most threats can be generalized to what many consider the greatest threat to biodiversity at both the species and ecosystem levels: habitat loss, alteration, or degradation. However, there are many different sources for this stress. Overall, 6 major sources of threat were identified in the watershed: agriculture (crop and livestock production practices), forestry, development, invasive/alien species, waste disposal (trash and septic systems), and altered disturbance regimes. These threats are compounded by habitat fragmentation and the isolation and small population sizes of many of the rare species that occur in the watersheds.

Agriculture

Agricultural practices have long been considered the most widespread and significant source of

NPS pollution in the United States, and are known to have major impacts on water quality and wildlife habitat. The negative impacts of agriculture on wildlife are indisputable and often diminish the ability of agricultural ecosystems to sustain viable populations. In addition to the direct habitat loss caused by the initial land use conversion to agriculture, the effects of agriculture include increased habitat fragmentation and isolation and decreased habitat diversity. The high impact of sustained anthropogenic disturbance profoundly alters biotic communities, and may result in long-term modifications that may still be evident long after land use has reverted to a more natural state.

The primary effects of livestock grazing include the removal and trampling of vegetation, compaction of underlying soils, and dispersal of exotic plant species and pathogens. Where livestock have access to streams, riparian vegetation is generally lacking and cattle entering and leaving the stream adds to the instability of the stream bank. This can lead to increased erosion and sedimentation and fecal contamination of the stream. Excluding livestock from riparian areas is the most effective tool for restoring and maintaining water quality and ecological function of riparian areas impacted by livestock. Where it is not feasible to exclude cattle from streams, the impacts can be reduced by changing the season of use, reducing the stocking rate or grazing period, resting the area from livestock use for several seasons, and/or implementing a different grazing system.

The negative impacts from agriculture can be minimized somewhat through implementation of Best Management Practices (BMP) designed to minimize agricultural contributions to NPS pollution. Increasing the implementation of agricultural BMPs, especially the use of riparian buffers, should be a goal in both watersheds. Implementation of the strategies outlined in the Watershed Management Plan to reduce agricultural pollution and TNC's Cumberland and Southern Ridge and Valley Ecoregion Plan for abating threats from agricultural practices will help with conservation of aquatic species in the watershed.

Development

Urban development is a leading cause of habitat destruction for many species, and was identified as the greatest threat for endangered and threatened plants in a review of recovery plans. Urbanization changes the structure, function, and composition of natural ecosystems, and alters the species composition of an area. To address urbanization's effects on ecosystem health, an integrative and interdisciplinary approach is necessary, and must include terrestrial and aquatic systems and account for ecological processes operating at different spatial and temporal scales and the complexity of interactions among the social, ecological, and physical components of an ecosystem. Many state agencies have BMPs designed to reduce nutrient and sediment loads from urban runoff to abate the impact of urban development on aquatic systems. However, if these BMPs are not properly implemented and maintained, they contribute little to abating the impact of urban runoff.

Major changes in biota can occur with relatively small amounts of urban land use in a watershed. Research consistently shows a strong negative correlation between the imperviousness of a drainage basin and the health of its receiving stream so that percent of impervious surface within a watershed is a viable indicator of watershed health and ecosystem quality. Degradation first begins to become noticeable at 10% impervious surface and becomes so severe as to be almost unavoidable at 25-30%. Imperviousness works well as a surrogate for water quality in planning and land use decisions because it is integrative and measurable. Roads usually account for the majority of a communities impervious coverage and tend to produce the most pollutant-laden runoff, so decreasing road widths is one of the best design-related opportunities for reducing imperviousness. In commercial and industrial areas, reducing imperviousness through design-related reductions can best be achieved by targeting reductions in impervious surface needed for parking through smaller lot sizes and emphasizing the use of infiltration and nonstructural solutions.

Forestry

Many of the impacts from forestry can be minimized through proper implementation of BMPs. Numerous studies have shown properly implemented BMPs limit the negative impacts of forestry practices on water quality and aquatic biota. Properly implementing forestry BMPs during road construction and maintenance is very important because surface erosion rates on roads often equal or exceed erosion rates reported on severely eroding agricultural lands. It is critical that all silvicultural activities be strongly encouraged to properly implement the use of streamside buffers and other BMPs.

Invasive Species

Invasive organisms are one of the greatest threats to the natural species and ecosystems of the U.S., and impact nearly half of the species currently listed as "Threatened" or "Endangered" under the U.S. Federal Endangered Species Act. This threat often works in tandem with habitat destruction because exotic species more readily invade disturbed habitat. These unwelcome plants, insects, and other organisms disrupt the ecology of natural ecosystems, displace native plant and animal species, and degrade our nation's unique and diverse biological resources. Invasive species also reduce an ecosystem's ability to provide basic ecological services on which humans depend, such as flood control and crop pollination.

Because of their life cycle, small population sizes, and limited habitat availability, the federally listed mussel and snail species in both watersheds are highly susceptible to competitive or predaceous nonnative species. The most abundant aquatic invasive faunal species of concern in both watersheds is the Asian clam (*Corbicula fluminea*). Other nonnative aquatic species of concern include the black carp (*Mylopharyngodon piceus*), zebra mussel (*Dreissena polymorpha*), and quagga mussel (*D. bugensis*). There are numerous invasive plant species in both watersheds, including kudzu (*Pueraria montana* var. *lobata*), Japanese stilt grass (*Microstegium vimineum*), and privet (*Ligustrum* spp.). Efforts should be made to eradicate existing populations of invasive species and to prevent new populations and species from becoming established in the watershed.

Altered Disturbance Regimes

Ecosystems are dynamic and change through time as ecological, physical, and social components change. The habitat structure of an ecosystem can change dramatically when its natural processes are disrupted or altered. In the South, one of the single most disruptive changes in the natural disturbance regime has been fire suppression, which has been identified as a major threat to conservation in the region. Fire suppression policies have endangered the existence of fire-dependent communities and species, enabled xeric communities to become more mesic in species composition, increased the size and severity of forest fires, and reduced landscape heterogeneity. Restoring these fire-dependent communities will require the ability of managers to use prescribed fire. The main impediments to using prescribed fire often are negative public opinion towards the use of prescribed fire and liability issues, particularly in areas containing any type of development.

Conservation Measures

Information on the occurrence of rare and sensitive species is often incomplete and heavily influenced by where surveys have been conducted in the past and the taxonomic expertise of the searchers. Many areas of both the MCR & UCR watersheds have not been surveyed or have been surveyed only for specific taxonomic groups. A comprehensive survey is needed throughout both watersheds.

One of the greatest general threats to the survival of many rare species populations in both watersheds is the isolation and small size and extent of the populations that remain which magnifies the negative impacts of anthropogenic stresses. These small isolated populations remain vulnerable to extinction or extirpation due to demographic stochasticity, catastrophic events, or habitat loss and degradation caused by

the many potential stresses in the watersheds. For several species, especially the freshwater mussels and snails, maintaining the species as part of the biota in the watershed may require not only protection of existing populations, but also reintroductions into currently unoccupied portions of their historic range.

An action which is likely to have a great impact on aquatic systems and should be a priority in both watersheds is the protection and restoration of riparian vegetation along the waterbodies in the watershed, particularly the lower order streams. Protection should be the goal for the riparian areas in the watersheds in the best ecological condition, while riparian areas that are degraded should have restoration as their goal. Land use practices in adjacent uplands must be considered and addressed in riparian area management because upslope management practices can influence the ability of riparian areas to function. Riparian area management should be based on the same principles that characterize watershed management: partnerships, geographic focus, and science-based management. Because many of the options for improving riparian areas across watersheds encompass a wide range of individual and societal values, there is a great need to engage various stakeholders in broad-scale and collaborative restoration efforts.

Establishment and maintenance of well-vegetated buffer strips along streams has become a major focus in the restoration and management of landscapes. However, to be effective, buffers must extend along all streams, including intermittent and ephemeral channels. In addition, buffers must be augmented with enforceable on-site sediment controls and a limited amount of impervious surfaces. An adequate buffer size to protect aquatic resources will depend on the specific function it needs to provide under site-specific conditions. Riparian buffer zones should be used as part of a larger conservation management system that improves management of upland areas to reduce pollutant loads at the source, and should not be relied upon as the sole BMP for water-quality improvement. Instead, they should be viewed as a secondary practice that assists in in-field and upland conservation practices and "polishes" the hillslope runoff from an upland area.

To understand the ecological effects of urbanization, we need to look at entire landscapes (broad scale) as well as affected sites (fine scale). Therefore, planning and management should include broad scale considerations that cover the needs of entire ecosystems, not just the pieces. However, managing ecosystems at a broader scale presents many challenges. Because ecosystems are so complex and in many cases exceed our ability to understand them completely, managers should use "adaptive management," meaning that managed ecosystems should be monitored so that timely action can be taken to correct for faulty management or changing conditions.

In addition to incorporating broad-scale issues, planning should consider the cumulative ecological effects of an activity in a watershed because actions that are harmless in isolation can create serious problems when large numbers of people act in the same way. The current degraded status of many habitats and ecosystems represents the cumulative, long-term effects of numerous persistent, and often incremental impacts from a wide variety of land uses and human alterations. Preservation of our biological resources would receive tremendous help if biologically sensitive spatial planning was incorporated early in the development process.

A vital aspect of measuring success involves assessing the effect of conservation efforts on the biological resource. To abate threats to the MCR and UCR watersheds, ALNHP identified numerous biological goals, within which lie the measures of biological success. Inherent within some of these desired results are monitoring programs that gather more detailed information relevant to progress. Many of the strategies developed in the Mid-Coosa River Basin Management Plan and TNC's Cumberland and Southern Ridge and Valley Ecoregion Plan could be applied to address these goals.

Goals

- Protect and maintain multiple, viable populations of all local scale conservation targets ensuring that, for each species, enough populations are protected to conserve their remaining natural range of ecological and genetic diversity.

- Add biomonitoring to the water quality monitoring efforts in the watersheds, using species such as mussels, caddisflies or other aquatic invertebrates, and fish species sensitive to changes in water quality

- Protect and, where possible, restore riparian vegetation.

- Maintain or improve water quality and hydrologic function within the watershed.

- Maintain or restore the natural ecological processes that maintain this ecosystem, including fire and habitat connectivity, to the extent possible.

- Maintain or restore the condition and long-term viability of portions of the main stem Coosa River that have not been inundated by impoundments, such as the Weiss Bypass Channel, and all tributaries where feasible.

- Increase conservation awareness and promote a land ethic within the watershed through education and outreach.

- Prevent the spread of established exotic invasive species, prevent the establishment of new invasive species, and eradicate existing populations of exotic invasive species where feasible.

- Conserve key parcels through easements, acquisitions, or government funded programs such as the USFWS Landowner Incentive Program and the various Farm Bill conservation programs.

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INTRODUCTION

The nation's surface water quality has improved in many ways since the enactment of the Clean Water Act in 1972, primarily through reductions in industrial and municipal source pollution as much effort has focused on understanding and addressing point source issues. However, water quality problems remain, especially those associated with non-point source (NPS) pollution which enters water diffusely in the runoff or leachate from rain or melting snow and is often a function of land use (Horan and Ribaudo 1999). NPS pollution has been identified as a major reason for remaining U.S. water quality problems (United States Environmental Protection Agency and United States Department of Agriculture 1998). In recent years, more focus and funding have been dedicated to furthering our understanding of NPS pollution and how to abate this ever-increasing problem in our nation's waters, but major problems still remain. The 2000 U. S. Environmental Protection Agency (EPA) Water Quality Inventory (United States Environmental Protection Agency 2002a) reported that 40% of streams, 45% of lakes, and 50% of estuaries assessed did not meet goals to support designated uses such as fishing and swimming. The leading causes of impairment included bacteria, nutrients, metals, and siltation, with the primary sources of impairment being runoff from agricultural lands and urban areas, municipal point sources, and hydrologic modifications (United States Environmental Protection Agency 2002a). Excessive sedimentation is generally recognized as the most significant NPS pollutant to many waterways (Clark et. al 1985). The impacts of these pollutants include: loss of fish and wildlife habitat; loss of recreational use of streams, rivers, and lakes; impacts to the drinking water supply; reduction in the aesthetic qualities of the aquatic environment; decreased water storage capacity in streams, lakes, and estuaries; clogging of drainage ditches and irrigation canals; and adverse human health impacts (Tim et al. 1992, Tim and Jolly 1994, United States Environmental Protection Agency 2002a). Nonpoint emissions typically are stochastic due to the impact of weather-related and other environmental processes, and the diffuse and complex nature of NPS pollution makes it difficult to measure and control (Hairston and Stribling 1995, Horan and Ribaudo 1999). NPS pollution has been identified as and remains a threat to water quality in Alabama (Alabama Department of Environmental Management 2002a).

NPS pollution is one of the leading national threats to biodiversity (Richter et al. 1997), particularly freshwater aquatic species which have the largest percentage of species extinct or at risk of any of the species groupings. NPS pollution has been identified as the leading factor contributing to the jeopardized status of southeastern native freshwater fishes (Etnier 1997), with excessive sedimentation resulting from poor land-use patterns identified as one the most insidious threats to southeastern fish, mussels, and snails (Bogan et al. 1995, Walsh et al. 1995, Etnier 1997, Neves et al. 1997). Recent studies of biodiversity patterns in the United States have ranked Alabama fifth among the states in total biodiversity, behind California, Texas, Arizona, and New Mexico, all of which are significantly larger (Stein 2002). This is largely due to the rich diversity of aquatic species in the state as Alabama leads the nation in the number of species of freshwater fish, turtles, mussels, snails, crayfish, and caddisflies. However, Alabama also ranks high in the number of species extinct or at risk of extinction. Alabama is ranked second in the number of species that have become extinct; only Hawaii is ranked higher (Stein 2002). Although Alabama is not ranked in the top five states for any single major taxonomic group, it is ranked fourth in total number of species at risk of extinction behind Hawaii, California, and Nevada (Stein 2002). The majority of the extinct species and a large number of the at risk

species are aquatic species that have been lost or declined due to habitat loss and degradation (impoundments, channelization, draining, hydrological alteration, etc.) and water quality degradation (point and NPS pollution). Noss and Peters (1995) developed various risk indices to evaluate ecosystem risks, and ranked each state in one of 3 categories: extreme risk, high risk, or moderate risk. Alabama was ranked in the extreme risk category for the overall risk index and ecosystem risk index and high risk for the species risk index. Alabama was ranked second with regard to number of the 21 most endangered ecosystems represented in the state and fifth in total risk to ecosystems.

The primary purpose of this project was to identify, remediate, or prevent habitat loss and degradation of various threatened and endangered (T & E) flora and fauna within the Middle Coosa River and Upper Coosa River watersheds. The scope of this project was to locate, assess, and quantify sensitive areas and habitats for T & E species and identify potential NPS land use stresses related to the watershed. As an overall measure, the biodiversity of the watersheds has been analyzed through identification of sensitive species and community occurrences indicative of the watershed's health.

WATERSHED DESCRIPTION – MIDDLE & UPPER COOSA RIVER

The Middle Coosa River (MCR) watershed encompasses approximately 6,659 km^2 (2,571 mi^2) in the Coosa River Basin in northeast Alabama (Fig. 1). The watershed encompasses the majority of Calhoun, Etowah, St. Clair, and Talladega counties and includes portions of Blount, Cherokee, Clay, Cleburne, De Kalb, Jefferson, and Shelby counties. The MCR watershed begins along the Coosa River where it crosses from Cherokee County into Etowah County south of Weiss Reservoir, flows through Neely Henry and Logan Martin lakes, and terminates in Lay Lake along the Shelby/Talladega County boarder (Fig. 1). The tributaries in the watershed all drain directly to the Coosa River which eventually drains to the Gulf of Mexico at Mobile Bay via the Alabama River (formed at the confluence of the Coosa and Tallapoosa rivers). The MCR watershed basin forms one of the United States Geological Survey's (USGS) third level hydrological unit code (HUC) subregion accounting units (Seaber et al. 1987) designated by an 8-digit HUC (03150106), and lies within the much larger Mobile River basin . There are 33 fourth level classification cataloging units (11-digit HUC formed by the 8-digit HUC plus an additional 3-digit code), or subwatersheds, within the MCR watershed (Fig. 2): Acker Creek (210), Ballplay Creek (010), Beaver Creek (140), Big Cove Creek (030), Black Creek (080), Blue Eye Creek (220), Bridge Creek (180), Cane Creek (190), Cheaha Creek (260), Clear Creek (280), Coosa River (020), Coosa River (230), Coosa River/Neely Henry Reservoir (090), Dye Creek (200), Easonville Creek (290), Flipper Creek (320), Greens Creek (130), Little Canoe Creek (110), Lower Big Canoe Creek (120), Lower Big Wills Creek (070), Lower Choccolocco Creek (270), Lower Kelly Creek (310), Middle Big Wills Creek (060), Middle Choccolocco Creek (250), Ohatchee Creek (160), Shoal Creek (150), Talladega Creek (330), Tallasseehatchee Creek (170), Town Creek (040), Upper Big Canoe Creek (100), Upper Big Wills Creek (050), Upper Choccolocco Creek (240), and Upper Kelly Creek (300).

The Upper Coosa River (UCR) watershed in Alabama encompasses approximately 2,202 km^2 (850 mi^2) in the Coosa River Basin in northeast Alabama (Fig. 3), and is part of a larger UCR watershed that extends into Georgia. Although the portion of the watershed in Alabama is

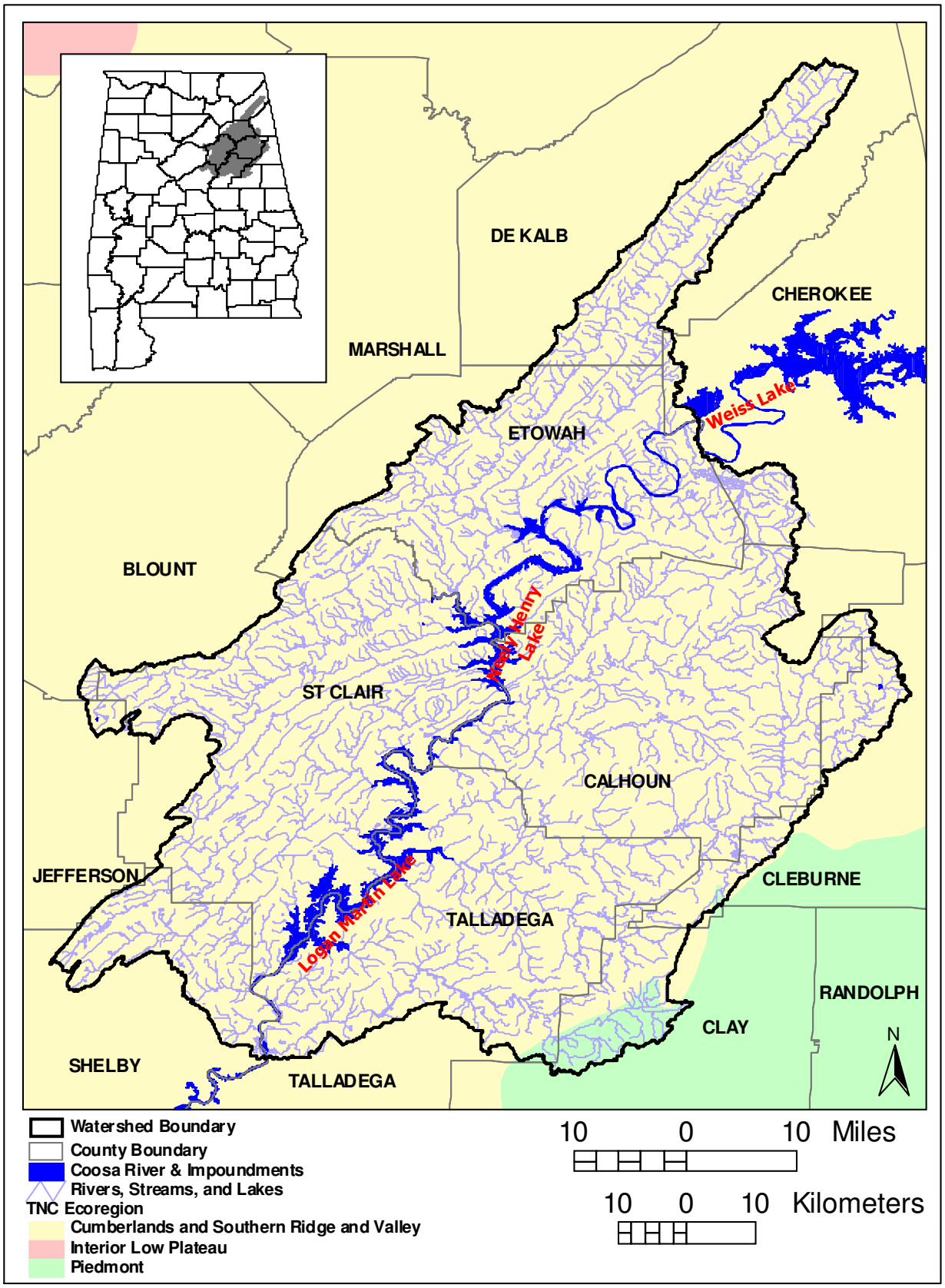

Figure 1. Location of the Middle Coosa River watershed in Alabama.

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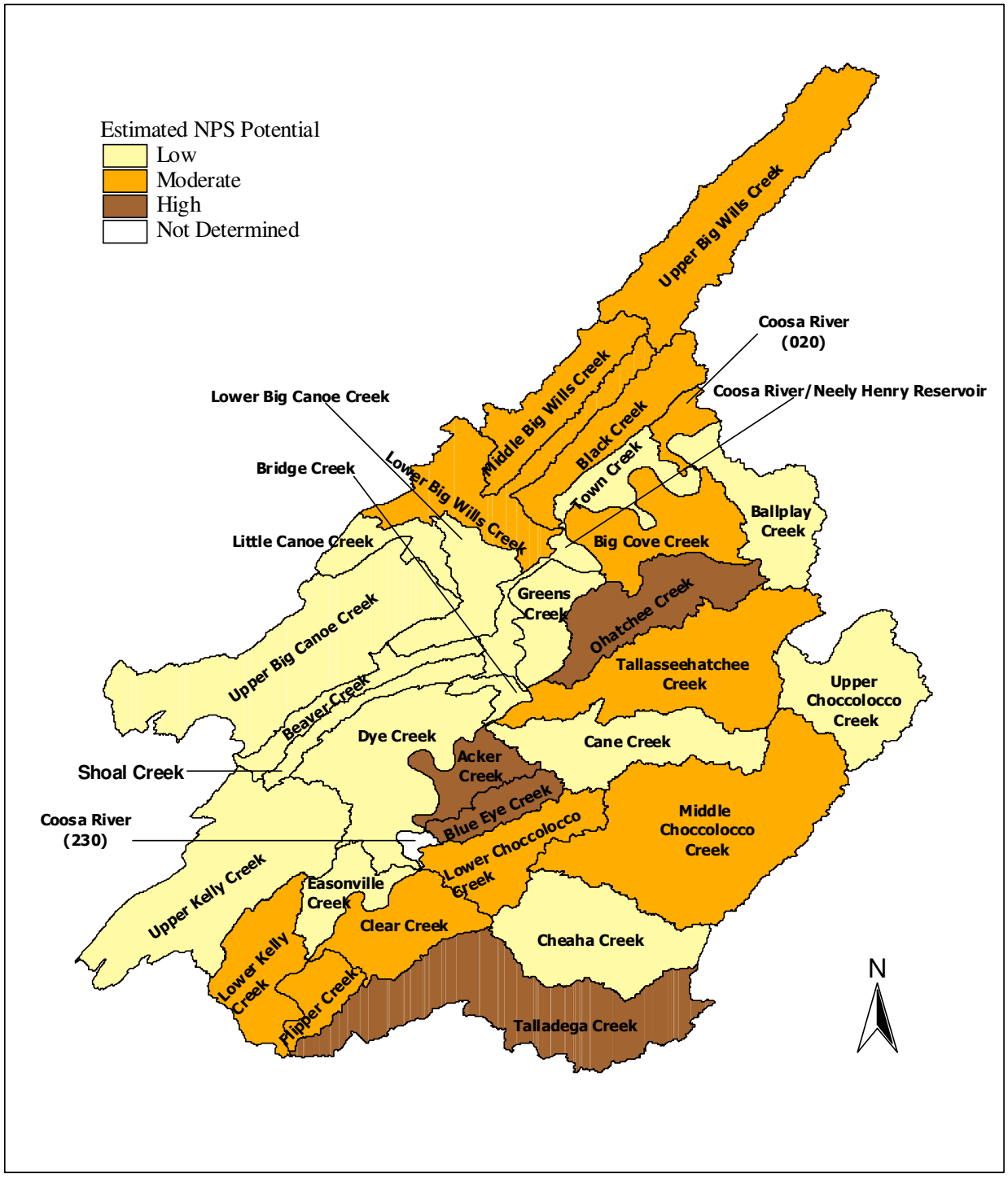

Figure 2. Subwatersheds within the Middle Coosa River watershed, Alabama. Estimates of NPS impairment potential are from Alabama Department of Environmental Management (2002b).

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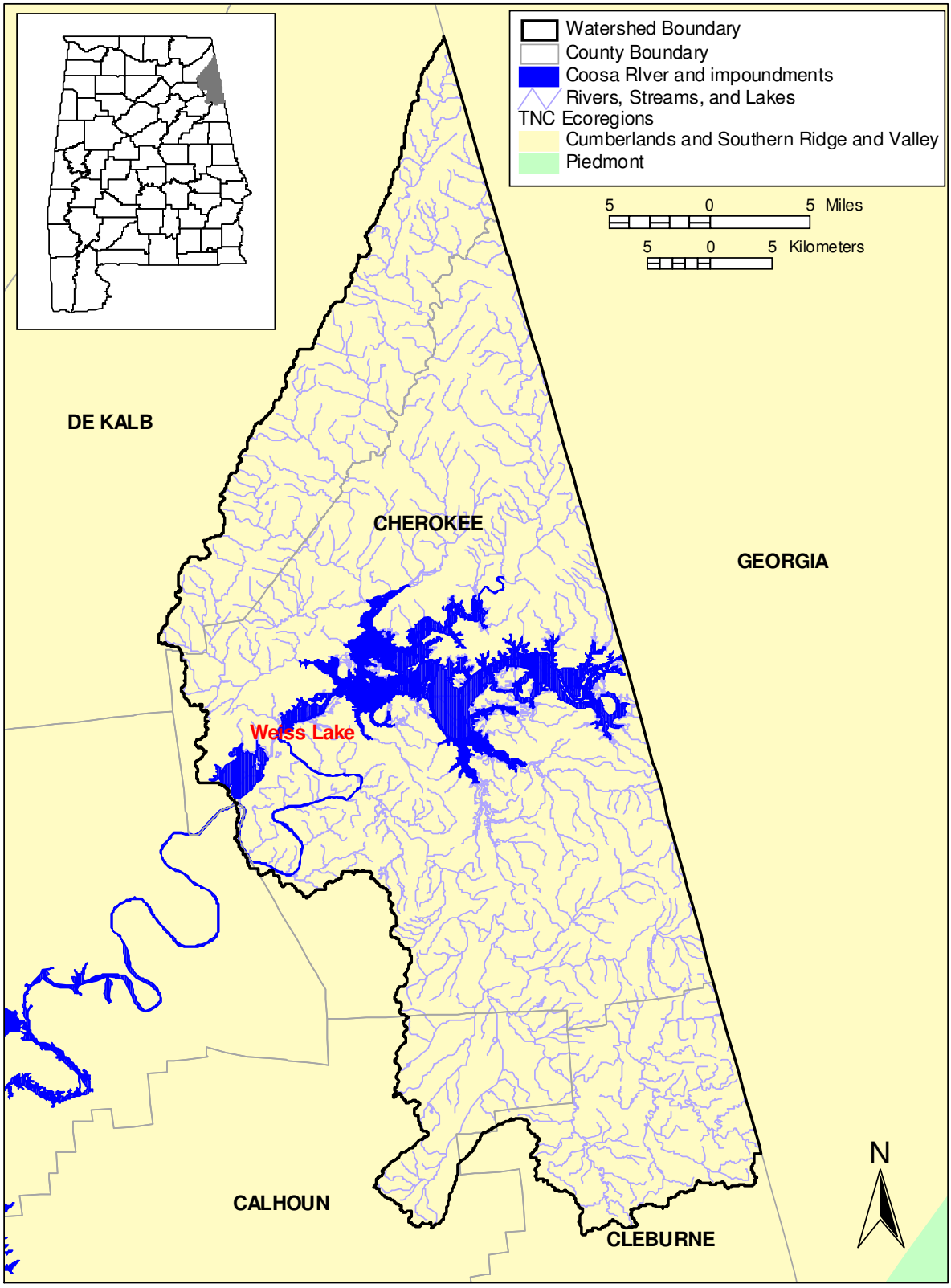

Figure 3. Location of the Upper Coosa River watershed in Alabama.

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influenced by water flowing into the watershed from Georgia, this analysis is restricted to the portion of the watershed in Alabama. The watershed encompasses the majority of Cherokee County, and portions of Calhoun, Cleburne, and De Kalb counties. The UCR watershed begins along the eastern state boundary in Cherokee, Cleburne, and De Kalb counties, flows through Weiss Reservoir and terminates where the Coosa River crosses from Cherokee County into Etowah County south of Weiss Reservoir (Fig. 3). The tributaries in the watershed all drain directly to the Coosa River which eventually drains to the Gulf of Mexico at Mobile Bay via the Alabama River (formed at the confluence of the Coosa and Tallapoosa rivers). The UCR watershed basin forms one of the USGS third level hydrological unit code (HUC) subregion accounting units (Seaber et al. 1987) designated by an 8-digit HUC (3150105), and lies within the much larger Mobile River basin . There are 16 fourth level classification cataloging units (11-digit HUC), or subwatersheds, within the MCR watershed (Fig. 4): Bear Creek (110), Coosa River (180), Coosa River (270), East Fork of the Little River (100), Hurricane Creek (240), Little River (120), Lower Chattooga River (060), Lower Terrapin Creek (250), Mills Creek (050), Spring Creek (130), Spring Creek (200), Sugar Creek (260), Upper Chattooga River (030), Upper Terrapin Creek (220), West Fork of the Little River (080), and Yellow Creek (140).

The majority of the MCR watershed is within the Cumberlands and Southern Ridge and Valley (CSRV) ecoregion (using ecoregion boundaries developed by The Nature Conservancy (TNC) (1999) as modified from Bailey (1995)), but a small part of the southeastern watershed is within the Piedmont ecoregion (Fig. 1). The UCR watershed is located entirely within the CSRV ecoregion (Fig. 3). The CSRV ecoregion is considered to be one of the most biologically important ecoregions in the Unites States, and contains more imperiled species (186) than any other ecoregion in the country (The Nature Conservancy 2003). It is the most significant ecoregion in North America north of Mexico for rare aquatic species, and is also significant in the eastern U.S. for its large tracts of second growth, unfragmented forest. Sandstone, shale, and cherty limestone are abundant. The topography varies from steeply sloped mountain terrain to gently sloped valleys. The Cumberlands and the Southern Ridge and Valley portions of the ecoregion are separated by an extreme physiographic divide. The Cumberlands section is composed of a high plateau and low mountains, which represent the western-most extension of the Southern Appalachian mountain chain. In contrast, the Southern Ridge and Valley (SRV) section is characterized by a series of narrow valleys bounded by high ridges (The Nature Conservancy 2003). However, much of the SRV area also consists of plains and open high hills.

The Coosa River watershed has a temperate climate with hot, humid summers and moderately cold winters. Average daily temperature is 26°C (79°F) during summer [32°C (90°F) average daily maximum] and 7°C (45°F) during winter [1°C (34°F) average daily minimum]. Total annual precipitation is approximately 135 cm (53 in).

The natural vegetation is primarily a southern Appalachian oak-hickory-pine forest community, with mixed mesophytic forest in riparian areas (Braun 1950, Skeen et al. 1993). The area supports forests of oaks (*Quercus* spp.), hickories (*Carya* spp.) and pines (*Pinus* spp.), with beech (*Fagus grandifolia*), tulip poplar (*Liriodendron tulipifera*), and sugar maple (*Acer saccharum*) prominent in some areas (Braun 1950, Skeen et al. 1993). Herbs such as showy orchis (*Platanthera nivea*), twinleaf (*Jeffersonia diphylla*), bent trillium (*Trillium flexipes*), and purple sedge (*Carex purpurifera*) inhabit the humus-rich slopes beneath the hardwood canopy.

Streamside zones range from well or moderately forested to narrowly vegetated or nonvegetated. Many of the smaller streams maintain their natural meanders but some smaller streams and many of the larger flowing water courses have been channelized.

Historically, the Mobile River Basin (MRB) aquatic fauna was one of the most diverse in the world, with 40 endemic fish species, 30 endemic mussels, and 120 endemic snails (Noss and Peters 1995). However, this basin has suffered from the highest number of extinctions in the nation; almost 50% of all documented species extinctions in the U.S. since European settlement occurred in the MRB during the 20th century (Master et al. 1998), with many occurring in the Coosa River. At least 18 mussel species and 32 snail species are already extinct. The MRB's historic gastropod fauna was the most diverse in the world, represented by 9 families and approximately 118 species (Bogan et al. 1995). Several genera were endemic to the Mobile River Basin: *Tulotoma*, *Clappia*, *Lepyrium*, *Gyrotoma*, *Amphigyra*, and *Neoplanorbis*. The family Pleuroceridae had the greatest described species diversity (76 species), with the genera *Pleurocera*, *Leptoxis*, and *Elimia* having their greatest radiation in the Coosa River basin (Bogan et al. 1995). This unique gastropod fauna has declined precipitously, especially in the Coosa River (Heard 1970, Stein 1976, Palmer 1986, Bogan et al. 1995). Historically, the Coosa River drainage had at least 82 snail species, 60 of which were endemic to this drainage (Hartfield 1993). Twenty-six (31.7%) of these species (in 6 genera) are presumed extinct (Appendix D), with 4 genera presumed extinct: *Clappia* (2 species), *Gyrotoma* (6 species restricted primarily to the Shoals of the Coosa River), *Amphigyra* (1 species), and *Neoplanorbis* (4 species) (Bogan et al. 1995). The genus *Leptoxis* has been reduced to a single species restricted to 3 Coosa River creek tributary systems. The Mobile River basin endemic genus *Tulotoma*, formerly widespread in the main channel of the Alabama and Coosa rivers, was presumed extinct until a population of the Alabama livebearing, or tulotoma, snail (*Tulotoma magnifica*) was rediscovered by Hershler et al. (1990). The majority of the remaining gastropod species are at a high risk of decline or extinction, with 43 species on the federal Endangered Species Candidate List before it was restructured (Bogan et al. 1995). Declining gastropod species diversity can be directly linked to the inundation of shoal areas of rivers by impoundment and siltation resulting from a variety of watershed disturbances (Bogan et al. 1995). Many species that were not eliminated by river impoundments have had their ranges fragmented by the impoundments and persist as isolated populations, increasing the risk to these species.

Both the MCR and UCR watersheds were identified as watersheds critical to conserving freshwater fish and mussel species, with the MCR watershed considered to be a hot spot (>10 species) for at-risk fish and mussel species (Master et al. 1998). Much of both the UCR watershed and the lower half of the MCR watershed were identified as priority areas for freshwater biodiversity conservation in the southeastern United States (Smith et al. 2002). Priority terrestrial and aquatic conservation areas identified in TNC's Cumberland and Southern Ridge and Valley Ecoregion Plan (The Nature Conservancy 2003) covered approximately half of both watersheds (Fig. 5). Conservation areas can be considered to be broad-scale areas for enacting a wide-range of conservation measures which may be tailored to specific targets at a variety of scales. Threats to TNC conservation targets identified in the ecoregion included incompatible forestry practices, residential development, agricultural practices, fire suppression, impoundments/stream modification, mining practices, incompatible recreation, industrial/municipal pollution, invasive exotic species, and oil & natural gas drilling.

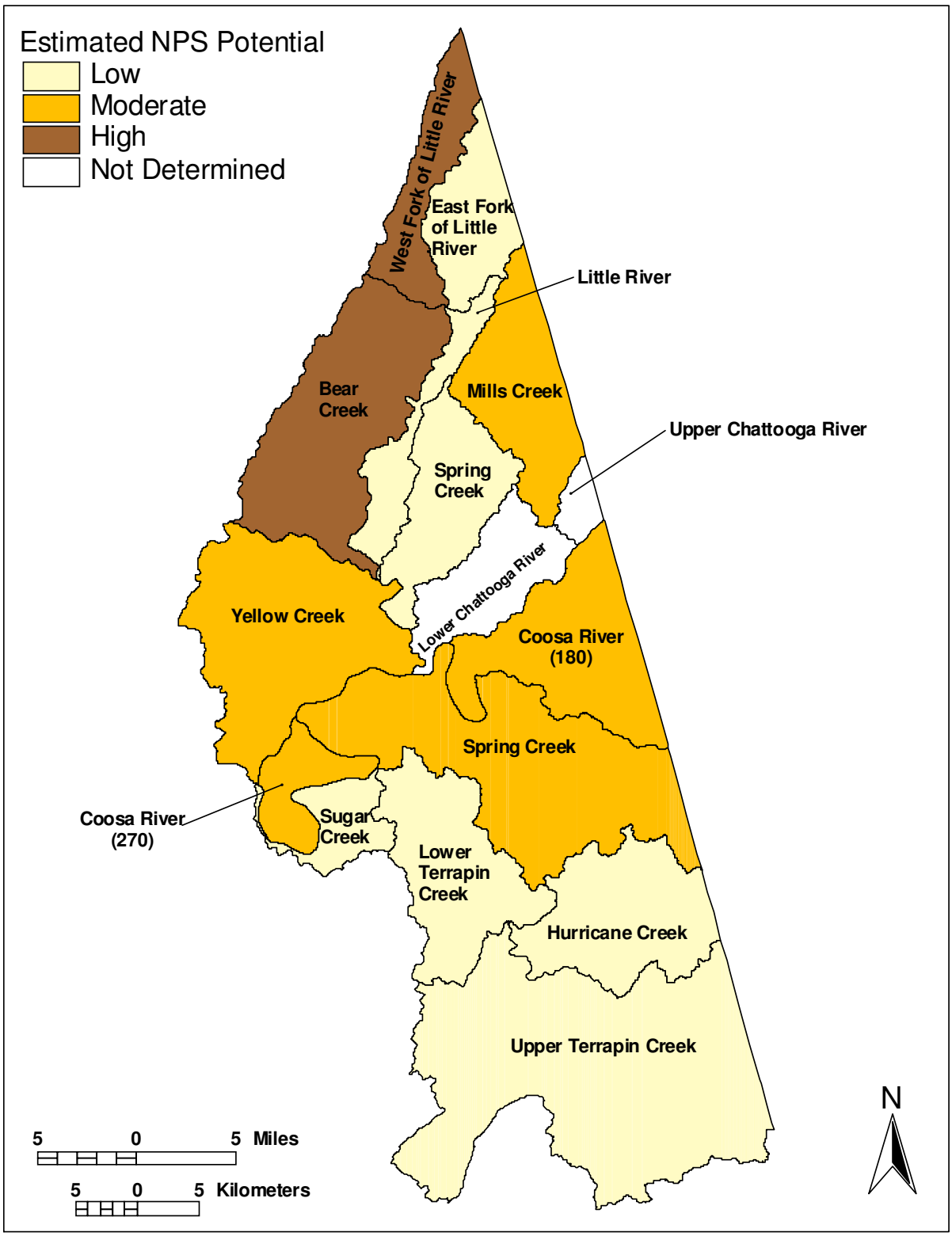

Figure 4. Subwatersheds within the Upper Coosa River watershed, Alabama. Estimates of NPS impairment potential are from Alabama Department of Environmental Management (2002b).

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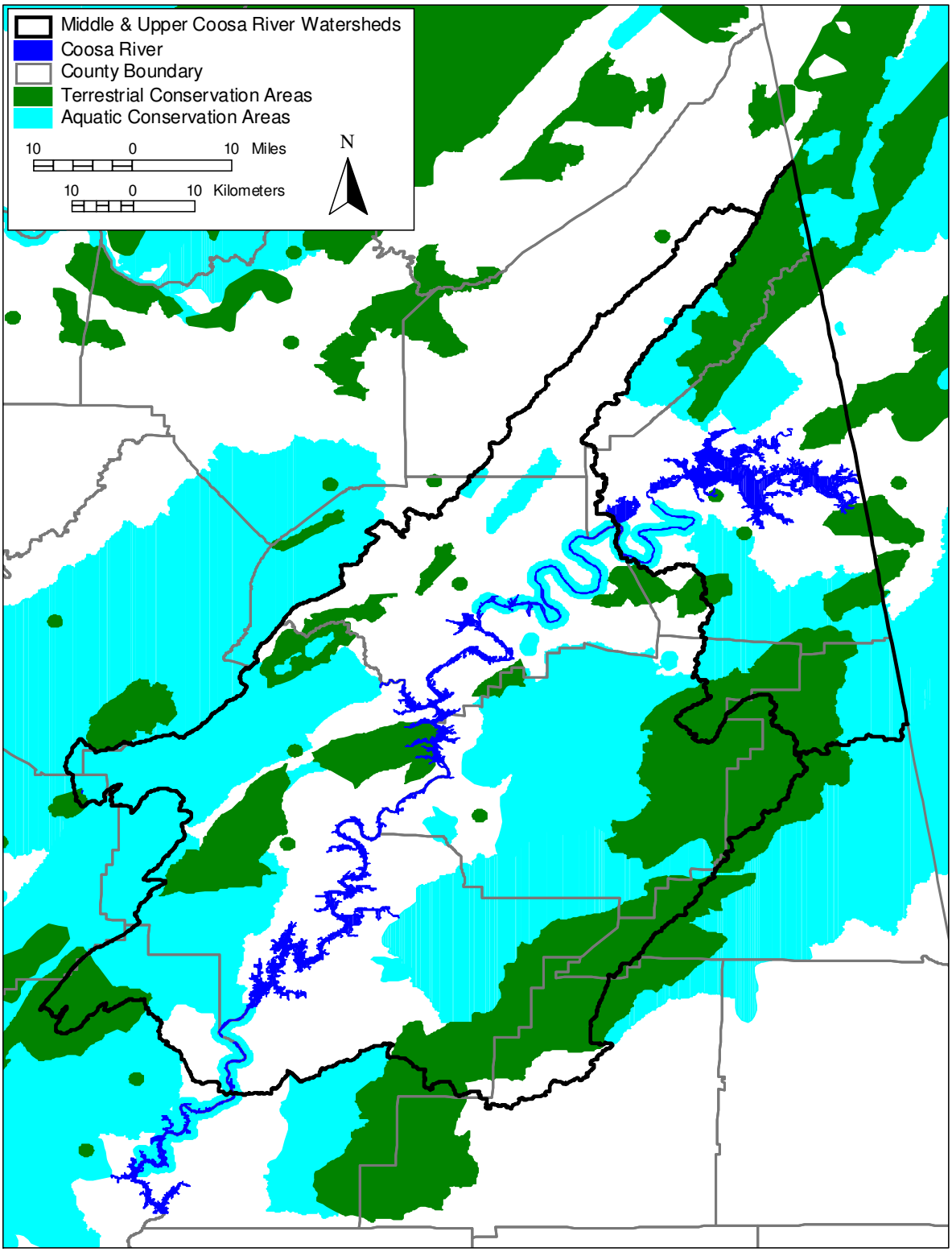

Figure 5. Conservation areas in the Middle and Upper Coosa River watersheds as identified by The Nature Conservancy in their Cumberlands and Southern Ridge & Valley Ecoregion Conservation Plan (The Nature Conservancy 2003).

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Logan Martin Dam

Human development has drastically altered the hydrology within both the MCR and UCR watersheds. Six major dams were constructed along the Coosa River between 1914 and 1966, with the river impounded for hydropower from just above its confluence with the Tallapoosa River for approximately 402 river kilometers (250 mi). In the MCR watershed, there are 2 major dams on the Coosa River, both constructed by Alabama Power: Logan Martin Dam and H. Neely Henry Dam. Construction of Logan Martin Dam was completed in 1964, forming the 6,177 ha (15,263 ac) Logan Martin Lake. Construction of H. Neely Henry Dam was completed in 1966, forming the 4,532 ha (11,200ac) H. Neely Henry Lake. The major dam in the UCR watershed is Weiss Dam, which was also constructed by Alabama Power. Construction of Weiss Dam was completed in 1961, forming the 12,222 ha (30,200 ac) Weiss Lake. All three lakes are major recreational areas with extensive development around their shores. These dams have impounded the majority of the main stem Coosa River within both watersheds, and also have affected the hydrology of the tributaries, particularly those affected by backflow from the impoundments. The impoundment of the main stem Coosa River and its resulting altered hydrology adversely impacted the aquatic fauna of the watershed, resulting in many of the extinctions mentioned above.

The Alabama Department of Environmental Management (ADEM) rated the potential for NPS impairment within the subwatersheds of the MCR watershed as low (16 subwatersheds), moderate (12 subwatersheds), or high (4 subwatersheds) with 1 subwatershed unranked because of lack of data (Fig. 2) (Alabama Department of Environmental Management 2002b). Six sources for potential NPS impairment were evaluated, and nonrural sources had the most subwatersheds (6) rated as having a high NPS impairment potential within the MCR watershed. Both the Etowah and St. Clair County watershed assessment advisory groups rated the Middle Coosa River watershed as the most degraded watershed in both counties in the last quarter of 1998. Primary concerns cited by the locally led advisory group were nutrients, bacteria, and low dissolved oxygen in surface and ground waters; excessive animal waste applied to land; livestock water inadequate for proper rotation of grazing animals; and erosion and sedimentation from cropland areas. Issues related to urbanization of the watershed and the accompanying sedimentation and bacterial contamination also were concerns raised by the group.

ADEM rated the potential for NPS impairment within the subwatersheds of the UCR watershed as low (7 subwatersheds), moderate (5 subwatersheds), or high (2 subwatersheds) with 2 subwatersheds unranked because of lack of data (Fig. 4) (Alabama Department of Environmental Management 2002b). Six sources for potential NPS impairment were evaluated, and the only activities with a subwatershed rated as having a high NPS impairment potential were forestry activities (2 subwatersheds) and cropland runoff (5 subwatersheds).

METHODS

Rare, Threatened, and Endangered Species

Rare, threatened, and endangered species in these watersheds were identified using the Alabama Natural Heritage Program[SM] Biological Conservation Database (BCD), a natural heritage database documenting rare species and natural communities recorded in Alabama following established Natural Heritage Protocol for processing biological information. The basic unit of this protocol is the Element: any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, or other ecological feature. As defined in the Element Occurrence Data Standard (NatureServe 2002), an Element Occurrence (EO) is "a locational record representing a single extant habitat which sustains or otherwise contributes to the survival of a population" or natural community, and represents the area in which the element is, or was, present. The Element Occurrence Record (EOR) is the computerized record in the database that contains the biological and locational information regarding a specific EO, as well as an assessment and ranking of the conservation value of that EO against other EOs of its kind. A key component of the Heritage EO Methodology is the assignment of Heritage Ranks to species at the global and subnational, or state, level (Appendix B).

Rare species in the MCR watershed were identified by selecting EORs within the watershed boundaries within a geographic information system (GIS). The EOR spatial file was created by exporting all EORs from BCD and converting them to an ArcView (Environmental Research Systems Institute, Redlands, California) shapefile format. EORs within the MCR were selected by intersecting the EOR shapefile with a shapefile delineating the watershed boundaries. Additional locations of mussel species in the MCR and UCR watersheds were identified from surveys conducted by Gangloff (2003) for which EORs have not yet been extracted.

The association between EORs and water bodies was evaluated using the EOR shapefile and Environmental Protection Agency's (EPA) National Hydrography Dataset (NHD) coverage (available online at http://nhd.usgs.gov/data.html). NHD data for the watersheds were buffered to 100 m, and the number of EORs within the buffer were counted using the Count Points in Polygon Extension for ArcView (Zhou 2000).

Rare species areas were identified using a hexagon coverage, with hexagons of 1,000 and 100 ha. The hexagon coverages were generated using the Make Hexes command of the Habitat Analyst module of Patch Analyst Extension 2.2 for ArcView (Rempel 2002). The number of EORs within the hexagon were counted using the Count Points in Polygon Extension for ArcView (Zhou 2000). Hexagons were coded "critical", "imperiled", and "rare" based on the federal and state protection status and heritage rank of the species present within the hexagon. Hexagons were coded "critical" if federal or state protected species or species with a heritage rank of G1 or S1 were within the hexagon. "Imperiled" hexagons were those containing species with a heritage rank of G2 or S2 without federal or state protection. "Rare" hexagons were those containing species with a heritage rank of G3 – G5 without federal or state protection.

Conservation Targets

The identification of focal conservation targets is the basis of the TNC standard methodology (The Nature Conservancy 2000) for site conservation (called the Five-S Approach) and is the basis for all subsequent steps of the methodology including identifying threats, developing strategies, and measuring success. The selection of conservation targets has an enormous impact on planning and conservation efforts as they define the ecological processes that need to be protected, managed, and restored as well as defining the ecological boundaries of the conservation effort. In this case, the boundaries for conservation efforts in the MCR watershed were defined by the watershed. However, prioritizing focal areas within the watershed was determined by defining conservation targets at the local, intermediate, and coarse scale levels in order to conserve biodiversity at multiple scales within the landscape along with the ecological processes that sustain biodiversity (see Appendix C for a discussion of scale). Conservation targets were selected to represent the biodiversity within the site as determined from ALNHP's records.

Human Context Information

Managed Areas

In addition to data on rare species, information regarding managed areas within the state is maintained in ALNHP's BCD system. All managed areas within the 11 Alabama counties in the MCR and UCR watersheds were exported from BCD and imported into the GIS for analysis. Managed areas within the MCR watershed were identified by intersecting the managed area point data layer with the existing MCR watershed boundary layer. Additional managed areas were identified by intersecting the appropriate GIS data layers with the MCR watershed boundary layer. Polygon data layers representing managed area boundaries were downloaded from the appropriate website when possible. A wildlife management area coverage was obtained from the Alabama Lands Division of the Alabama Department of Conservation and Natural Resources. United States Forest Service (USFS) National Forest boundaries, Inventoried Roadless Areas, and Special Designated Areas coverages were downloaded from the USFS GIS coverages website (http://roadless.fs.fed.us/documents/feis/data/gis/coverages/index.shtml). State parks were identified using the managed area database file from EPA's Better Assessment Science Integrating point and Nonpoint Sources (BASINS) 3.0 dataset (United States Environmental Protection Agency 2001a). BASINS is a multipurpose environmental analysis system developed by EPA for use in performing watershed- and water-quality-based studies, and contains both data layers and spatial models and tools. For more information on BASINS, see the website http://www.epa.gov/ost/basins/. TNC preserves were identified using the file exported from BCD. In the MCR watershed, Fort McClellan Military Reservation boundaries were obtained from the BASINS managed area database file, and boundaries for the Anniston Ordinance Depot Military Reservation and Coosa River Depot Annex and the location of Noccalula Falls were digitized from USGS topographic maps. In the UCR watershed, Little River National Preserve boundaries were obtained from the BASINS managed area database file.

Land Cover

Land cover information was obtained from Alabama Soil and Water Conservation Committee (ASWCC) published estimates of percent land cover for Alabama (Alabama Soil and Water Conservation Committee 1998). Land cover information also was obtained using GIS estimates calculated from the National Land Cover Data (NLCD) (Vogelmann et al. 2001, United States

Table 1. Land cover classes used to reclassify U.S. Geological Survey National Land Cover Data (NLCD) for analysis.

NLCD class	analysis class
open water	water
low intensity residential	urban
high intensity residential	urban
commercial/industrial/transportation	urban
bare rock/sand/clay	other
quarries/strip mines/gravel pits	mined land
transitional	other
deciduous forest	forest
evergreen forest	forest
mixed forest	forest
shrubland	other
orchards/vineyards/other	other
grasslands/herbaceous	other
pasture/hay	pasture
row crops	row crop
urban/recreational grasses	pasture
woody wetlands	forest
emergent herbaceous wetlands	other

Geological Survey 2002). Derived from the early to mid-1990s Landsat Thematic Mapper satellite data, NLCD is a 21-class land cover classification scheme applied consistently over the United States. The spatial resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, North American Datum 1983. NLCD for Alabama was reclassified using seven classes (Table 1) to more closely match the broad land use categories used by the ASWCC; classes that are part of the 21-class NLCD classification not listed did not occur in Alabama. The percentage of the watershed covered by each class was calculated for the subwatersheds, with the reclassified NLCD classes not included in the ASWCC estimates grouped as "other" in summarizing the data. Road densities were calculated using Topologically Integrated Geographic Encoding and Referencing (TIGER) system line files (United States Census Bureau 2000a) for road representations and HUC code files representing the watershed.

Population & Demographics

Municipalities and urban areas were identified using data from EPA's BASINS dataset (United States Environmental Protection Agency 2001a) and TIGER/Line Files (United States Census Bureau 2000a, Environmental Systems Research Institute 2000). The populated place locations file from the BASINS dataset were used to select all populated place locations within the watershed, and urbanized

areas were identified using the urban areas 2000 TIGER file and the urban area file from BASINS. Population and demographic information were obtained using census 2000 data (United States Census Bureau 2000b, 2000c).

Potential Pollution Sources

Geographic Information System (GIS) spatial data layers for the Middle Coosa watershed were collected from a variety of sources, including descriptive layers developed by The Nature Conservancy and other layers described below. Other spatial layers covering the watershed obtained include 30 m LANDSAT Thematic Mapper satellite data, US Geological Survey (USGS) 7.5 minute topographic quadrangles in digital raster graphic format, and USGS Digital Orthophotographic Quarter Quadrangles (DOQQ). All GIS operations and analyses were conducted using ArcView 3.3 or ArcGIS 8.3 (Environmental Systems Research Institute, Redlands, California, USA).

Agricultural & Animal Production
Animal concentrations for each of the subwatersheds were obtained from ADEM (2002b) and ASWCC (1998).

Permitted Sites
Permitted discharge sites within the watershed were obtained from ADEM (2002b) and from data layers in EPA's BASINS dataset (United States Environmental Protection Agency 2001a). BASINS was used to identify Toxics Release Inventory (TRI) sites; National Pollutant Discharge Elimination System (NPDES) permit compliance system (PCS) sites; Industrial Facilities Discharge (IFD) sites; Resource Conservation and Recovery Information System (RCRIS) hazardous and solid waste sites; Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) or Superfund national priority list sites; and dam and mine locations. Descriptions below are from the metadata for these files (Environmental Protection Agency 2001b).

PCS is a national computerized management information system that automates entry, updating, and retrieval of NPDES data and tracks permit issuance, permit limits and monitoring data, and other data pertaining to facilities regulated under NPDES. PCS records water-discharge permit data on more than 75,000 facilities nationwide. The NPDES permit program regulates direct discharges from municipal and industrial wastewater treatment facilities that discharge into the navigable waters of the United States. Wastewater treatment facilities (also called "point sources") are issued NPDES permits regulating their discharge.

IFD Sites are industrial or municipal point sources discharging to surface waters. The facilities were extracted from the U.S. EPA's IFD database to which a number of organizations including federal, state, and interstate agencies contribute.

RCRIS is a national computerized management information system in support of the Resource Conservation and Recovery Act (RCRA). RCRA requires that generators, transporters, treaters, storers, and disposers of hazardous waste provide information concerning their activities to state environmental agencies.

CERCLIS is a national computerized management information system that automates entry, updating, and retrieval of CERCLIS data and tracks site and non-site specific Superfund data in support of the Comprehensive Environmental Response, Compensation, and Liability Act. It contains information on hazardous waste site assessment and remediation.

The TRI database (United States Environmental Protection Agency 1999) contains data on annual estimated releases of over 300 toxic chemicals to air, water, and land by the manufacturing industry. Industrial facilities provide the information, which includes: the location of the facility where chemicals are manufactured, processed, or otherwise used; amounts of chemicals stored on-site; estimated quantities of chemicals released; on-site source reduction and recycling practices; and estimated amounts of chemicals transferred to treatment, recycling, or waste facilities. The TRI data for chemical releases to land are limited to releases within the boundary of a facility. Releases to land include: landfills; land treatment/application farming; and surface impoundments, such as topographic depressions, man-made excavations, or diked areas. Air releases are identified as either point source releases or as non-point (i.e. fugitive) releases, such as those occurring from vents, ducts, pipes, or any confined air stream. Surface water releases include discharges to rivers, lakes, streams, and other bodies of water. In addition, the database covers releases to underground injection wells (where chemicals are injected into the groundwater) and off-site transfers of chemicals to either publicly-owned treatment works (POTWs) or any other disposal, treatment, storage, or recycling facility.

Septic Systems

The number of estimated septic systems and estimated number of failing septic systems within each watershed was obtained from ASWCC published estimates (Alabama Soil and Water Conservation Committee 1998). Estimates of point source impairment potential from septic systems were obtained from Alabama Department of Environmental Management (2002b).

Other Sources

Other potential point and nonpoint sources of pollution were identified using data obtained from the Consortium of Alabama Environmental Groups (2003). They identified and documented potential sources using low-flying aircraft. Photos and their digital database were obtained from the Consortium and used in the GIS analysis.

303 (d) Listed Streams

Alabama's 2000 Final 303 (d) list of impaired streams and the corresponding GIS file were obtained online from ADEM (2000). However, the downloaded shapefile contained the 1998 listed waterbodies, not those on the final 2000 list. After comparison to the 2000 final list to eliminate those segments no longer on the list, the streams were buffered in the GIS and the resulting file was intersected with the BCD export file to determine rare species in the vicinity of the listed streams.

RESULTS AND DISCUSSION – MIDDLE COOSA RIVER WATERSHED

Rare, Threatened, and Endangered Species

There were 281 occurrences of rare plant and animal species and natural communities documented in the MCR watershed (Appendix E). Sixty-four of these rare species occurrences were historical: occurrences last observed prior to 1980. Some of these historical populations have been extirpated

from the watershed as habitat conditions have changed. However, some populations may still be extant because the historical occurrence status may reflect the absence of survey work since last observed rather than a loss of the population. Therefore, if the habitat still exists, these historical occurrences need to be revisited to determine if the population is still extant. No rare occurrences were documented in 11 of the 33 subwatersheds: Acker Creek (210), Blue Eye Creek (220), Bridge Creek (180), Coosa River (020), Coosa River (230), Coosa River/Neely Henry Reservoir (090), Easonville Creek (290), Flipper Creek (320), Lower Big Canoe Creek (120), Middle Big Wills Creek (060), and Town Creek (040). Surveys of these subwatersheds are needed to verify the absence of rare species.

The rare species documented in the MCR watershed included 73 occurrences of 23 species that are federal or state protected species (Table 2). Eighteen were historical occurrences. The protected species included 2 amphibians, 1 bird, 4 fish, 1 mammal, 5 mussels, 1 reptile, 3 snails, and 6 vascular plants. One amphibian species, tiger salamander (*Ambystoma tigrinum*), had only historical occurrences documented in the watershed. Three mussel species had only 1 historic occurrence documented in the watershed. One species, southern acornshell (*Epioblasma othcaloogensis*), may be extinct, but the other 2 mussel species, southern clubshell (*Pleurobema decisum*) and triangular kidneyshell (*Ptychobranchus greenii*) were detected in a recent survey not yet incorporated into BCD.

There were an additional 43 occurrences of 20 species considered globally imperiled by Natural Heritage ranks that are not state or federally protected (Table 3), with 2 of these being historical occurrences. This included 7 insects, 1 natural community, 5 snails, and 7 vascular plants. One of the plants, limerock arrowwood (*Viburnum bracteatum*), was known only from 1 historic occurrence. There were 101 occurrences of 68 species without state or federal protection considered state imperiled (S1 and S2) but not globally imperiled (Table 4), with 22 being historical occurrences. This included 2 amphibians, 1 fish, 25 insects, 1 mussel, and 39 vascular plants.

A large number of the rare occurrences were associated with water bodies (lakes, rivers, and streams) in the watershed; 97.3 % of all occurrences were within 1 km (82.2% within 500 m) of a water body and 54.8% were within 100 m. However, very few occurrences were associated with the main stem of the Coosa River (Fig. 6). One hundred stream segments had EORs within 100 m of the stream, but only 4 stream reaches had $\geq$5 EORs within 100 m of the stream: sections of South Branch Cane Creek in Calhoun County, Black Creek in Etowah County, and Choccolocco Creek and Shoal Creek in Cleburne County (Fig. 6, Appendix F).

The EOR-rich stream segment of South Branch Cane Creek was an approximately 1.9 km (1.2 mi) segment on Fort McClellan Military Reservation on the Anniston topographic quadrangle. There were 15 species of caddisfly within this stream segment: *Cheumatopsyche harwoodi* (rank GNR/S2), *Heteroplectron americanum* (rank GNR/S2), *Hydroptila consimilis* (rank GNR/S2S3), *Hydroptila setigera* (rank G1/S1), *Ironoquia punctatissima* (rank GNR/S2), *Molanna blenda* (rank GNR/S2), *Polycentropus carlsoni* (Carlson's polycentropus caddisfly - rank G1G3/S1), *Psilotreta frontalis* (rank GNR/S2), *Pycnopsyche gentilis* (rank GNR/S1), *Pycnopsyche lepida* (rank GNR/S2), *Pycnopsyche luculenta* (rank GNR/S2), *Rhyacophila glaberrima* (rank GNR/S2), *R. nigrita* (rank GNR/S2), *R. torva* (rank GNR/S2), and *Triaenodes taenia* (Cold Spring triaenodes caddisfly - rank GNR/S1).

Table 2. Federal listed endangered and threatened species and state protected species documented by the Alabama Natural Heritage Program[SM] occurring in the Middle Coosa River watershed, Alabama. The hydrologic unit code (HUC) is the 3 digit subwatershed code of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]	HUC
Amphibians	*Ambystoma tigrinum*	tiger salamander	G5	S3	(PS)[c]		4[d]	250, 270
Amphibians	*Aneides aeneus*	green salamander	G3G4	S3		SP	2	110, 050
Birds	*Picoides borealis*	red-cockaded woodpecker	G3	S2	LE	SP	4	240
Fish	*Cottus paulus*	pygmy sculpin	G1	S1	LT	SP	1	250
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	10[e]	250, 240, 050
Fish	*Etheostoma ditrema*	coldwater darter	G1G2	S1		SP	6	250, 030, 190, 170
Fish	*Typhlichthys subterraneus*	southern cavefish	G4	S3		SP	2	050
Mammals	*Myotis grisescens*	gray bat	G3	S2	LE	SP	3[f]	050
Mussels	*Epioblasma othcaloogensis*	southern acornshell	GHQ	SH	LE	SP	1[d]	310
Mussels	*Lampsilis altilis*	fine-lined pocketbook	G2	S2	LT	SP	3[f]	250, 240
Mussels	*Pleurobema decisum*	southern clubshell	G1G2	S1S2	LE	SP	1[g]	310
Mussels	*Pleurobema georgianum*	southern pigtoe	G1	S1	LE	SP	2	240
Mussels	*Ptychobranchus greenii*	triangular kidneyshell	G1	S1	LE	SP	1[g]	310
Reptiles	*Heterodon simus*	southern hognose snake	G2	SH		SP	3	250, 270, 170
Snails	*Elimia crenatella*	lacey elimia	G1	S1	LT	SP	3	260, 330
Snails	*Leptoxis taeniata*	painted rocksnail	G1	S1	LT	SP	3	270, 250
Snails	*Tulotoma magnifica*	Alabama livebearing snail	G1	S1	LE	SP	4	270, 310, 160
Vascular Plants	*Aster georgianus*	Georgia aster	G2G3	S2S3	C		9[h]	100, 140, 200, 280, 070
Vascular Plants	*Clematis socialis*	Alabama leather-flower	G1	S1	LE		4	070, 100
Vascular Plants	*Marshallia mohrii*	Mohr's Barbara's buttons	G3	S3	LT		1	190
Vascular Plants	*Platanthera integrilabia*	white fringeless orchid	G2G3	S2	C		2	170, 190
Vascular Plants	*Sarracenia oreophila*	green pitcher plant	G2	S2	LE		1	010
Vascular Plants	*Xyris tennesseensis*	Tennessee yellow-eyed grass	G2	S1	LE		3	190

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.
[c] *Ambystoma tigrinum stebbensi*, LE rangewide - Arizona, Mexico.
[d] All occurrences were historical.
[e] Six occurrences were historical.
[f] One occurrence was historical.
[g] Occurrence was historical but recent surveys not yet incorporated into ALNHP's database detected the species.
[h] Three occurrences were historical.

Table 3. Globally imperiled (G2) or critically imperiled (G1) species without state or federal protection documented occurring within the Middle Coosa River watershed, Alabama, by the Alabama Natural Heritage Program[SM]. Imperilment status was indicated by Natural Heritage ranks. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Insects	*Cheumatopsyche helma*	Helma's cheumatopsyche caddisfly	G1G3	S1	1	260
Insects	*Hydroptila cheaha*	caddisfly	G1	S1	1	330
Insects	*Hydroptila choccolocco*	caddisfly	G1	S1	1	240
Insects	*Hydroptila patriciae*	caddisfly	G1	S1	1	240
Insects	*Hydroptila setigera*	caddisfly	G1	S1	1	190
Insects	*Polycentropus carlsoni*	Carlson's polycentropus caddisfly	G1G3	S1	2	190, 250
Insects	*Pseudanophthalmus alabamae*	a ground beetle	G1G2	SNR	7	050
Natural Communities	*Bigelowia nuttallii – Coreopsis pulchra - Liatris microcephala*	sandstone glade	G2?	S2	3	080
Snails	*Antrorbis breweri*	snail	G1	S1	1	050
Snails	*Elimia bellula*	walnut elimia	G1	S1	7	240, 250, 260, 270
Snails	*Elimia capillaris*	spindle elimia	G1	S1	1	100
Snails	*Elimia chiltonensis*	prune elimia	G1	S1	1	150
Snails	*Pleurocera showalteri*	upland hornsnail	G1Q	S1	1	310
Vascular Plants	*Cuscuta harperi*	Harper's dodder	G2	S2	1	080
Vascular Plants	*Hymenocallis coronaria*	shoals spider-lily	G2Q	S2	1	270
Vascular Plants	*Lysimachia fraseri*	Fraser's loosestrife	G2	S1	2[c]	110, 250
Vascular Plants	*Quercus boyntonii*	running post oak	G1	S1	4	200, 300
Vascular Plants	*Sabatia capitata*	rose gentian	G2	S2	3	100, 190
Vascular Plants	*Scutellaria alabamensis*	Alabama skullcap	G2	S2	3	150, 170
Vascular Plants	*Viburnum bracteatum*	limerock arrowwood	G1	S1	1[c]	030

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.
[c] One occurrence was historical.

Table 4. State imperiled (S2) or critically imperiled (S1) species not globally imperiled and without state or federal protection documented occurring within the Middle Coosa River watershed, Alabama, by the Alabama Natural Heritage Program[SM]. Imperilment status was indicated by Natural Heritage ranks. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Amphibians	*Desmognathus aeneus*	seepage salamander	G3G4	S2	8[c]	170, 240, 250, 260, 330
Amphibians	*Rana sylvatica*	wood frog	G5	S2	4[d]	250
Fish	*Moxostoma* sp. 1	grayfin redhorse	G3	S2	1[d]	050
Insects	*Agapetus iridis*	caddisfly	GNR	S1	2	240, 260
Insects	*Agapetus pinatus*	caddisfly	GNR	S1	1	240
Insects	*Cheumatopsyche harwoodi*	caddisfly	GNR	S2	1	190
Insects	*Chimarra augusta*	caddisfly	GNR	S1	3	240, 260
Insects	*Dolophilodes major*	caddisfly	GNR	S1	1	240
Insects	*Heteroplectron americanum*	caddisfly	GNR	S2	1	190
Insects	*Hydroptila consimilis*	caddisfly	GNR	S2S3	1	190
Insects	*Hydroptila talladega*	caddisfly	GNR	S1	2	240, 250
Insects	*Ironoquia punctatissima*	caddisfly	GNR	S2	1	190
Insects	*Lepidostoma griseum*	caddisfly	GNR	S1	1	240
Insects	*Molanna blenda*	caddisfly	GNR	S2	1	190
Insects	*Ochrotrichia confusa*	caddisfly	GNR	S2	1	250
Insects	*Oxyethira michiganensis*	caddisfly	GNR	S1	1	240
Insects	*Protoptila maculata*	caddisfly	GNR	S2	1	190
Insects	*Psilotreta frontalis*	caddisfly	GNR	S2	1	190
Insects	*Pycnopsyche gentilis*	caddisfly	GNR	S1	2	190, 240
Insects	*Pycnopsyche lepida*	caddisfly	GNR	S2	1	190
Insects	*Pycnopsyche luculenta*	caddisfly	GNR	S2	2	190, 250
Insects	*Pycnopsyche virginica*	caddisfly	GNR	S1	2	250
Insects	*Rhyacophila glaberrima*	caddisfly	GNR	S2	2	190, 250
Insects	*Rhyacophila nigrita*	caddisfly	GNR	S2	2	190, 250
Insects	*Rhyacophila teddyi*	caddisfly	GNR	S1	2	240
Insects	*Rhyacophila torva*	caddisfly	GNR	S2	2	190, 250
Insects	*Speyeria diana*	Diana	G3	S2?	2	070, 190
Insects	*Triaenodes taenia*	Cold Spring triaenodes caddisfly	GNR	S1	2	190, 240
Mussels	*Strophitus subvexus*	southern creekmussel	G3	S2	2	240
Vascular Plants	*Aplectrum hyemale*	puttyroot	G5	S2	1	070
Vascular Plants	*Aralia racemosa*	American spikenard	G4G5	S1	1	070

Table 4. Continued.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Vascular Plants	*Asplenium bradleyi*	Bradley's spleenwort	G4	S2	2[e]	080, 330
Vascular Plants	*Asplenium ruta-muraria*	wall rue spleenwort	G5	S2	1[d]	080
Vascular Plants	*Asplenium trichomanes*	maidenhair spleenwort	G5	S2S3	2	070, 330
Vascular Plants	*Aster oolentangiensis* var *oolentangiensis*	sky blue aster	G5T5	S1	1	190
Vascular Plants	*Carex decomposita*	cypress-knee sedge	G3	S1	1	260
Vascular Plants	*Celastrus scandens*	climbing bittersweet	G5	S2	1	070
Vascular Plants	*Croomia pauciflora*	croomia	G3	S2	2	070
Vascular Plants	*Dicentra cucullaria*	Dutchman's breeches	G5	S2	2[e]	030, 130
Vascular Plants	*Echinacea pallida*	pale-purple coneflower	G4	S2	1[d]	170
Vascular Plants	*Equisetum arvense*	field horsetail	G5	S2	2[e]	190, 200
Vascular Plants	*Fothergilla major*	mountain witch-alder	G3	S2	1[d]	300
Vascular Plants	*Heuchera longiflora*	long-flower alumroot	G4	S1	1	330
Vascular Plants	*Isotria verticillata*	large whorled pogonia	G5	S2	1	240
Vascular Plants	*Juniperus communis*	ground juniper	G5	S1	1	170
Vascular Plants	*Lathyrus venosus*	smooth veiny peavine	G5	S1	1	100
Vascular Plants	*Lilium canadense*	Canada lily	G5	S1	1	110
Vascular Plants	*Listera australis*	southern twayblade	G4	S2	1	070
Vascular Plants	*Monarda clinopodia*	basil bee-balm	G5	S2	1	070
Vascular Plants	*Monotropa hypopithys*	pinesap	G5	S2	1	170
Vascular Plants	*Orobanche uniflora*	one-flower broomrape	G5	S2	2	070
Vascular Plants	*Parnassia asarifolia*	kidneyleaf grass-of-parnassus	G4	S2	1	240
Vascular Plants	*Phacelia dubia* var *dubia*	phacelia	G5T5	S1S2	1	3303
Vascular Plants	*Platanthera flava* var *flava*	southern rein orchid	G4T4?Q	S2S3	1	190
Vascular Plants	*Platanthera lacera*	green-fringed orchid	G5	S2	1	240
Vascular Plants	*Ptilimnium costatum*	eastern bishop-weed	G3G4	S1	2[e]	100
Vascular Plants	*Pyrularia pubera*	buffalo-nut	G5	S2	1[d]	250
Vascular Plants	*Quercus georgiana*	Georgia oak	G4	S2	3	200, 300
Vascular Plants	*Salix humilis*	tall prairie willow	G5	S2S3	1	190
Vascular Plants	*Silphium mohrii*	Mohr's rosinweed	G3?Q	S1	1	010
Vascular Plants	*Talinum mengesii*	Menge's fame-flower	G3	S2S3	1[d]	050
Vascular Plants	*Trichomanes petersii*	dwarf filmy-fern	G4G5	S2	1[d]	080
Vascular Plants	*Trillium flexipes*	nodding trillium	G5	S2S3	1	070
Vascular Plants	*Trillium lancifolium*	narrow-leaved trillium	G3	S2S3	1	190
Vascular Plants	*Triosteum angustifolium*	yellowleaf tinker's-weed	G5	S1	2e	070, 130

Table 4. Continued.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Vascular Plants	*Viola canadensis*	Canada violet	G5	S2	1[d]	050
Vascular Plants	*Xerophyllum asphodeloides*	turkeybeard	G4	S1	1	240
Vascular Plants	*Zigadenus leimanthoides*	crow-poison	G4Q	S1	1	190

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.
[c] Five occurrences were historical.
[d] All occurrences were historical.
[e] One occurrence was historical.

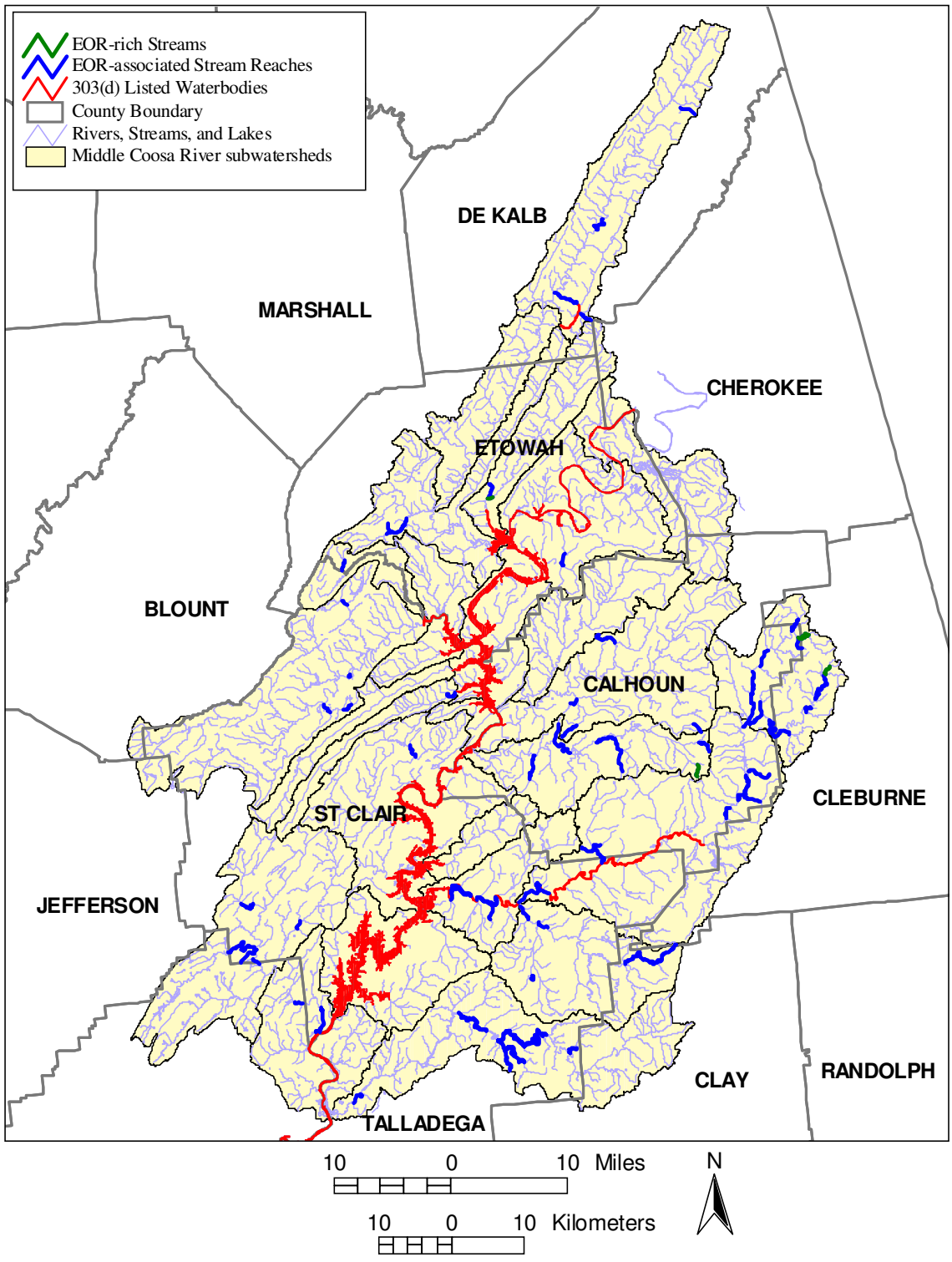

Figure 6. EOR-rich stream segments within the Middle Coosa River watershed, Alabama. EOR-rich stream segments were those with ≥5 EORs within 100m of the stream. EOR-associated stream reaches were those with 1-4 EORs within 100m of the stream.

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Shoal Creek at Forest Road 548 crossing

Both EOR-rich stream segments in Cleburne County were within the boundaries of the Talladega National Forest (TNF) on the Piedmont SE topographic quadrangle. Both EOR-rich stream segments in Cleburne county were within the boundaries of the Talladega National Forest (TNF) on the Piedmont SE topographic quadrangle. The EOR-rich segment of Shoal Creek was an approximately 1.4 km (0.9 mi) reach near Coleman Lake. It was a small, clear, moderate-flow stream with a sand/gravel substrate and well-vegetated banks (see Appendix F). The stream flows The EOR-rich segment of Shoal Creek was an approximately 1.4 km (0.9 mi) reach near Coleman Lake. It was a small, clear, moderate-flow stream with a sand/gravel substrate and well-vegetated banks (see Appendix F). The stream flows through a mesic mixed pine-hardwood forest dominated by pine, poplar, and sweetgum (*Liquidambar styraciflua*), with a mostly herbaceous understory. All 6 of the EORs associated with this stream segment were caddisflies: *Agapetus pinatus* (rank GNR/S1), *Chimarra augusta* (rank GNR/S1), *Dolophilodes major* (rank GNR/S1), *Hydroptila talladega* (rank GNR/S1), *Rhyacophila teddyi* (rank GNR/S1), and *Triaenodes taenia* (Cold Spring triaenodes caddisfly - rank GNR/S1). Forest Road 548, a gravel road, crosses the stream (by culvert) near the documented EORs, and is the only potential source for NPS pollution in the immediate vicinity.


Choccolocco Creek downstream of Forest Road 540 crossing

The EOR-rich segment of Choccolocco Creek was an approximately 2.4 km (1.5 mi) reach near the boundary between Calhoun and Cleburne counties. It was a medium, clear, moderate-flow stream with a sand gravel substrate and well-vegetated banks (see Appendix F). The topography around the stream was steep ridge and valley, and the stream flowed through a ravine with a mesic mixed pine-hardwood forest different from the vegetation on the ridges. The 5 EORs associated with this stream segment were a caddisfly (*Lepidostoma griseum* - rank GNR/S1), a caddisfly (*Pycnopsyche gentilis* - rank GNR/S1), coldwater elimia (*Elimia gerhardti* - rank G5/S3S4), and 2 occurrences of jamesianthus (*Jamesianthus alabamensis* - rank G3/S3). Forest Road 540, a gravel/dirt road, crossed through Choccolocco Creek and is a potential source for sediments and contamination of the water (see Appendix F). Litter also is a potential problem at this site as there was a moderate amount of litter in the forest around the stream. The litter was mostly small items such as bottles and cans, but there was a mattress and other larger items as well. In addition, there was a recreation site adjacent to the stream with a trash barrel and fire ring that appeared to be fairly regularly used (see Appendix F).


Black Creek below Noccalula Falls

The EOR-rich stream segment of Black Creek was an approximately 0.8 km (0.5 mi) segment below Noccalula Falls in Gadsden on the Gadsden West topographic quadrangle. The 6 EORs associated with this stream segment were Bradley's spleenwort (*Asplenium bradleyi* - rank G4/S2), dwarf filmy-fern (*Trichomanes petersii* - rank G4G5/S2), Harper's dodder (*Cuscuta harperi* - rank G2/S2), Nuttall's rayless goldenrod (*Bigelowia nuttallii* - rank G3G4/S3), Piedmont pimpernel (*Lindernia monticola* - rank G4/S3), and a sandstone glade (*Bigelowia nuttallii*, *Coreopsis pulchra*, *Liatris microcephala* - rank G2?/S2). Below the falls, the stream banks and ravine are well vegetated, but stream-side vegetation is lacking above the falls (see Appendix F). Unlike the EOR-rich streams in the TNF, Black Creek drains parts of Gadsden and has problems with excessive sedimentation, particularly after rain. In addition, there is a large paved parking lot for Noccalula Falls Park adjacent to Black Creek with only a very small grass strip between the parking lot and the creek. Without an adequate vegetated buffer strip on the stream banks above the falls, contaminants are easily washed into the stream from the parking lot and surrounding roads. In addition, the parking lot slopes to the creek and creates concentrated flow at spots, causing erosion problems in the narrow strip between the parking lot and creek.

The association with flowing water was mainly a factor of the rich aquatic biodiversity in the watershed. The southeastern United States has been recognized as a global center for freshwater biodiversity (Lydeard and Mayden 1995, Stein 2002), with a globally unparalleled diversity of bivalves and gastropods (Neves et al. 1997). Because Alabama is home to an exceptionally rich freshwater fauna, and the Coosa River watershed is a contributor to this biodiversity, it supports a diverse array of aquatic life. The proportion of faunal diversity within the watershed accounted for by aquatic species is not as high as some other areas in northeastern Alabama because habitat loss (dam construction and channelization) and degradation has already caused the extirpation of many of the endemic gastropods and mussels in the river (Bogan et al. 1995, Gangloff 2003).

One hundred twenty 1,000 ha rare species areas were identified in the MCR watershed (Fig. 7 Appendix F): 65 critical, 34 imperiled, and 21 rare (Appendix G). The number of EORs within rare species areas ranged from 1 to 15, with the majority (55.6%) of the rare species areas only having one rare species documented within the area covered by the hexagon (Fig. 8). There were 5 subwatersheds with no portion of the watershed covered by a rare species area: Acker Creek (210), Blue Eye Creek (220), Bridge Creek (180), Coosa River (230), and Town Creek (040). Surveys of these watersheds are needed to verify the absence of areas important to rare species.

Although the rare species area identified within the watershed can be used to identify regions within the watershed important for the conservation of rare species, most conservation efforts will likely be targeted at a smaller scale. Therefore, smaller rare species areas were identified using 100-ha hexagons. There were 158 100-ha rare species areas identified in the MCR

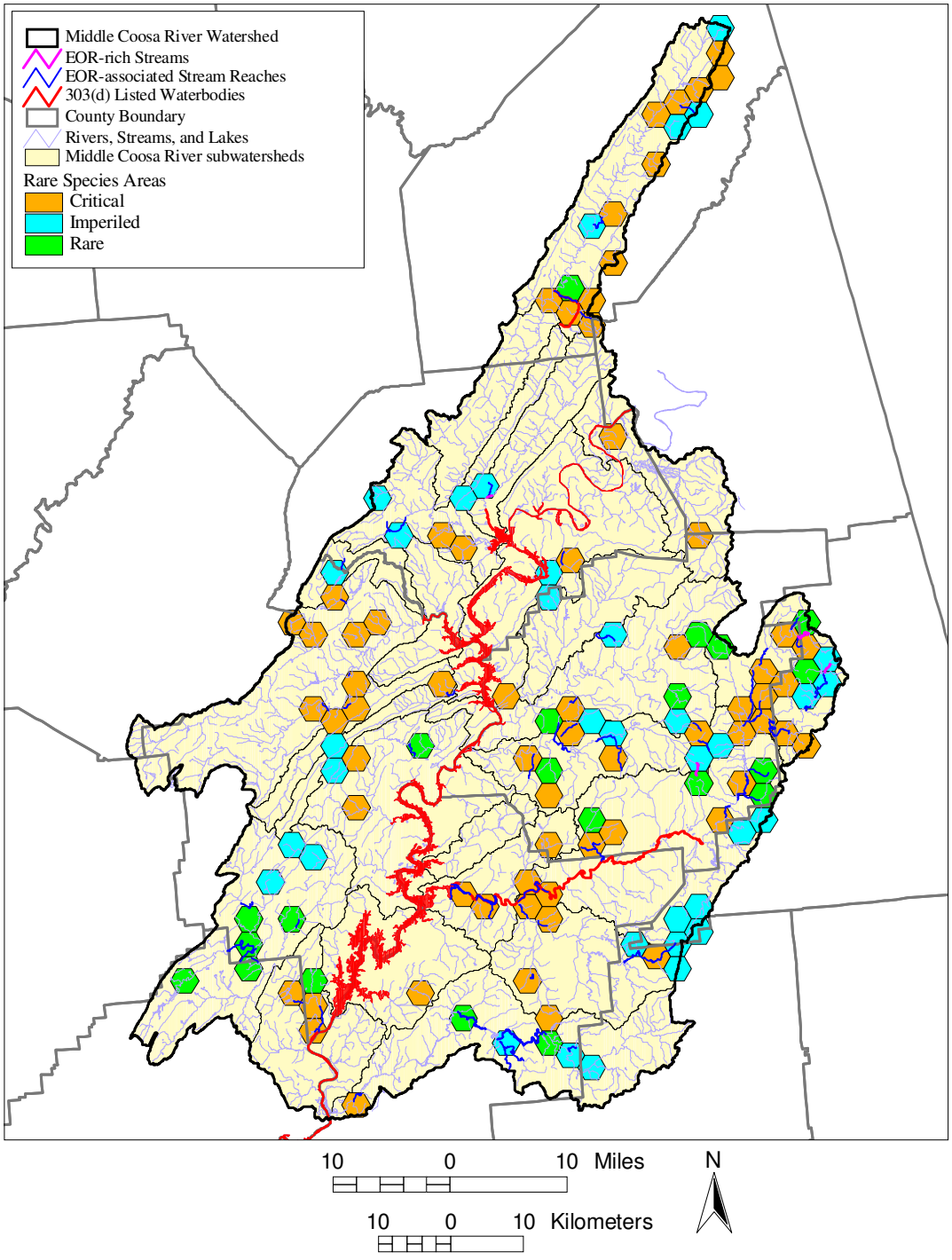

Figure 7. One thousand hectare rare species areas in the Middle Coosa River watershed, Alabama. Hexagon type was coded "critical", "imperiled", and "rare" based on the presence of federal or state protected species and heritage ranks. "Critical" hexagons were those containing federal or state protected species or species with a heritage rank of G1 or S1. "Imperiled" hexagons were those containing species with a heritage rank of G2 or S2 without federal or state protection. "Rare" hexagons were those containing species with a heritage rank of G3 – G5 without federal or state protection.

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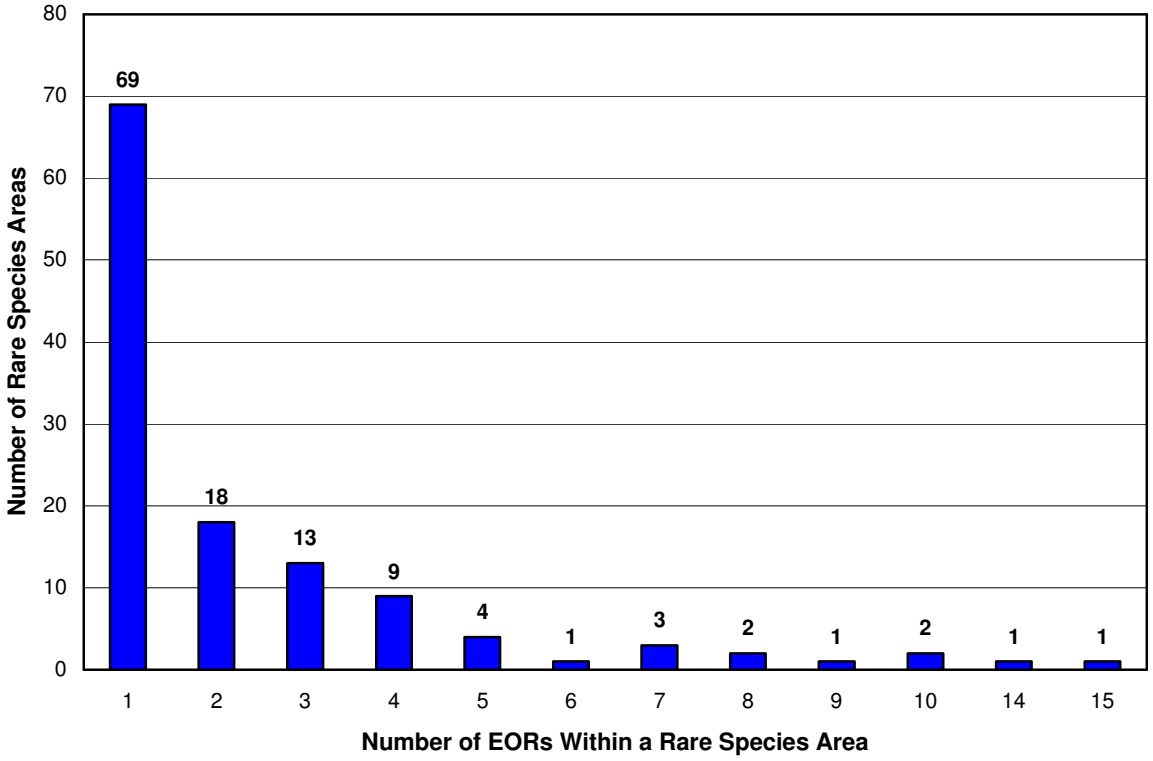
A.



B.

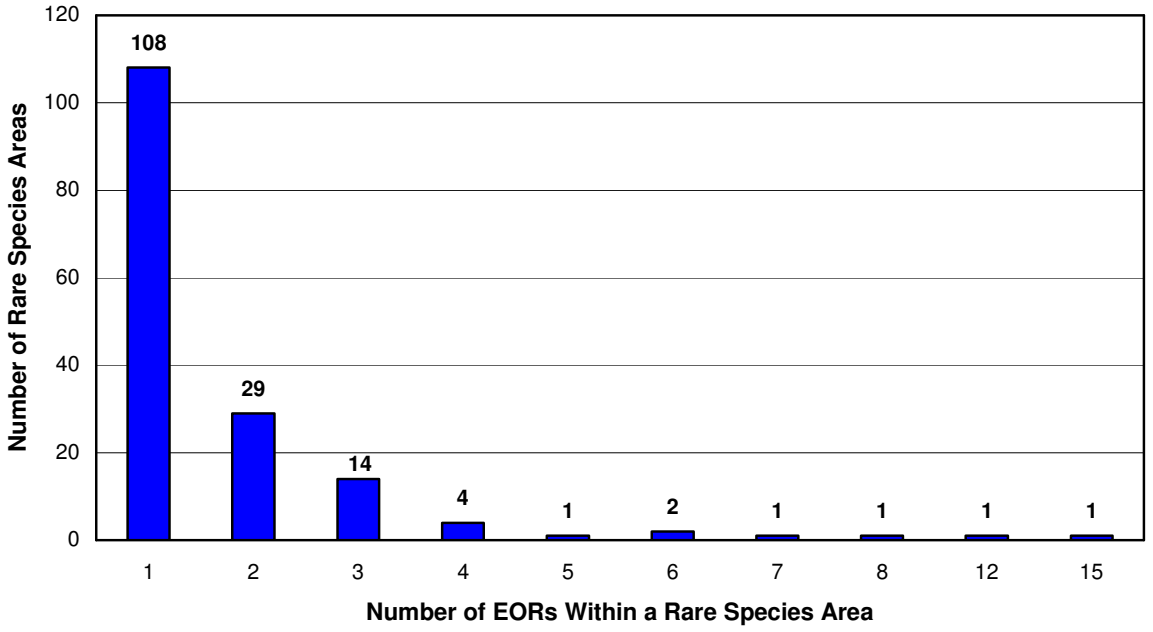


Figure 8. Number of 1,000 ha rare species areas (A) and 100 ha rare species areas (B) ranked by the number of Element Occurrence Records within the rare species area for the Middle Coosa River watershed, Alabama.

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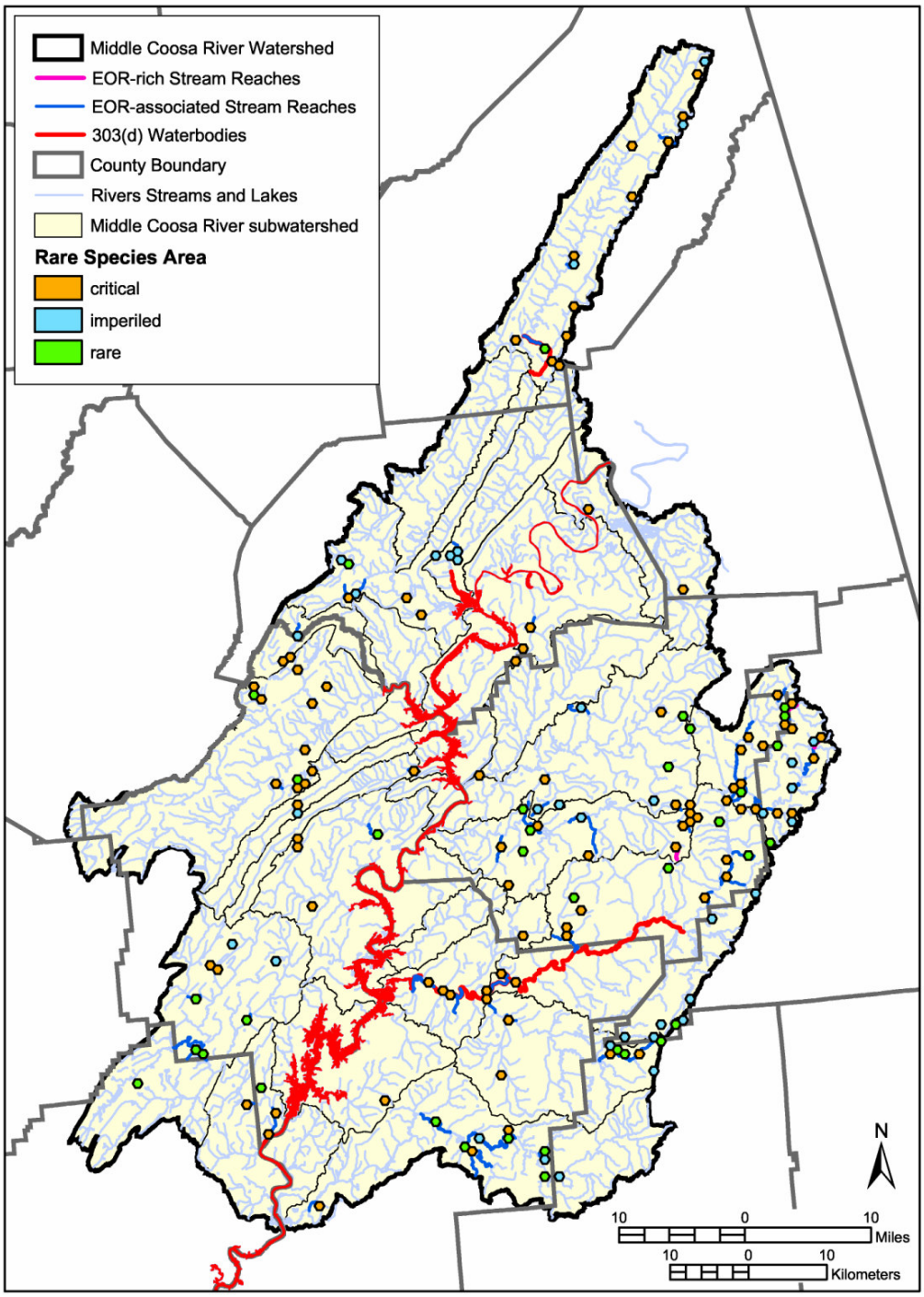

Figure 9. One hundred hectare rare species areas in the Middle Coosa River watershed, Alabama. Hexagon type was coded "critical", "imperiled", and "rare" based on the presence of federal or state protected species and heritage ranks. "Critical" hexagons were those containing federal or state protected species or species with a heritage rank of G1 or S1. "Imperiled" hexagons were those containing species with a heritage rank of G2 or S2 without federal or state protection. "Rare" hexagons were those containing species with a heritage rank of G3 – G5 without federal or state protection.

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watershed (Fig. 9 Appendix G): 93 critical, 34 imperiled, and 31 rare (Appendix G). The number of EORs within these areas ranged from 1 to 15, with the majority (66.9%) having only 1 rare species documented within the area covered by the hexagon (Fig. 8). In addition to the 5 watersheds with no 1000-ha rare species areas, there were 3 additional subwatersheds with no portion of the watershed covered by the 100-ha rare species areas: Coosa River (020), Middle Big Wills Creek (060), and Easonville Creek (290).

Conservation Targets

Ten conservation targets were chosen for the MCR watershed: riverine system, matrix forest communities (oak-hickory-pine forest), gray bat (*Myotis grisescens*), riparian vegetation, mountain longleaf pine (*Pinus palustris*) forest communities, red-cockaded woodpecker (*Picoides borealis*), freshwater fish, mussels, and snails of critical conservation concern, southern hognose snake (*Heterodon simus*), caddisflies, and endangered plants.

I. Coarse Scale

Coarse scale conservation targets selected within the MCR watershed were the matrix forest community, the riverine system, and gray bat. The terrestrial system which was represented at the coarse scale in the MCR watershed was the southern Appalachian oak-hickory-pine forest community which forms the matrix terrestrial community of the region. The MCR and its tributaries, as part of the larger Mobile River system, represents the regional aquatic system. Gray bats represent a coarse scale target because of the large distances that often exist between winter hibernaculum and summer breeding areas.

A. Oak-Hickory-Pine Matrix Forest Communities

This target encompasses large blocks of the natural communities which make up the natural vegetative cover of the watershed. The natural vegetation is primarily an oak-hickory-pine forest community, with mixed mesophytic forest in riparian areas. The current day oak-hickory-pine forests represent the most common and widespread forest type in the Southeast (Skeen et al. 1993). The canopy generally consists of oaks, pignut hickory (*Carya ovata*), mockernut hickory (*C. tomentosa*), and pines. The oaks are primarily post oak (*Quercus stellata*), southern red oak (*Q. falcata*), blackjack oak (*Q. ameilandica*) and white oak (*Q. alba*). The pines are generally shortleaf pine (*Pinus echinata*) and loblolly pine (*P. taeda*) and occasionally longleaf pine (Harper 1943, Braun 1950, Skeen et al. 1993). Species common in the understory include sourwood (*Oxydendron arboreum*), persimmon (*Diospyros virginiana*), redbud (*Cercis canadensis*), sassafras (*Sassafras albidum*), dogwood (*Cornus* spp.), smilax (*Smilax* spp.), grapes

(*Vitis* spp.), blackberries (*Rubus* spp.), sumacs (*Rhus* spp.), viburnums (*Viburnum* spp.) and Japanese honeysuckle *(Lonicera japonica*) (Harper 1943, Braun 1950, Skeen et al 1993).

In an evaluation of loss and degradation of ecosystems, Noss et al. (1995) reported that forest habitats and communities were 1 of the 2 general ecosystem types that had suffered the greatest loss in the US from historic abundance; old-growth eastern deciduous forests have declined by >98% since European settlement. Shifting patterns in land use are causing dramatic changes to the native forests of the southern United States. The Cumberland Plateau contains some of the largest remaining tracts of privately-owned, contiguous temperate deciduous forest in North America. These forest tracts represent important Neotropical migratory songbird habitat; serve as headwaters to some of the most biologically diverse, freshwater stream systems found in the world; and have some of the most diverse communities of woody plants in the eastern United States (Ricketts et al. 1999). However, forests in the Cumberland Plateau are susceptible to increased fragmentation (Wear and Greis 2002), and retaining these areas in a natural setting faces increasing challenges as the population continues to grow. Education will be one of the keys to sustaining forests and other natural land and water in the South, because rapid social, economic, and land use changes point to an urgent need for effective conservation education (Macie and Hermansen 2002).

Forest communities provide a wide array of ecosystem goods and services, such as providing food, wood, decorative, and medicinal products; providing tourism and recreation opportunities; providing wild genes for domestic plants and animals; maintaining hydrologic cycles; regulating climate; generating and maintaining soils; storing and cycling essential nutrients; absorbing and detoxifying pollutants from water and air; providing pollinators for crops and other important plants; providing wildlife habitat; and providing aesthetics (Macie and Hermansen 2002). Forests also play a critical role in the earth's water cycle, with approximately 80 percent of the Nation's fresh water originating in forests. Forests provide many water-related benefits that are threatened when forests are converted to other uses, including refilling underground aquifers, slowing storm runoff, reducing flooding, sustaining watershed stability and resilience, providing critical fish and wildlife habitat, and carbon sequestration (Macie and Hermansen 2002).

The matrix forest community is important for many of the recreational areas in the MCR watershed. Many of the more heavily used recreational areas in the MCR watershed are in these forested areas, and recreational use of natural areas is important to how these areas are managed. More than 95% of the population in the south participate to some extent in one or more outdoor recreation activities, with the growth rate of some activities such as bird watching, hiking, backpacking, camping, and off-road driving exceeding population growth (Macie and Hermansen 2002). Recreation demand is projected to continue growing, and therefore will put additional pressure on and add to urban expansion and to tourist development in these matrix forest communities.

The large blocks of matrix-forming communities are believed to be of great significance for breeding populations of some Neotropical migratory songbirds, although the extent of the significance has not been well-documented. Numerous forest specialists, such as the wood thrush (*Hylocichla mustelina*), have experienced significant population declines due to continued habitat loss, degradation, and fragmentation as forests are converted to other land uses in both

their North American breeding grounds and Central American wintering grounds. TNC (2003) identified the Talladega National Forest and Coosa River valley as neo-tropical migratory bird "hotspots" of nesting area and flyway corridors important to forest interior birds in the Cumberland and Southern Ridge and Valley Ecoregion. Addressing the loss and degradation of migratory bird habitat was identified by the Migratory Bird Program (MBP) as one of its top three priorities; the MBP also recognized the need for habitat conservation and population monitoring (United States Fish and Wildlife Service 2004a). Habitat loss and degradation as forests were converted to other land uses also has negatively impacted many salamander and frog populations in the southeastern United States (Bury et al. 1995).

The large areas of once primarily contiguous forest land in the south are increasingly influenced by humans and surrounded by or intermixed with urban development. Rapid development leads to the fragmentation and loss of forest land in growing areas, as well as continued degradation of environmental resources. In general forest loss rates are greatest near major urban centers, along major communication corridors, and near recreational areas such as national forests, and are lowest in areas with slow economic development (Boyce and Martin 1993). Demographics, economics and taxation, fire risk, and land use planning and policy are some of the major forces driving the land-use change affecting forest communities (Macie and Hermansen 2002). In addition to direct habitat loss from urbanization and other land use changes, these forest systems face destruction and degradation from other sources such as road construction, poor forestry practices, introduction of exotic species, outbreaks of exotic and natural pests, mining, industrial pollution, and fire suppression.

Future population growth will create a variety of pressures on forests, including demands for development, forest gathering, timber harvesting, recreation, and road building. The MCR watershed is projected to have moderate to heavy population pressures on forest resources through 2020, with Birmingham and the surrounding area and most of the Upper Coosa River watershed in Georgia projected to exert a heavy pressure on forests (Macie and Hermansen 2002). Growth in recreation demand puts direct pressure on forest land, and projected ambient recreation pressures on forests in the MCR watershed are heavy to moderate with pressure lightening as you move north in the watershed, with a lot of the high pressure being driven by proximity to Birmingham. Areas that experience high recreation demands typically end up being developed for tourism, and then ultimately into urbanized areas.

B. Riverine Ecosystem

This target comprises the riverine aquatic ecosystem (main stem and tributaries) throughout the MCR watershed and the ecological processes needed to maintain this system. Noss and Peters (1995) identified large streams and rivers as one of the 21 most-endangered ecosystems in the US, and reported that it is difficult to find a large stream or river in the conterminous US that has not been dammed, channelized, polluted, or otherwise degraded significantly from its natural condition. The major threats to riverine systems are habitat loss and degradation caused by hydrologic alteration (impoundments, channelization, and their associated operations), impaired water quality (siltation and other NPS pollutants), and non-native invasive species (Master et al. 1998). The MCR supports a diverse array of aquatic life, including many fish, mussel, and freshwater turtle species. In addition, many other aquatic plants and invertebrates are supported

in the watershed. The freshwater systems found in this target also provide for many of society's fundamental needs: water for drinking and irrigation; food in the form of fish and waterfowl; and instream services such as flood control, transportation, recreation, and water quality (Master et al. 1998). Although the riverine system is a coarse scale target, many local scale activities and problems affect the integrity of the system.

C. Gray Bat

Photo – from Johnson and Wehrle 2004

The gray bat was chosen as a conservation target because of its federal status and continued vulnerability to population declines. The gray bat was listed as a federal endangered species by the United States Fish and Wildlife Service (USFWS) in 1976 due to dramatic declines in many areas (United States Fish and Wildlife Service 1976). It is a state protected species in Alabama (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 1 species (highest conservation concern) (Mirarchi 2004). The Natural Heritage Network (NHN) and TNC consider the gray bat to be rare globally and imperiled in Alabama. Fern Cave, located within the Upper Paint Rock River watershed in the Fern Cave National Wildlife Refuge, is Alabama's only Priority 1 gray bat hibernaculum (Priority 1 caves are major hibernacula and their most important maternity colonies; United States Fish and Wildlife Service 1982), and is reportedly used by over 50% of the entire gray bat population (Miller and Sankaran 1991; Hudson 1993, 1995). Six of the 8 maternity caves in Alabama associated with this hibernaculum cave also are Priority 1 caves. Several other critically important gray bat caves are north of the MCR watershed.

Primarily restricted to limestone karst regions of the southeastern United States, gray bats typically roost in caves along rivers and large reservoirs, with populations found mainly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee (United States Fish and Wildlife Service 1982). The gray bat is perhaps the most restricted to cave habitats of any U.S. mammal (Hall and Wilson 1966, Barbour and Davis 1969). Because of highly specific roost and habitat requirements, fewer than 5% of available caves are suitable for occupation by gray bats, so gray bats congregate in larger numbers and in fewer hibernating caves than any other North American vespertilionid (Tuttle 1979); about 95% of the total population use only 9 caves for hibernation, 1 of which is northern Alabama (Best 2004). The concentrations of large numbers of bats in relatively few caves made the species especially susceptible to declines. The declines in gray bat populations have been attributed to human disturbance and vandalism (excessive disturbance may cause a colony to completely abandon a cave), commercialization of hibernaculum and roosting caves; disturbances caused by increased numbers of spelunkers and bat banding programs; pesticide and other contaminant poisoning; natural calamities such as flooding and cave-ins, loss of caves due to inundation by man-made impoundments, and possibly a reduction in insect prey over streams that have been degraded through excessive pollution and siltation (Tuttle 1979; Mount 1986; Clark et al. 1988; United States Fish and Wildlife Service 1991a, 1997a). Improper cave gating has also contributed to some population declines. Clark et al. (1988) documented organochlorine contamination and possible organochlorine-induced bat

deaths in northern Alabama in the Tennessee River Basin. In response to cave protection, the Alabama populations in general appear to be stable (Alabama Agricultural Experiment Station 1984).

The gray bat occupied 3 caves in the UCR watereshed in De Kalb County within the Upper Big Wills Creek (03150106050) subwatershed: Lykes Cave, Portersville Bat Cave, and Stanley Carden Cave. All 3 caves were on the USFWS (1982) Restricted Access Bat Caves list, and are privately owned. Lykes Cave and Portersville Bat Cave are Priority 2 caves (primary maternity caves), and Stanley Carden Cave is a Priority 3 cave (primary bachelor cave). None of the caves have been surveyed recently, but Lykes Cave formerly served as a hibernaculum, Portersville Bat Cave was once used as a bachelor colony, and Stanley Carden Cave reportedly was inhabited by a summer colony of approximately 1,000 individuals. Gray bats also have been documented in low numbers in the MCR watershed in Calhoun County during mid- and late-summer (United States Army Corps of Engineers 1997). However, no areas within the MCR watershed have been designated as gray bat critical habitat, and there are no known caves used as maternity or winter roosts in Calhoun County. Ongoing surveys to monitor gray bat populations are needed.

II. Intermediate Scale

A. Riparian Vegetation

Riparian vegetation along the Little River at State Route 273

Riparian vegetation was chosen as a conservation target because of its importance in providing protection to aquatic communities and the increased biodiversity these communities add to a region. Riparian areas are primarily defined by their position as those lands bordering streams, rivers, and lakes (National Research Council 2002). The riparian vegetation target encompasses the natural communities along the waterbodies of the MCR watershed. Riparian vegetation in the watershed is a mixture of mesic species and generally consists of mixed mesophytic forests. This is a diverse forest type with canopy species including red maple (*Acer rubrum*), basswood (*Tilia* spp.), northern red oak (*Quercus rubra*), tulip poplar, white ash (*Fraxinus americana*), black gum *(Nyssa sylvatica*), black walnut (*Juglans nigra*), beech, and willows (*Salix* spp.) (Braun 1950, Hinkle et al. 1993). Sub-canopy species include the canopy species listed above, magnolia (*Magnolia acuminata*), sourwood, American hornbeam (*Carpinus caroliniana*), service-berry (*Amelanchier arborea*), and various shrub and herbaceous species (Braun 1950).

In proportion to their area within a watershed, riparian areas perform more biologically important functions than do most uplands (Fischer and Fischenich 2000). Riparian areas provide a wide array of ecological functions and values including providing organic litter and coarse woody debris to aquatic systems, providing fish and wildlife habitat and food-web support for a wide range of aquatic and terrestrial organisms, local microclimate modification, promotion of infiltration of overland flow, retention and recycling, bank and stream channel stabilization, and trapping and redistributing sediments (National Research Council 2002). Riparian areas also can serve as corridors for animal movement connecting isolated populations, potentially lowering the risk of local extinctions. The presence of riparian areas tend to increase the biodiversity of a region because they support high numbers of species, many of which are not found in other communities of the region. This support of high species diversity and ecological processes is due in part to regular disturbance events, climatic and topographic variation, and the availability of water and nutrients (Naiman et al. 1993). Adequate natural riparian vegetation also provides many societal benefits including removal of pollutants and sediment from overland flow and shallow groundwater, maintaining stream flows, water storage and conveyance, enhancing groundwater recharge, stabilizing stream banks and channels, promoting flood control, and reducing wind erosion (National Research Council 2002).

Riparian areas are effective in reducing nonpoint source pollutants entering surface waters and are considered important for surface water quality protection (Gilliam 1994). However, riparian areas that become hydrologically disconnected from their adjacent stream channels (e.g., via levees or channel incision) lose many of their ecological functions (National Research Council 2002). Although riparian areas provide many of the same environmental functions as wetlands, there are vast differences in the protection of these two ecosystem components; wetlands are protected under federal regulations, but riparian areas generally have weak or no protection.


Example of creek lacking native riparian vegetation

Riparian areas in native vegetation are very important for water quality preservation. Unfortunately, riparian systems are threatened nationwide (Noss et al. 1995) and are continuously threatened by adjacent or upstream human activities. The majority of riparian areas in the US have been converted to other land uses or have been degraded, and riparian areas are some of the most severely altered landscapes in the country (National Research Council 2002). Development or other human activities have resulted in >80% loss of riparian vegetation in North America and Europe in the last 100 years (Naiman et al. 1993). Agricultural conversion is probably the largest contributor to riparian area decline nationwide (National Research Council 2002). When riparian areas are converted to agricultural uses, infiltration generally decreases and overland flow volumes and peak runoff rates generally increase, resulting in high erosion rates that inundate riparian vegetation with sediment and limit the filtering functions of riparian areas. The higher flows generally result in an increased cross-

sectional area of the channel through a widening of the channel or downcutting of the streambed. Finally, the transport of agricultural chemicals from upslope can negatively impact fauna and flora located in the riparian areas and downstream receiving waters.

The hydrologic regime of many riparian areas have been altered through dam construction, interbasin diversion, channelization, irrigation, and other water withdrawals (National Research Council 2002). These alterations are usually accompanied by a serious degradation of the ecological functions of the riparian areas affected. The significant human impact on the structure and functioning of riparian areas includes changes in the hydrology of rivers and riparian areas, alteration of geomorphic structure, and the removal of riparian vegetation (National Research Council 2002). The loss of riparian vegetation affects both the terrestrial and aquatic communities, degrading water quality and diminishing suitable aquatic habitat through increased levels of light, temperature, stormwater runoff, sedimentation, pollutant loading, and erosion (Castelle et al. 1994).

In many areas of the MCR watershed, human development has resulted in the loss of riparian vegetation, which has been identified as a concern for aquatic communities in the watershed and the surrounding region (Williams et al 1993). Retaining and restoring adequate riparian vegetation is essential to maintaining biodiversity within the watershed, and also will provide many benefits to the landowners and general population of the watershed because riparian vegetation protects the quality of water resources used for agricultural and domestic purposes and provides many ecological functions and economic benefits.

B. Mountain Longleaf Pine Forest Community


Photo – USFWS

Mountain longleaf pine forests were selected as a conservation target because they support numerous rare species and this forest community is now extremely rare. The longleaf pine community is composed of a number of upland and plant community types in which longleaf pine is the dominant canopy tree, and is a fire-maintained community. Longleaf pine ecosystems are among the most imperiled systems on earth (Simberloff 1993, Ware et al. 1993, Noss et al. 1995, Noss and Peters 1995), and mountain longleaf pine forests are a critically endangered component of the once vast longleaf pine forests of the southeast. It is estimated that less than 3% of the longleaf pine ecosystem remains in a relatively natural state (Ware et al. 1993).

While longleaf pine forests were generally restricted to the Coastal Plain, they extended into the mountainous regions in northeast Alabama and northwest Georgia. Most of these forests were harvested and converted to loblolly pine or allowed to develop scattered stands of second growth longleaf pine. Recent estimates indicated that 98,550 acres of mountain longleaf remained with 80% of it located in Alabama. Isolated stands can be found within the Talladega and Shoal Creek Ranger Districts of the Talladega National Forest, Cheaha State Park and Oak Mountain State Park in Alabama, Lavender Mountain near Rome, GA, and on private lands in both north

Alabama and Georgia. Most stands are highly degraded, with a few old individuals interspersed among younger trees. Harvesting of the original longleaf stands and suppression of fire caused mountain longleaf forests to not regenerate and lose most of their inherent diversity. The large blocks of mountain longleaf pine forest in the area of MCR watershed that became the Mountain Longleaf National Wildlife Refuge represent the largest remaining stands of old growth mountain longleaf pine forests. Much of this forest retains the longleaf forest characteristics because of frequent fires resulting from military training exercises at Fort McClellan. Retaining the fire disturbance regime this forest type requires is essential to maintaining this forest community in Alabama.

C. Red-cockaded Woodpecker


Photo – Cornell Laboratory of Ornithology

The red-cockaded woodpecker was listed by the USFWS as a federal endangered species 13 October 1970 (United States Fish and Wildlife Service 1970) and received federal protection with the passage of the Endangered Species Act in 1973. It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority I (highest conservation concern) species (Mirarchi 2004), and is considered to be globally rare (rank G3) and state imperiled (rank S2) by the NHN and TNC. Mount (1986) considered this species to be endangered in Alabama. Historically, this species was a regional endemic common throughout the southeastern United States (Jackson 1971), and was found locally in much of Alabama south of the Tennessee River. However, it has suffered a decline in distribution and abundance with the loss of much of the old-growth pine forests with which it was associated. Currently, <3% of the estimated population at the time of European settlement remains, with an estimated 14,068 red-cockaded woodpeckers in 5,627 known active clusters across eleven states (United States Fish and Wildlife Service 2003a). ALNHP had 4 occurrences documented in the MCR watershed from the Talladega National Forest in Calhoun and Cleburne counties in the Upper Choccolocco Creek (240) subwatershed. However, with proper management of the mountain longleaf pine communities, the range of this species could possibly be expanded in the watershed.

Red-cockaded woodpeckers are relatively small, measuring approximately 20 cm (8-9 in) tall (Keeler 1986). This woodpecker resembles the hairy woodpecker in appearance and size, but is distinguished by the zebra-like back, a black crown and a large white cheek patch (Keeler 1986). Male birds have a small red spot near the ear, but it is difficult to see. Red-cockaded woodpeckers have a cooperative breeding system and live in groups that share, and jointly defend, all-purpose territories throughout the year (United States Fish and Wildlife Service 2003a). These groups, or colonies, consist of 2-8 birds; a breeding pair and auxiliary group of male helpers that assist the breeding pair in rearing offspring. The helpers are usually offspring of the breeding pair from the previous year. The majority of the red-cockaded woodpecker's diet consists of insects captured on and under the bark of pines with fruits and seeds making up the remaining small portion of their diet (United States Fish and Wildlife Service 2003a).

Red-cockaded woodpeckers are associated with mature long-leaf pine, slash pine (*Pinus ellioti*), loblolly pine, or shortleaf pine forests (Beck 1991). Most active colonies are found in mature, open, park-like stands of pine with relatively sparse mid-stories. Increases in both pine and hardwood midstory density are associated with colony abandonment (Loeb et al. 1992). This woodpecker selects large, mature living pine trees for cavity excavation (Beck 1991). Early observers noted that cavity trees selected by red-cockaded woodpeckers had rotten heartwood, and were generally infected by the heartwood-decaying fungus *Pellinus pini* (Bent 1939). At active nests, the birds drill small holes in the bark and sapwood around the cavity to tap the resin of the tree, producing a sticky barrier around the cavity from the exuding resin flowing down the trunk (Beck 1991). Dennis (1971) suggested this was primarily a defense against tree climbing snakes, but it also is a distinctive characteristic for identifying red-cockaded woodpecker cavity trees.


red-cockaded woodpecker cavity

The decline of the red-cockaded woodpecker was caused primarily by habitat loss with an almost complete loss of the pine ecosystems due to intense logging for lumber and agriculture (United States Fish and Wildlife Service 2003a). Other contributing factors to this decline included fire suppression and detrimental silvicultural practices (short rotations, clearcutting, and conversion to sub-optimal pine species). Primary threats to this species' viability all have the same basic cause: lack of suitable habitat (Lennartz et al. 1983, United States Fish and Wildlife Service 2003a). Current threats to this species include fire suppression and exclusion, silvicultural practices, a lack of suitable foraging habitat and severe bottleneck in the number of pines available as cavity tress due to past habitat loss, the fragmentation and isolation of the remaining populations, and the risks inherent to critically small populations (United States Fish and Wildlife Service 1985, 2003a).The USFWS (2003a) identified 4 types of threats to species and population viability: genetic stochasticity, demographic stochasticity, environmental stochasticity, and catastrophes. To maintain populations, provisions to perpetuate mature pine stands are needed (Lennartz et al. 1983). Active sites must be managed and silviculturally treated to support continued occupancy by woodpeckers. Loeb et al. (1992) recommended midstory vegetation be kept relatively sparse throughout a pine stand occupied by a colony and not just around individual cavity trees.

III. Local Scale

A. Freshwater Fish, Mussels, & Snails of Critical Conservation Concern

The freshwater fish, mussels and snails of critical conservation concern within the MCR watershed were selected as a conservation target because of the importance of these fauna in the watershed and the importance of the watershed to several species of the fauna. This target included those fish, mussels, and snails that are federal or state protected species or are considered globally imperiled (ranked G1 or G2). The species included in this target were Manitou cavesnail (*Antrorbis breweri*), pygmy sculpin (*Cottus paulus*), blue shiner (*Cyprinella caerulea*), walnut elimia (*Elimia bellula*), spindle elimia (*E. capillaris*), prune elimia (*E. chiltonensis*), lacey elimia (*E. crenatella*), delicate spike (*Elliptio arctata*), upland combshell (*Epioblasma metastriata*), southern acornshell, coldwater darter (*Etheostoma ditrema*), fine-lined

pocketbook (*Lampsilis altilis*), painted rocksnail (*Leptoxis taeniata*), Coosa moccasinshell (*Medionidus parvulus*) southern clubshell, Canoe Creek pigtoe (*Pleurobema fritzi*), southern pigtoe (*P. georgianum*), ovate clubshell (*P. perovatum*) upland hornsnail (*Pleurocera showalteri*), triangular kidneyshell, and Alabama livebearing, or tulotoma, snail.

Focusing conservation efforts on freshwater species is needed because this is the most imperiled species group in the United States and freshwater species are much more imperiled that terrestrial species (Master et al. 1998). Freshwater mussels are the most imperiled taxonomic group in North America, with many mussel populations having undergone a precipitous decline or been eradicated due to impoundment by dams, sedimentation, channelization, dredging, water withdrawal, water pollution, and displacement by invasive species.

These freshwater taxa, particularly mussels and snails, are often used as "indicator species" because they have certain physiological and ecological traits that justify their use as bioindicators of environmental health. A decline or loss of these species often indicates problems with water quality and ecosystem stability in their watershed. Aquatic resources are economically, ecologically, culturally and aesthetically important to the nation, yet many of these resources are in decline and a large percentage of the aquatic taxa in the southeastern US are imperiled (Williams et al. 1993, Warren and Burr 1994, Bogan et al. 1995, Walsh et al. 1995, Williams and Neves 1995, Etnier 1997, Neves et al. 1997, Hall and Williams 2000). This suite of species is imperiled due to a variety of complex and interconnected threats, including habitat destruction, alteration, and degradation (including water quality degradation); hydrologic alterations; water availability; overharvest; the introduction of exotic species; and the cumulative effects of all these factors (Ahlstedt 1986, Williams et al. 1993, Bogan et al. 1995, Walsh et al. 1995, Williams and Neves 1995, Etnier 1997, Neves et al. 1997). The principal causes of habitat loss and degradation are dams, channelization, urbanization, agriculture, deforestation, erosion, and pollution. Perhaps the most insidious threat to freshwater species is sedimentation and siltation resulting from poor land-use patterns that eliminate suitable habitat required by many bottom-dwelling species. Many freshwater species historically present in the MCR watershed are now extinct, and much of the remaining freshwater fauna has exhibited declines from their historic distribution and abundance. Conservation and recovery of the remaining freshwater faunal diversity will require immediate action to prevent further declines and extinctions. This will necessitate action to improve water quality across the basin and to decrease the amount of silt and pollutants entering the streams and rivers. By maintaining and restoring the health of the watershed, we not only help insure the survival of aquatic biodiversity, but also help protect human well-being and quality of life.

Manitou Cavesnail

The Manitou cavesnail is considered to be critically imperiled (rank G1/S1) by the Natural Heritage Network (NHN) and The Nature Conservancy (TNC) and a Priority 3 species (moderate conservation concern) in Alabama (Mirarchi 2004). It was a candidate species under the Endangered Species Program before the candidate program was restructured. ALNHP had 1 occurrence documented Manitou Cave in the Upper Big Wills Creek (050) subwatershed in De Kalb County. This is the only known occurrence of this species. Little is known about the ecology of this species.

Pygmy Sculpin

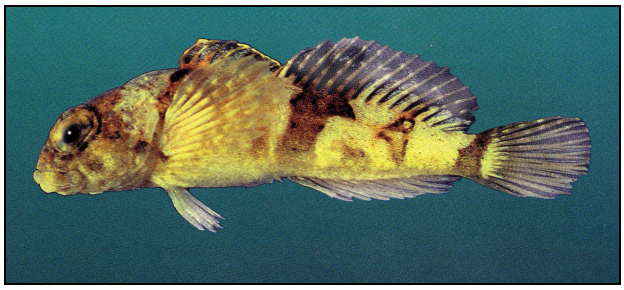

Photo – from Mettee et al. 1998

The pygmy sculpin was listed as a federal threatened species by the USFWS 28 September 1989 (Bowker 1991), is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered a Priority 1 species (highest conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Boschung (1986) listed this species as threatened in Alabama. The species is endemic to Alabama and is known only from Coldwater Spring and its run, a tributary to Choccolocco Creek in Calhoun County (McCaleb 1973). The pygmy sculpin was first collected from Coldwater Spring in 1963 and described in 1968 (Williams 1968). Although abundant at this location, the species remains vulnerable to a catastrophic event at the spring.

Coldwater spring is impounded by a low weir dam approximately 6.7 m (22 ft) wide to form a pool >0.4 ha (1.0 ac) that is 0.4 – 1.6 m (2 – 4 ft) deep (McCaleb 1973). The spring run is 12 – 15 m (40 – 60 ft) wide, up to 0.5 m (1.5 ft) deep, and approximately 137 m (450 ft) long. The substrate is predominately rock, gravel, and sand, and is often covered with *Fontinalis* and *Fissidens*. The dominant plants in the spring pool are *Myriophyllum* and *Ceratophyllum*, and the edges of the spring run are dominated by *Nasturtium* (McCaleb 1973, Boschung 1986).

Spawning apparently occurs throughout the year, peaking from April to August. Pygmy sculpins use cavities for nesting, with nests generally in areas of coarse substrate, shallow water depth, and relatively swift water velocity (McCaleb 1973, Johnston 1999). Males guard the eggs until hatching. The most important food item throughout the year for adults is isopods, with amphipods, gastropods, and trichopterans of seasonal importance (McCaleb 1973). Food items for young include choronomid larvae, copepods, and ostracods.

Coldwater Spring is the major water supply for the city of Anniston, which owns the spring and its run and approximately 97 ha (240 ac) of land in the immediate area. It is managed by the city of Anniston Waterworks and Sewer Board, and serves nearly 60% of Calhoun County residents. The City of Anniston has a cooperative agreement with the USFWS to protect the pygmy sculpin in this spring. The population's downstream limit occurs at the confluence of the spring run with Dry Creek. Dry Creek drains an area containing Anniston Army Depot and a clay mining operation, and has had a long-term problem with water quality degradation (Bowker 1991). Possible groundwater degradation is the most serious threat facing the population (Bowker 1991), with recent concern that toxic compounds, trichloroethylene in particular, may be entering the aquifer from Anniston Army Depot (Stiles and Warren 2004). Other threats identified including a lowering of the aquifer. The greatest protection need is the prevention of ground water contamination and protection of recharge areas.

Blue Shiner

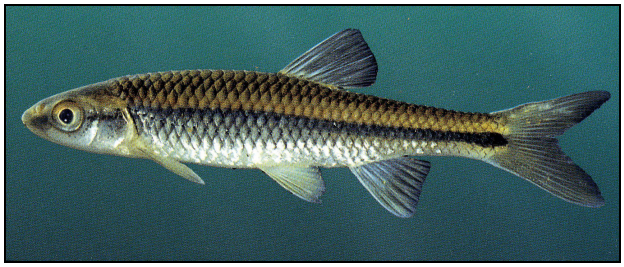

Photo – from Mettee et al. 1996

The blue shiner was listed as a federal threatened species by the USFWS 22 April 1992 (United States Fish and Wildlife Service 1992a), is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 species (high conservation concern) (Mirarchi 2004) and is considered to be imperiled globally (rank G2) and critically imperiled in Alabama (rank S1) by the NHN and TNC. Ramsey and Pierson (1986) considered this a species of special concern in Alabama. The species is endemic to the Mobile basin above the Fall Line in the upper Coosa River system, with its distribution restricted to northeastern Alabama, northwestern Georgia, and southeastern Tennessee (Mettee et al. 1996). In Alabama, it is restricted to the lower reaches of Little River in Cherokee County, Weogufka Creek in Coosa County, and Shoal and Choccolocco creeks in Calhoun and Talladega County (Ramsey and Pierson 1986, Pierson and Krotzer 1987 as cited in Mettee et al. 1996). Historically, the blue shiner also occurred in Big Wills Creek in DeKalb and Etowah counties and a 100-km (60-mi) reach of the Cahaba River, extending from Jefferson County to Bibb County, but it has not been collected in these systems since 1958 and 1971, respectively (Ramsey and Pierson 1986, Stewart and Larson 1995). ALNHP had 10 occurrences documented for the blue shiner in the MCR watershed. The species was documented in the Upper Big Wills Creek (50), Upper Choccolocco Creek (240), and Middle Choccolocco Creek (250) subwatersheds. Dam construction, loss of habitat, and water pollution have reduced and fragmented the blue shiner's range, creating isolated and relatively small populations vulnerable to extirpation (Stewart and Larson 1995).

Blue shiners prefer cool, clear, medium or large streams, and are usually found in shallow pools with slow currents or in slack water (upper pool habitat) with a firm substrate (sand, gravel, or rubble) (Ramsey and Pierson 1986). Spawning in the upper Coosa River system occurs from late April to late July (Krotzer 1984).

Strong circumstantial evidence suggests water quality degradation was a major factor in the blue shiner's decline in distribution and abundance (Stewart and Larson 1995). The extirpation of the blue shiner and other aquatic species from the Cahaba River coincided with reductions in water quality, e.g. nutrification and probable low dissolved oxygen. The species is intolerant of high turbidity (Ramsey and Pierson 1986), and excessive turbidity and siltation may have detrimental effects on feeding and reproduction, so the blue shiner may require high water clarity for these activities (Stewart and Larson 1995). Another factor in the species' decline was the construction of reservoirs for hydropower, navigation, and flood control. Recovery may best be achieved through reduction of threats. Watershed protection to reduce siltation and nutrient loading is an essential component of threat reduction and recovery cannot be achieved without it (Stewart and Larson 1995).

Walnut Elimia

Photo – Malcolm Pierson

The walnut elimia is <2.5 cm (1.0 in) in length, and is subfusiform in shape. The shell color is yellowish with 4 prominent dark bands. It is found in rivers and streams but little is known about its ecology.

The walnut elimina is considered to be a critically imperiled species (rank G1/S1) by the NHN and TNC and a Priority 3 (moderate conservation concern) species by state experts (Mirarchi 2004). The walnut elimia was a candidate species for protection under the Endangered Species Program before the candidate program was restructured. The walnut elimia is a Coosa River basin endemic whose historic distribution was the middle Coosa River mainstem, Yellowleaf Creek, and Choccolocco Creek (Hartfield 1993). In the mainstem Coosa, the species ranged from Gadsden, Etowah County, to Wetumpka, Elmore County, but was most common in mainstem shoals in Talladega and Shelby counties. Apparently extirpated from the main stem Coosa River, it is now restricted to Yellowleaf and Choccolocco creeks (Bogan and Pierson 1993), resulting in 2 disjunct populations that form an extremely vulnerable distribution in a river system that is heavily impacted by impoundments and suffers from water pollution and siltation. ALNHP had 7 occurrences of this snail documented in the MCR watershed in Calhoun, Cleburne, and Talladega (5) counties, with the most recent documentation from 1992. These occurrences were in the Cheaha Creek (260), Lower Choccolocco Creek (270), Middle Choccolocco Creek (250), and Upper Choccolocco Creek (240) subwatersheds.

Spindle Elimia

The spindle elimia is easily distinguished by the development of fine, dense spiral ornamentation covering the whole surface of the shell. The shell grows to approximately 2.3 cm (0.9 in) in length, and is cylindrical to subfusiform in shape. Color bands often are present, but they usually only show in the aperture.

The spindle elimia is considered to be a critically imperiled species (rank G1/S1) by the NHN and TNC. The species was endemic to the Coosa River system, and was historically found from the headwaters downstream to Coosa County. However, much of its former habitat has been impounded. Mirarchi (2004) listed the species as extinct, stating that it had not been reported since the river was impounded. However, ALNHP has 1 EOR for this snail in Big Canoe Creek (Upper Big Canoe Creek subwatershed – HUC 100) from 1990 as documented by Bogan and Pierson (1993). The status of this snail in the state is uncertain, and surveys in its former range are needed to determine if the species is still extant.

Prune Elimia

The prune elimia has a yellowish brown, conic shell, usually marked with 4 dark bands. It is a tributary species and is usually found in lotic habitats. However, the ecology of the species is poorly known.

The prune elimia is considered to be a critically imperiled species (rank G1S1) by the NHN and TNC and a Priority 3 species (moderate conservation concern) by state experts (Mirarchi 2004). The species is endemic to Coosa River tributaries and was found in 6 different tributaries of the Coosa River (Bogan and Pierson 1993): Chestnut and Mountain creeks in Chilton County, Waxahatchee Creek in Shelby County, Weogufka and Hatchet Creek in Coosa County, and Shoal Creek in St Clair County. ALNHP had 1 occurrence of this snail documented in the MCR watershed in the Shoal Creek subwatershed (150).

Lacey Elimia

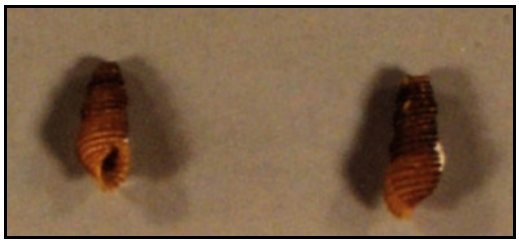

Photo – Arthur Bogan

The lacey elimia is a freshwater snail which usually attains a shell length <2.5 cm (1 in). The outer shell is dark brown to black, with a conic shape that is heavily sculptured with raised spiral lines. The aperture is small and ovate. This species is a gill breathing snail that typically inhabits highly oxygenated waters on rock shoals and gravel bars (United States Fish and Wildlife Service 1998). It is most often found under rock slabs in small headwater streams with moderate current and a substrate which consists of sand, gravel, cobble, and rock slabs.

The lacy elimia was listed as a federal threatened species by the USFWS 27 November 1998 (United States Fish and Wildlife Service 1998), is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 1 species (highest conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1) by the NHN and TNC. This species is endemic to the Coosa River system and was historically abundant in the main stem Coosa River from St. Clair to Chilton counties. It also occurred in several tributaries: Big Wills Creek, DeKalb County; Kelly's Creek, St. Clair County; and Choccolocco and Tallaseehatchee creeks, Talladega County (Hartfield 1993, United States Fish and Wildlife Service 1998). Impoundment of the mainstem Coosa River and the gradual degradation of suitable impounded habitat has apparently resulted in the extirpation of this species from historical collection sites. However, survey efforts during the early 1990s located 3 previously unreported populations in Cheaha, Emauhee, and Weewoka creeks, Talladega County (Bogan and Pierson 1993). It is locally abundant in Cheaha Creek, but rare in Emauhee and Weewoka creeks. ALNHP had 3 occurrences documented in 2 MCR subwatersheds: Cheaha Creek (260) and Talladega Creek (330).

This snail species was historically abundant over several counties, but is now restricted to 3 streams in 1 county, with all 3 populations inhabiting private lands. Although Cheaha Creek originates in the Talladega National Forest, no specimens have been found on Forest Service lands. The habitat is moderately impacted by runoff from localized agricultural activities and private homes. This species is sensitive to pollution, siltation, habitat perturbation, and inundation. The primary threat to the remaining populations is NPS pollution (United State Fish and Wildlife Service 1998). Therefore, efforts to minimize NPS pollution in the areas it occupies are essential to maintaining the remaining populations.

Delicate Spike

The delicate spike is a small mussel with an elongated and elliptical shell that may reach a length of 8 cm (3.1 in). Shell color varies from a dull yellowish green in juveniles to dark brown or blackish in old adults (Parmalee and Bogan 1998). The periostracum is fairly smooth, but irregular growth lines may roughen some old specimens. This species is most often found in

Photo – G. Thomas Watters

streams and rivers with a course sand and gravel substrate at depths of <0.9 m (<3 ft) (Parmalee and Bogan 1998). Gangloff (2003) reported an apparent preference for habitat beneath large slab-like stones in fast water. The reproductive season and host fish are unknown.

The delicate spike is considered to be rare globally (rank G3G4) and imperiled (rank S2) in Alabama by the NHN and TNC and a Priority I species (highest conservation concern) by state experts (Mirarchi 2004). Williams et al. (1993) assigned the delicate spike a conservation status of special concern, and Gangloff (2003) suggested that it should be considered endangered because he found it to be much less common than other listed species. Gangloff (2003) reported the species was endemic to the Mobile basin and historically occurred throughout the Coosa, Cahaba, Tallapoosa, and Tombigbee drainages in Alabama, Georgia, Mississippi, and Tennessee. He suggested that historic reports from adjacent drainages in the Atlantic Coastal Plain were misidentifications of other *Elliptio* species. Parmalee and Bogan (1998) also doubted the veracity of these records. Historically, the delicate spike was abundant in main channel Coosa River and its tributaries, but it appears to have been extirpated from some of the tributaries and much of the main channel. ALNHP had no occurrences documented for this species in the MCR watershed. However, Gangloff (2003) collected fresh dead specimens from Kelly, Big Canoe, and Terrapin creeks..

The major threats to this species are sedimentation resulting from poor land management practices, chemicals from industrial runoff, bank and streambed destabilization, reservoirs, and water withdrawals. One of the greatest inventory needs identified by the NHN for this species was surveys of Coosa River tributaries for possible new populations. They also considered the identification of point and non-point sources of pollution one the greatest research needs.

Upland Combshell

The upland combshell is a small mussel with a shell that is rhomboidal to quadrate in outline and rarely exceeds 6 cm (2.4 in) in length and is sexually dimorphic (United States Fish and Wildlife

Photo – from Parmalee and Bogan 1998

Service 1993). Males are moderately inflated with a broadly curved posterior ridge. Females are considerably inflated, with a sharply elevated posterior ridge that swells broadly post-ventrally forming a well-developed sulcus (the groove anterior to the posterior ridge) (United States Fish and Wildlife Service 1993). The periostracum is smooth, shiny, and yellowish to greenish in color often with numerous light, narrow green bands or small green spots (Parmalee and Bogan 1998). The life history and host fish for this species is unknown, but it has been found in riffle sections of small to medium-sized rivers with a sand and gravel substrate (Parmalee and Bogan 1998).

The USFWS listed the upland combshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) ranked historically occurring by the NHN and TNC. Historically, this species was a regional endemic restricted to the Mobile Basin, and occurred in large rivers and streams in the Black Warrior and Cahaba river drainages in Alabama, and the Coosa River drainage in Alabama, Georgia, and Tennessee. The present range has declined substantially and this species now appears to be restricted to the Conasauga River in Georgia (United States Fish and Wildlife Service 1993). ALNHP had no occurrences documented in the MCR watershed for this species. The most recent record in the Coosa River watershed in Alabama was a record from 1968 in the UCR watershed, despite more recent survey efforts (Hurd 1974, Gangloff 2003). However, the most recent record in the Coosa watershed is the collection of a single individual from the Conasauga River, Georgia, in 1988 (United States Fish and Wildlife Service 1993). Mirarchi (2004) considered this species to be extirpated in Alabama and Gangloff (2003) suggested that the species is extinct. However, the USFWS has developed a recovery plan for this species (United States Fish and Wildlife Service 1997b), and has designated critical habitat for this species, including areas in the MCR watershed (United States Fish and Wildlife Service 2004b). Eight units were designated critical habitat for this species, all currently unoccupied, and included 3 units in the MCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 21 – Kelly Creek and Shoal Creek, Shelby and St. Clair counties; and unit 24 – Big Canoe Creek, St. Clair County (United States Fish and Wildlife Service 2004b).

If still extant, the major threats to this species are habitat modification, sedimentation, and other forms of water quality degradation. Potential habitat is locally impacted by carpet mill and other industrial discharge, sewage treatment discharge, urban and agricultural runoff, and surface mine drainage (United States Fish and Wildlife Service 1997b)

Southern Acornshell

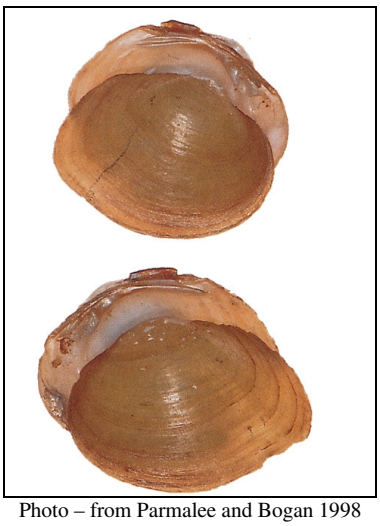

Photo – from Parmalee and Bogan 1998

The southern acornshell is a small mussel that may grow up to 3 cm (1.2 in) in shell length. The shells are round to oval in outline and sexually dimorphic, with a swollen posterior ridge in females. The periostracum is smooth, shiny, and yellow in color. Life history and host fish are unknown (Parmalee and Bogan 1998).

The USFWS listed the southern acornshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) ranked historically occurring by the NHN and TNC. Williams et al. (1993) listed the southern acornshell as endangered. Mirarchi (2004) listed the species as extirpated in the state. Historically the species was a regional endemic found in the Cahaba River and middle and upper Coosa systems above the Fall Line in Alabama, Georgia, and Tennessee (Williams et al. 1993), including occurrences in Choccolocco Creek, Kelly Creek, Little Canoe Creek, Mill Creek, Cowan's Creek, Othcalooga Creek, and Conasauga River (United States Fish and Wildlife Service 1993, Gangloff 2003). However, the more recent range of the southern acornshell appears to be restricted to streams in the Coosa River drainage in Alabama, Georgia, and Tennessee (United States Fish and Wildlife Service 1993, Parmalee and Bogan 1998). ALNHP had 1 historic occurrence documented in the Lower Kelly Creek subwatershed (310), but the last observation at this location was 1966. The most recent record for this species was Hurd's (1974) record of specimens in Little Canoe Creek and the Upper Conasauga River. More recent surveys (Evans 2001, Gangloff 2003) failed to detect the species, and many consider the southern acornshell to now be extinct. Despite the failure of recent surveys to detect the species, the USFWS has designated critical habitat for this species, including areas in the MCR watershed (United States Fish and Wildlife Service 2004b). The USFWS (2204b) designated 7 critical habitat units for this species (all currently unoccupied), including 2 in the MCR watershed: unit 21 - Kelly Creek and Shoal Creek, Shelby and St. Clair counties and unit 24 - Big Canoe Creek, St. Clair County.

Coldwater Darter

Photo – from Mettee et al. 1996

The coldwater darter is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 species (high conservation concern) (Mirarchi 2004) and is considered a critically imperiled species (rank G1G2/S1) by the NHN and TNC. Ramsey (1986) considered this a species of special concern in the state. It is endemic to the Coosa

River system of the Mobile Basin, occurring intermittently from the Conasauga River in Georgia and Tennessee downstream to Waxahatchee Creek in Chilton and Shelby counties, Alabama (Mettee et al. 1996). The typical spring-dwelling form has strong Alabama populations only in Glencoe Spring, Etowah County, and Coldwater Spring, Calhoun County. The stream-dwelling form is limited to Alabama with populations in Waxahatchee Creek tributaries, Shelby County, and 2 Coosa River tributaries, Coosa County (Ramsey 1986). ALNHP had 6 occurrences documented in 4 of the MCR subwatersheds: Big Cove Creek (030), Tallasseehatchee Creek (170), Cane Creek (190), and Middle Choccolocco Creek (250). Four of these occurrences are ranked historical (<20 years since the last observation), with one population likely extirpated by the creation of Weiss Lake. Additional populations possibly could be discovered in some of the numerous unexplored springs in the upper Coosa system (Ramsey 1986).

Preferred habitats of the coldwater darter are usually vegetated limestone spring pools and runs and small streams in areas with extensive springs, where it is most common in beds of aquatic mosses (*Fontinalis* and *Fissidens*). This darter tends to avoid unvegetated areas and extremely dense patches of *Myriophyllum* (Ramsey 1986, Mettee et al. 1996). In spring habitats, the species has a spawning season from March to September, with peak activity from April to June (Ramsey 1986).

Threats to the species include water quality degradation, lowering of aquifer levels, and loss of aquatic vegetation in spring habitat. This species is probably very sensitive to changes in its physical habitat such as temperature, turbidity, and pH. Many of the occupied streams have sedimentation problems, especially within Shelby County, and most of occupied springs have some degree of degradation, with common disturbances including removal of aquatic vegetation and water, excessive sedimentation, and livestock entering springs (Kuhajda 2004). The NHN considers the greatest protection need to be the prevention of contamination of groundwater and protection of recharge areas. The Coldwater Spring population is coincidentally protected by a cooperative agreement between the city of Anniston and USFWS to protect the pygmy sculpin at the site. The Glencoe Spring population is in a municipal roadside park, but receives no formal protection other than that afforded by the nongame regulations (Ramsey 1986).

Fine-Lined Pocketbook

The fine-lined pocketbook is a yellow-brown to blackish, medium-sized mussel, suboval in shape with fine rays on the posterior half, that rarely exceeds 10 cm (4 in) in length. Gravid females have been observed March through June, and have been observed releasing glochidia in a single large conglutinate, termed a superconglutinate (Haag et al. 1999). Redeye bass (*Micropterus coosa*), spotted bass (*M. puctulatus*), largemouth bass (*M. salmoides*), and green sunfish (*Lepomis cyanellus*) have been identified as suitable hosts (Haag et al., 1999). Fine-lined pocketbooks appear to prefer habitat conditions characteristic of headwater streams, with specimens more commonly found in moderate to high flow small stream riffles or runs.

The USFWS listed the fine-lined pocketbook as a federal threatened species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation

Photo – from Parmalee and Bogan 1998

and Natural Resources 2002) considered a Priority 2 species (high conservation concern) (Mirarchi 2004), and is considered to be imperiled (rank G2/S2) by the NHN and TNC. Williams et al. (1993) considered the species to be threatened. Historically, this mussel species was a regional endemic found throughout the Mobile River Basin, and was reported from the Alabama, Black Warrior, Cahaba, Coosa, Tallapoosa, and Tombigbee rivers and their tributaries in Alabama, Georgia, Mississippi, and Tennessee (Parmalee and Bogan 1998, United States Fish and Wildlife Service 2003b). In the Coosa River system in Alabama, it was found in Choccolocco and Talladega creeks. ALNHP had 3 occurrences documented in Calhoun or Cleburne counties from the Middle Choccolocco Creek (250) and Upper Choccolocco Creek (240) subwatersheds. Gangloff (2003) found this species to be more widely distributed throughout the watershed. The fine-lined pocketbook was one of the most widely dispersed species in his study area and was encountered at more sites than any other species. However, they were abundant only in Chewacla and Shoal creeks. At most survey sites, the species was present but not abundant. Gangloff (2003) reported the populations in Chewacla and Terrapin creeks to be threatened by de-watering from quarry and mining operations. The USFWS (2004b) has designated 12 critical habitat units (2 currently unoccupied) for this species, including 5 covering parts of the MCR watershed (all indicated to be occupied): unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 20 - Shoal Creek, Calhoun and Cleburne counties; unit 21 - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; unit 22 - Cheaha Creek, Talladega and Clay counties; and unit 24 - Big Canoe Creek, St. Clair County.

The major threats to this species are habitat modification, sedimentation, and water quality degradation. The species may also be threatened by overutilization for commercial, recreational, scientific, or educational purposes, as well as by disease and predation (United States Fish and Wildlife Service 1993).

Painted Rocksnail

Photo – Paul Johnson

The painted rocksnail is a small to medium, yellowish to olive-brown snail, usually with 4 dark bands, approximately 1.9 cm (0.8 in) long and subglobose to oval in shape (United States Fish and Wildlife Service 1998). Rocksnails are gill-breathing snails found in shoals and riffles on substrates of gravel and cobble. Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat (Goodrich 1922).

The painted rocksnail is one of only 2 known survivors of the 15 rocksnail species that historically occurred in Coosa River basin. The USFWS listed the painted rocksnail as a federal threatened species 28 October 1998 (United States Fish and Wildlife Service 1998). The painted rocksnail is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 (high conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1) by the NHN and TNC. This species was endemic to the Mobile River basin and historically had the largest range of any rocksnail in the basin (Goodrich 1922): from the Coosa River and tributaries in northeastern St. Clair County downstream into the main stem of the Alabama River to Claiborne, Monroe County and the Cahaba River below the fall line in Dallas and Perry counties (Hartfield 1993). It is apparently extirpated from the Alabama, Cahaba, and mainstem Coosa rivers, and is currently restricted to 3 localized populations from the lower reaches of only 3 Coosa River tributaries: Buxahatchee Creek, Shelby County; Choccolocco Creek, Talladega County; and Ohatchee Creek, Talladega County (Bogan and Pierson 1993, United States Fish and Wildlife Service 1998). In the MCR watershed, ALNHP had 3 occurrences documented along Choccolocco Creek in Talladega County from the Lower Choccolocco Creek (270) or Middle Choccolocco Creek (250) subwatersheds.

The extirpation of this species from many areas was likely due to impoundments. Although this species appears to be more tolerant of siltation than other *Leptoxis* in the Mobile Basin, it remains vulnerable to extinction because of its limited and isolated distribution and specialized habitat requirements (Johnson 2004). The streams with extant populations are affected by sedimentation and degradation of water quality, and the lands bordering these populations are in private ownership. Retention of these populations likely will require efforts to control NPS pollution and outreach to the private landowners.

Coosa Moccasinshell

Photo – from Parmalee and Bogan 1998

The Coosa moccasinshell is a small, thin-shelled freshwater mussel that is yellow- to dark-brown with fine green rays and rarely exceeds 4 cm (1.6 in) in length (United States Fish and Wildlife Service 2003b). The nacre is bluish white, occasionally with salmon-colored spots. The shell is elongate and elliptical to rhomboidal in shape, with a broadly rounded posterior ridge (Haag 2004a). The species is usually found in clear small streams to large rivers with moderate flow and a sand, gravel, and cobble substrate, mostly above the Fall Line (Haag 2004a).

The USFWS listed the Coosa moccasinshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993) and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be extirpated in the state by Mirarchi (2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Historically, this

species was a regional endemic found in the Coosa River, Cahaba River, and the Sipsey Fork of the Black Warrior River and their tributaries in Alabama, Georgia, and Tennessee (United States Fish and Wildlife Service 2003b). The species is currently known to occur only in the Conasauga River drainage, Georgia, and is apparently extirpated in Alabama as is has not been detected in any surveys conducted during the past 30 years (Hurd 1974, Gangloff 2003). ALNHP had no occurrences of this species documented in the MCR watershed. However, the USFWS (2004b) has designated 9 critical habitat units (only 1 of which is currently occupied) for this species, including 5 covering parts of the MCR watershed (all unoccupied): unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 20 - Shoal Creek, Calhoun and Cleburne counties; unit 21 - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; unit 22 - Cheaha Creek, Talladega and Clay counties; and unit 24 - Big Canoe Creek, St. Clair County.

Habitat modification, sedimentation and water quality degradation represent the major threats to this species. The species may also be threatened by overutilization for commercial, recreational, scientific, or educational purposes; disease, and predation (United States Fish and Wildlife Service 1993). The NHN considers the greatest inventory need for this species to be continued surveys to locate existing populations and potential reintroduction sites, with surveys focused on the mainstem Coosa River and its tributaries.

Southern Clubshell

USGS/Florida Integrated Science Center photo

The southern clubshell is a yellow to yellowish-brown, thick-shelled, medium-sized freshwater mussel with a heavy hinge plate, which reaches an average adult size of 7 cm (2.8 in) in length (United States Fish and Wildlife Service 1993). Young specimens occasionally have green rays or spots on the umbo. This species is usually found in highly oxygenated streams with sand and gravel substrate. Individuals may be found in sand and gravel in the center of the stream or in sand along the margins of the stream.

The USFWS listed the southern clubshell as a federal threatened species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered a Priority 2 species (high conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1G2/S1S2) by the NHN and TNC. This species is endemic to the Mobile River basin, and historically was known from every major river system in the basin except for the Mobile Delta area of the Tensaw and Mobile rivers (Hartfield 1991, United States Fish and Wildlife Service 1993) and was abundant throughout the Coosa River drainage (Gangloff 2003). However, many historic populations have been extirpated, and the species is now limited to approximately 6 viable populations, which are isolated from each other. Currently the species is known from Bogue Chitto Creek in the Alabama River drainage; Buttahatchee, East Fork Tombigbee and Sipsey Rivers in the Tombigbee River drainage; Chewacla Creek in the Tallapoosa River Drainage; Conasauga

River, Etowah River, Holly Creek, and Armuchee Creek in the upper Coosa River drainage; Big Canoe Creek and the main channel Coosa River at the mouth of Terrapin Creek; and below Jordan Dam in the Coosa River drainage (Hartfield 1991, Gangloff 2003). ALNHP only had 1 historical occurrence documented in the MCR watershed in the Lower Kelly Creek subwatershed (310). However, Gangloff (2003) reported additional locations at which the species occurs in the watershed. He suggested that southern clubshell was extirpated from Kelly Creek, Choccolocco Creek, and H. Neely Henry Lake, and that the species is restricted to 3 actively recruiting (but highly isolated) populations in the Coosa River drainage: Big Canoe Creek and the main stem Coosa River at Terrapin Creek and below Jordan Dam. The USFWS (2004b) has designated 19 critical habitat units (6 currently unoccupied) for this species, including 3 covering parts of the MCR watershed (all indicated to be occupied): unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 21 - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; and unit 24 - Big Canoe Creek, St. Clair County.

This species' limited and isolated distribution and declining population trend make it vulnerable to extinction (Haag 2004b). The major threats to this species are habitat modification, sedimentation, and water quality degradation. The species may also be threatened by overutilization for commercial, recreational, scientific, or educational purposes, as well as by disease and predation (United States Fish and Wildlife Service 1993). Among the greatest research needs identified for this species by the NHN are to determine if culturing of the species is a viable means of conservation, and assessing potential sites for reintroduction if culturing of the species proves successful.

Canoe Creek Pigtoe

Gangloff (2003) reported a pigtoe that appeared to be a new, undescribed species of *Pleurobema*, closely related to the southern pigtoe, restricted to the Upper Big Canoe Creek subwatershed (100) of the Coosa River which he called the Canoe Creek pigtoe. He found this species in swift-flowing runs with a substrate of mixed gravel and sand throughout Big Canoe Creek, but he only collected 3 live specimens. He suggested that the species should be considered endangered based on its extremely restricted range and low abundance, and that it is in need of immediate recognition and federal protection.

Southern Pigtoe

The southern pigtoe is a small to medium-sized, yellow to yellow-brown freshwater mussel occasionally exceeding 6 cm (2.4 in) in length (Hartfield 1991). The shell is elliptical to oval in outline and somewhat compressed with numerous growth lines. Green spots may appear at the growth lines along the posterior ridge and near the umbo in small specimens. Host fish are Alabama shiner (*Cyprinella callistia*), blacktail shiner (*C. venusta*), and tricolor shiner (*C. trichroistia*) (United States Fish and Wildlife Service 2003b). The species inhabits high quality rivers and creeks with stable gravel and sandy-gravel substrates in moderate current, apparently concentrated in shallow gravel riffles with good flow (Parmalee and Bogan 1998, Gangloff 2003).

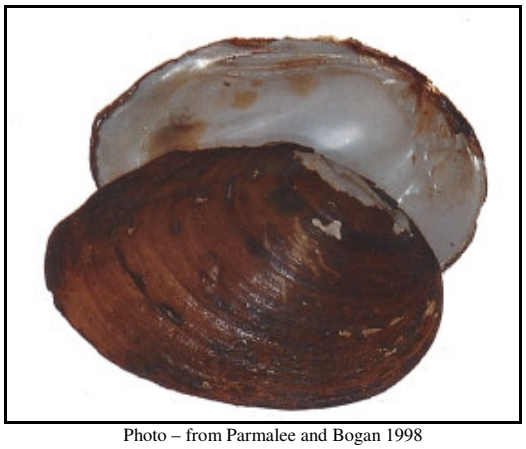

Photo – from Parmalee and Bogan 1998

The USFWS listed the southern pigtoe as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002), considered a Priority 1 species (highest conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Historically this species was presumably a Coosa River system endemic found in the Coosa River and its tributaries in Alabama, Georgia, and Tennessee. However, Gangloff (2003) also reported the species in the Lower Tallapoosa drainage. In the MCR watershed, ALNHP had 2 occurrences documented along Shoal Creek in the Upper Choccolocco Creek (240) subwatershed in Cleburne County. The southern pigtoe's range has been dramatically reduced and appears to be limited to 6 populations which are small, low density, and isolated. The populations are located in the Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee), Holly Creek (Murray County, Georgia), Shoal Creek (Cleburne County, Alabama), Big Canoe Creek (St. Clair County, Alabama), Cheaha Creek (Talladega County, Alabama), and Choctafaula Creek (Macon County, Alabama) (Evans 2001, Gangloff 2003, United States Fish and Wildlife Service 2003b). The USFWS (2004b) has designated 9 critical habitat units (5 currently unoccupied) for this species, including 5 covering parts of the MCR watershed (3 indicated to be currently occupied): unit 18 (unoccupied) - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 20 (occupied) - Shoal Creek, Calhoun and Cleburne counties; unit 21 (unoccupied) - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; unit 22 (occupied) - Cheaha Creek, Talladega and Clay counties; and unit 24 (occupied) - Big Canoe Creek, St. Clair County.

Threats to the species include habitat modification, sedimentation, and water quality degradation. Its limited distribution, rarity, and declining population trend make the species vulnerable to extinction (Haag 2004c).

Ovate clubshell

The ovate clubshell is a small to medium-sized, moderately thick-shelled, yellow to dark brown freshwater mussel that rarely exceeds 5 cm (2 in) in length (United States Fish and Wildlife Service 2003b). Occasionally, weak green rays of varying width may cover most of the umbo and posterior ridge (Haag 2004d). The posterior ridge is well-developed, narrowly rounded, and often concave (United States Fish and Wildlife Service 2003b). The shell nacre is white. This species is found in medium to large streams, and most frequently occurs in silt or silty sand along stream margins or in side channels (Haag 2004d). Glochidia are released in well-formed white conglutinates, but the host fish species are unknown.

Photo – Mike Gangloff

The USFWS listed the ovate clubshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002), considered a Priority 1 species (highest conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Historically, this species was endemic to the Mobile Basin and occurred in the Tombigbee, Black

Warrior, Alabama, Cahaba, and Coosa Rivers and their tributaries in Mississippi, Alabama, Georgia, and Tennessee; and in Chewacla, Uphapee and Opintlocco Creeks in the Tallapoosa River drainage, Alabama (United States Fish and Wildlife Service 2003b). It has apparently been extirpated from the Black Warrior, Cahaba, and Alabama River drainages, as well as the mainstem Tombigbee River and Uphapee and Opintlocco Creeks. Currently, small and localized populations are known to occur in several Tombigbee River tributaries including the Sipsey River and Sucarnoochee River, Chewacla Creek in the Tallapoosa River drainage; and a short reach of the Coosa River below the mouth of Terrapin Creek (United States Fish and Wildlife Service 2003b). ALNHP had no occurrences of this species documented in the MCR watershed. However, the USFWS (2004b) has designated 20 critical habitat units (only 6 currently occupied) for this species, including 3 covering parts of the MCR watershed (all indicated to be currently unoccupied): unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 21 - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; and unit 24 - Big Canoe Creek, St. Clair County.

Habitat modification, sedimentation and water quality degradation represent the major threats to this species. The species may also be threatened by overutilization for commercial, recreational, scientific, or educational purposes; disease, and predation (United States Fish and Wildlife Service 1993). In Chewacla Creek, it is affected by recent impacts including clear cutting for road improvement projects which did not use best management practices. This declining species is vulnerable to poor construction practices and may not recover from further habitat loss. Its limited distribution, rarity, and declining population trend make the species vulnerable to extinction (Haag 2004d). The NHN recommends continuing surveys to locate additional populations and assess potential reintroduction sites if culturing of the species proves successful.

Upland Hornsnail

The upland hornsnail is a species endemic to the upper Coosa River considered to be a Priority 3 species (moderate conservation concern) by state experts (Mirarchi 2004), and is considered to be critically imperiled (rank G1Q/S1) by the NHN and TNC. The upland hornsnail was a candidate species for protection under the Endangered Species Program before the candidate program was restructured. Historically, this species was found in the upper Coosa River and its tributaries in Alabama and Georgia. Currently, the species is known from only 3 sites in Coosa

River tributaries (only 1 in MCR watershed): Yellowleaf Creek, Shelby County; Weewoka Creek, Talladega County; and Kelly Creek, St. Clair County (Bogan and Pierson 1993, Hartfield 1993). In the MCR watershed, ALNHP had 1 occurrence documented in St. Clair County from the Kelly Creek (310) subwatershed. The species is usually found in areas with at least some current.

Triangular Kidneyshell

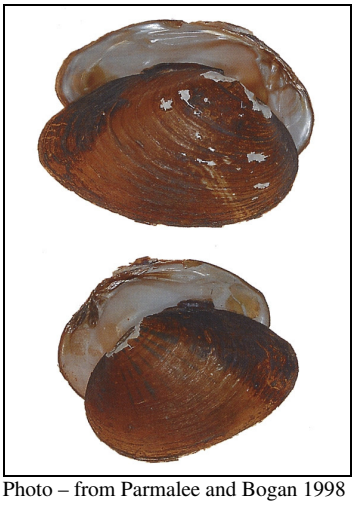

Photo – from Parmalee and Bogan 1998

The triangular kidneyshell is a medium-sized, oval to elliptical, yellow-brown freshwater mussel which attains a maximum adult size of approximately 10 cm (4.0 in) in length (Hartfield 1991). The outer shell is straw-yellow in young specimens. Occasionally, it may have fine and wavy or wide and broken green rays anterior to the posterior ridge. Glochidia are packaged into conglutinates that mimic small aquatic fly larvae (Hartfield and Hartfield 1996) or fish eggs (Haag and Warren 1997). The species appears to be most prevalent in water <1m (3 ft) deep with a firm gravel and sand substrate and a good current (Parmalee and Bogan 1998). The Warrior darter (*Etheostoma bellator*), Tuscaloosa darter (*E. douglasi*), blackbanded darter (*Percina nigrofasciata*) and logperch (*P. caprodes*) have been identified as potential suitable fish hosts (Haag and Warren 1997).

The USFWS listed the triangular kidneyshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 1 species (highest conservation concern) (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Historically, this species was endemic to the Mobile Basin upstream of the Fall Line and was found in Alabama, Georgia, and Tennessee in the Alabama, Black Warrior, Cahaba, and Coosa rivers and their tributaries (Williams et. al. 1993, United States Fish and Wildlife Service 2003b). It has disappeared from the Alabama River, and from the primary channels of the Black Warrior and Coosa Rivers. Gangloff (2003) reported historic records in the Coosa and Lower Tallapoosa basins from Choccolocco, Kelly, Terrapin, Mill, Big Wills, and Little Canoe creeks and throughout the Chattooga and Upper Coosa rivers. However, Hurd (1974) found the species restricted to Little Canoe, Big Canoe, and Kelly creeks and the Conasauga River in Georgia. ALNHP had 1 occurrence documented in the MCR watershed in the Lower Kelly Creek (310) subwatershed. Gangloff (2003) found live specimens only in Big Canoe Creek and good condition dead shells in Kelly Creek. Seven other small isolated populations are known from the Upper Coosa (Georgia), Cahaba, and Black Warrior River basins. The USFWS (2004b) has designated 13 critical habitat units (6 currently unoccupied) for this species, including 5 covering parts of the MCR watershed (3 indicated to be currently occupied): unit 18 (unoccupied) - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed); unit 20 (occupied) - Shoal Creek, Calhoun and Cleburne counties; unit 21 (occupied) - Kelly Creek and Shoal Creek, Shelby and St. Clair counties; unit

22 (unoccupied) - Cheaha Creek, Talladega and Clay counties; and unit 24 (occupied) - Big Canoe Creek, St. Clair County.

Loss of habitat due to impoundments is the primary reason for the decline of the species. It may also be threatened by overutilization for commercial, recreational, scientific and educational purposes (United States Fish and Wildlife Service 1993). Among the greatest research needs identified for this species by the NHN are to determine if culturing of the species is a viable means of conservation, and assessing potential sites for reintroduction if culturing of the species proves successful.

Alabama Livebearing Snail

Photo – from Bogan et al. 1995

The Alabama livebearing, or tulotoma, snail is a large, gill-breathing, operculate snail with a globular shell typically ornamented with spiral lines of knob-like structures that reaches a size somewhat larger than a golf ball (United States Fish and Wildlife Service 1991b). Its adult size and ornamentation distinguish it from all other freshwater snails in the Coosa-Alabama River system. The Alabama livebearing snail occurs in clean, cool, well-oxygenated, free-flowing waters (Hershler et al. 1990). This species is found in riffles and shoals and is strongly associated with boulder/cobble substrates, generally found on large rocks. Other aspects of its biology are virtually unknown, apart from the fact that it broods young and filter-feeds, as do other members of the family Viviparidae (United States Fish and Wildlife Service 1992b).

The USFWS listed the Alabama livebearing snail (or tulotoma snail) as a federal endangered species 9 January 1991 (United States Fish and Wildlife Service 1991b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 1 (highest conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1) by the NHN and TNC. This species was a endemic to the Mobile Basin and was found throughout much of the Coosa and Alabama River basins. Historically, it was found in the Coosa River and the lower reaches of large tributaries from St. Clair County to the Alabama River in Clarke and Monroe counties (United States Fish and Wildlife Service 1992b). The species was documented from numerous sites in the Coosa River system, but from only 2 sites in the Alabama River system: the type locality near Claiborne, Monroe County, and Chilachee Creek southwest of Selma, Dallas County. This snail's abundance and distribution declined dramatically during the past 60 years, and it was presumed extinct until rediscovered by Hershler et al. (1990). The current known range of tulotoma has been reduced to small, localized populations in a 5 km (3 mi) section of a river and localized portions of 5 tributaries in the lower, unimpounded portions of Coosa River tributaries: in the Coosa River between Jordan Dam and Wetumpka, Elmore County ; Kelly Creek, St. Clair and Shelby counties; Weogufka and Hatchet Creeks, Coosa County; Ohatchee Creek, Calhoun County; Choccolocco Creek, Talladega County, and Yellowleaf Creek, Shelby County (United States Fish and Wildlife Service 1991b, Hartfield 1993, DeVries 1994). All of these locations,

with the exception of Ohatchee Creek, where only a few snails have been observed, appear to have self-sustaining populations. All 6 populations are separated by large reaches of impounded river and are probably genetically isolated. The snail has apparently been extirpated in the Alabama River. In the MCR watershed, ALNHP had 1 occurrence documented in the Ohatchee (160) and Lower Choccolocco Creek (270) subwatersheds and 2 occurrences documented in the Lower Kelly Creek (310) subwatershed.

The range reduction of Alabama livebearing snail can be attributed to extensive channel modifications in the Coosa-Alabama River System for navigation and hydropower. Locks and dams on the Alabama and Coosa rivers impounded most of the mainstem habitat in these rivers, and most tributaries of these rivers within the historic tulotoma range have been affected in their lower reaches by backwater from the impoundments (United States Fish and Wildlife Service 1992b). The impoundment of the rivers inundated the shoals occupied by the snail, eliminating much of its former habitat. Threats to the remaining populations include water pollution (point and nonpoint), siltation, and hydropower discharge (especially Jordan Dam discharge for the population below the dam), with siltation possibly limiting potential habitat in the river channel and tributaries affected by reservoir backwater (United States Fish and Wildlife Service 1992b). The hydropower discharge threat to the population below Jordan Dam has been minimized with the restoration of minimum flow downstream of the dam. The small isolated populations remaining are vulnerable to extirpation from environmental disturbance and localized stochastic events, with the potential for genetic drift and eventual genetic divergence of the isolated populations also a concern (United States Fish and Wildlife Service 1991b, DeVries 1994).

B. Southern Hognose Snake

The southern hognose snake is a short, stocky snake that typically attains a total length of 36-51 cm (14-20 in), with a maximum length of 61 cm (24 in). Coloration varies from a gray, tan, or yellowish background overlain with a heavy pattern of mid-dorsal blotches that alternate with smaller dorsolateral blotches (Mount 1986). The snout is shovel-shaped and sharply upturned. This species' habitat apparently consists of sandy, xeric habitats (Mount 1986, Tuberville et al. 2000). The southern hognose snake is considered to be highly fossorial and infrequently encountered. Breeding apparently occurs in spring, particularly from May to June, but little is known about the reproduction or nesting behavior of this snake (Palmer and Braswell 1995). Apparently, its diet is limited almost exclusively to toads (Mount 1986).

The southern hognose snake is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) and is considered to be a Priority 1 (highest conservation concern) species that is possibly extirpated in the state (Mirarchi 2004). It is

considered an imperiled species (rank G2) by the NHN and TNC, but the state heritage ranking is SH (state historical) indicating that the species has not been documented in Alabama in over 20 years. Mount (1986) considered the species to be threatened in Alabama. The southern hognose snake was designated a candidate species (C2) for protection under the Endangered Species Program before the candidate program was restructured. Historically, the range of the southern hognose snake extended from southeastern North Carolina to central Florida westward to the Pearl River in southern Mississippi (Tuberville et al. 2000). In Alabama, Hart (2002) reported 23 historical records from 10 counties: Autauga, Baldwin, Calhoun, Choctaw, Covington, Dale, Escambia, Mobile, Shelby, and Tuscaloosa. This species has experienced an apparently alarming decline in distribution and abundance, particularly along the western edge of its range. It has been documented from only 41 counties in 4 states (North Carolina, South Carolina, Georgia, and Florida) in the past 16 years and may be extirpated in Alabama (Hart 2002). The reasons for this decline are not apparent. ALNHP had 3 occurrences (all historical) documented in the MCR watershed in Calhoun County; 1 each in the Lower Choccolocco Creek (270), Middle Choccolocco Creek (250), and Tallasseehatchee Creek (170) subwatersheds. However, the area near Anniston from which 2 of these occurrences are documented has undergone dense residential development supporting a high concentration of roads or agricultural lands so that little potential hognose habitat remains in this area (Hart 2002). It also is unclear if potential habitat remains in the Jacksonville area from which the other occurrence is documented, although a large block of forest is in the general vicinity (Hart 2002). A survey of this general area is needed to determine if southern hognose snakes or habitat for potential reintroductions occur there.

C. Caddisflies

Caddisflies were selected as a conservation target because of the diversity of caddisflies in the watershed, and because caddisflies, confined to water for much of their lives, reflect the quality of their habitat by their numbers and diversity (Harris et al. 1991). Caddisflies have long been utilized as indicators of water quality and health of water bodies because they are generally more numerous and diverse in clean, well-oxygenated waters (Harris and Lawrence 1978 as cited in Harris et al. 1991). Because of their general intolerance to perturbations, they also have been incorporated EPA's rapid bioassessment for streams protocol (Lenat 1988, Plafkin et. al 1989). Alabama has a rich caddisfly fauna, with more species than any other state in the nation; the Coosa River basin has the second highest number of species of the major river basins in the state (Harris et al. 1991). ALNHP had 30 rare species of caddisflies documented in the MCR watershed: *Agapetus iridis*, *Agapetus pinatus*, *Cheumatopsyche harwoodi*, *Cheumatopsyche helma* (Helma's cheumatopsyche caddisfly), *Chimarra augusta*, *Dolophilodes major*, *Heteroplectron americanum*, *Hydroptila cheaha*, *Hydroptila choccolocco*, *Hydroptila consimilis*, *Hydroptila patriciae*, *Hydroptila setigera*, *Hydroptila talladega*, *Ironoquia*

punctatissima, *Lepidostoma griseum*, *Molanna blenda*, *Ochrotrichia confusa*, *Oxyethira michiganensis*, *Polycentropus carlsoni* (Carlson's polycentropus caddisfly), *Protoptila maculata*, *Psilotreta frontalis*, *Pycnopsyche gentilis*, *Pycnopsyche lepida*, *Pycnopsyche luculenta*, *Pycnopsyche virginica*, *Rhyacophila glaberrima*, *Rhyacophila nigrita*, *Rhyacophila teddyi*, *Rhyacophila torva*, and *Triaenodes taenia* (Cold Spring triaenodes caddisfly).

Caddisflies, or Trichoptera, are one of the largest group of aquatic insects and are common inhabitants of streams and lakes. Specialized habitats such as marshes, swamps, springs, seeps, and intermittent streams may all support a caddisfly fauna. Adult caddisflies are small- to medium-sized (2-30 mm) dull-colored insects resembling moths in overall appearance (Harris et al. 1991). They differ from moths by having hairs on their wings rather than scales and by lacking a proboscis. Most species have a 1-year life cycle, beginning with eggs deposited in water either as strings or masses enclosed within a gelatinous covering or in sheets surrounded by a hard coating (Harris et al. 1991). Caddisflies are perhaps best known for the elaborate cases the larvae construct out of sand, pebbles, or small bits of plant material. Larvae typically have 5 instars, with the final instar larva attaching the case to a stable substrate and sealing the ends prior to pupation. The pupal stage generally lasts 2-3 weeks. The eggs and other life stages of some species are capable of diapause until water is present in some species. Adults of most species fly actively during the evening and are quiescent during the day, resting on vegetation or in concealed crevices adjacent to water (Harris et al. 1991). Adults feed primarily on liquids such as nectar, with most living only a month or two.

D. Plants of Conservation Concern

The plants of critical conservation concern within the MCR watershed were selected as a conservation target because of the importance of these flora in the watershed and the importance of the watershed to several of these floral species. This target included those plants that are federal or state protected species or are considered globally imperiled (ranked G1 or G2). The federally protected species included in this target were Georgia aster (*Aster georgianus*), Alabama leather-flower (*Clematis socialis*), Mohr's Barbara's button (*Marshallia mohrii*), white fringeless orchid (*Platanthera integrilabia*), green pitcher plant (*Sarracenia oreophila*), and Tennessee yellow-eyed grass (*Xyris tennesseensis*). The plants considered globally imperiled without federal protection included in this target were Harper's dodder, shoals spider-lily (*Hymenocallis coronaria*), Fraser's loosestrife (*Lysimachia fraseri*), running post oak (*Quercus boyntonii*), rose gentian (*Sabatia capitata*), Alabama skullcap (*Scutellaria alabamensis*), and limerock arrowwood (*Viburnum bracteatum*). Plant rarity in the CSRV ecoregion is most often associated with specific niche habitat types such as seeps, cobble bars, sandstone outcrops, river prairies, and glades that often are very restricted environments (The Nature Conservancy 2003). Plants face perhaps the widest assortment of threats throughout the ecoregion, with direct habitat destruction from conversion to other land uses believed to be the most pervasive threat (The Nature Conservancy 2003).

Georgia Aster

Georgia aster is a perennial herb, 45-80 cm (17.7-31.5 in) tall, that blooms in the fall with dark purple ray flowers surrounding the light (turning darker with age) reddish disk (Small 1933).

The flower heads are large, up to 6 cm (2.4 in) across. The species is found in dry open woods, roadsides, and other openings. It is possibly a relict species of the fire-maintained post oak-savanna communities that existed in the region prior to fire suppression (Jones 1992).

Georgia aster was designated as a candidate species by the USFWS (United States Fish and Wildlife Service 1999), and is considered to be imperiled/rare (rank G2G3/S2S3) by the NHN and TNC. Georgia aster is a species of the southeastern U.S., found in the inner Coastal Plain and Piedmont of North Carolina, South Carolina, Georgia, and Alabama (Small 1933, Jones 1992), with approximately 20 populations known extant. Most of these populations are small, consisting of colonial stands of 10-100 stems (Jones 1992). These plants are primarily reproducing asexually by means of rhizomes, so each population probably represents just a few genotypes. ALNHP had 9 occurrences documented in MCR watershed, with occurrences in the Lower Big Wills Creek (070), Upper Big Canoe Creek (100), Beaver Creek (140), Dye Creek (200), and Clear Creek (280) subwatersheds in Etowah, St. Clair (7 occurrences), and Talladega counties. Many populations are threatened by development and woody succession due to fire suppression.

Alabama Leather-flower

Alabama leather-flower was first collected in 1980 in St. Clair County and was first described by Kral (1982). It is an herbaceous perennial that produces erect stems 20-30 cm (7-12 in) tall, and grows in dense clones by horizontally branching rhizomes approximately 2-3 mm (0.08-0.1 in) thick. The leaves are erect or ascending and pinnately compound with 3-5 leaflets 4-12 cm (1.6-4.7 in) long. The plant blooms from late April to May with solitary, bell-shaped, blue-violet flowers at the tips of slender bractless peduncles with 4 oblong sepals 2.0-2.5 cm (0.8-1.0 in) long. The species' distinctive features are its rhizomatous nature and formation of dense clones (Kral 1982).

The Alabama leather-flower was listed by the USFWS as a federal endangered species 26 September 1986 (United States Fish and Wildlife Service 1986), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Listing was based on the limited number of populations (2) and colony sizes, the vulnerability of the populations and plants, and the lack of knowledge on the species biology and ecology (United States Fish and Wildlife Service 1986). Since its listing, additional populations have been discovered, but the species has not been observed at the site of initial discovery (Emanuel 1998). The species is a regional endemic restricted to 6 sites in Alabama (majority in the MCR watershed) and 1 site in Georgia. ALNHP had 4 occurrences documented in the MCR watershed, with occurrences documented in

the Lower Big Wills Creek (070) and Upper Big Canoe Creek (100) subwatersheds in Etowah and St. Clair counties.

The major threat to Alabama leather-flower is the loss or adverse modification of its habitat (United States Fish and Wildlife Service 1989). Other threats include the closure of the hardwood canopy and competition from other plants, the use of herbicides, mowing, mechanical scraping, road maintenance, development, land use changes, and practices that directly impact the rhizome system. All Alabama leatherflower sites are in private ownership, one of which is primarily owned by TNC. Populations mostly occur in areas subject to right-of-way maintenance activities under the jurisdiction of the Alabama State Highway Department (roadsides) or Alabama Power Company (powerlines). Highway crews are working with the USFWS to find maintenance techniques that are compatible with the species. This species is vulnerable because of its limited number of populations and the small area which each population occupies (United States Fish and Wildlife Service 1989).

Mohr's Barbara's Button

Photo – from Johnson and Wehrle 2004

Mohr's Barbara's button is an erect herbaceous perennial, 30-70 cm (12-28 in) tall (Small 1933). Flowering occurs from mid-May to June with the plant usually producing 2-6 rayless flower heads, each about 2.5 cm (1 in) wide, in a branched arrangement with pink or white disk flowers (United States Fish and Wildlife Service 1991c). The species is found in open, moist, grass-sedge dominated openings in woodlands and along shale-bedded streams. The soils are predominantly sandy clays which tend to be high in pH and organic matter and seasonally wet, with many populations occurring in full sun or partial shade on soils of the Conasauga-Firestone Association (United States Fish and Wildlife Service 1991c). This species appears to maintain itself only in areas which are naturally or artificially cleared, and was probably maintained naturally through occasional fire or local soil conditions that promoted a grass-sedge community (Kral 1983).

Mohr's Barbara's button was listed by the USFWS as a federal threatened species 7 September 1988 (United States Fish and Wildlife Service 1988a), and is considered to be rare (rank G3/S3) by the NHN and TNC. It was considered to be an endangered species in Alabama in the unofficial listings of both Thomas (1976) and Freeman et al. (1979). This species is a regional endemic found in the Appalachian plateau of northwestern Georgia (Lookout Mountain) and north Alabama, and is known from approximately 22 very localized sites (United States Fish and Wildlife Service 1991c). Mohr's Barbara's button is rare over most of its limited range, and is declining due to habitat loss. ALNHP had 1 occurrence documented in the MCR watershed on

the Fort McClellan Military Reservation in the Cane Creek (190) subwatershed in Calhoun County.

This species is vulnerable to future declines because it has a limited distribution and a small number of individuals at many of the sites at which it occurs (United States Fish and Wildlife Service 1991c). Many of the populations occur on or near roadside rights-of-way where they are vulnerable to a wide variety of activities such as road widening, herbicide application, mowing, and planting of aggressive competitors. Other threats include competition from shrubs and trees, conversion of habitat to non-compatible uses (pasture, cropland, or pulpwood plantations), grazing, and the gradual encroachment of woody species into the open habitat in the absence of fire (United States Fish and Wildlife Service 1991c).

White Fringeless Orchid

© Thomas G. Barnes

The white fringeless orchid is a slender, erect, white-flowered perennial up to 60 cm (24 in) tall. The plant grows in colonies, from fleshy roots, usually with many sterile stems or leaves. The inflorescence is a loose terminal spike with up to 20 white, long-spurred, very-fragrant flowers. The spike is round to short-oblong, 4-10 cm (1.6-3.9 in) long and approximately 5 cm (2 in) wide. This orchid blooms in late summer, usually July through September, with fruits maturing in October (Shea 1992). Most surviving populations are not vigorous and exhibit poor seed set and reproduction.

This species is generally found in wet, flat, boggy areas at the head of streams or on seepage slopes (Shea 1992). Its optimum habitat is boggy, deciduous-forested streambanks or ravines with a sphagnum mat. Populations are found on deep, poorly drained soils that are permanently moist, but are not often flooded (Shea 1992). Most populations are found in forests dominated by red maple and black tupelo with a partially open canopy and populations usually growing in partial shade.

The white fringeless orchid was designated as a candidate species by the USFWS (United States Fish and Wildlife Service 1999), and is considered to be imperiled/rare (rank G2G3/S2S3) by the NHN and TNC. Historically this species was widely distributed in the southeastern U.S., with populations in Mississippi, Alabama, Georgia, Tennessee, Kentucky, South Carolina, North Carolina, and Virginia (Zettler and Fairey 1990). It has become increasingly rare and is rare or endangered in every state of its range (Shea 1992). The white fringeless orchid is currently known from irregular scattered occurrences in Alabama, Georgia, Tennessee, Kentucky, and South Carolina, with populations primarily on the Cumberland Plateau of Tennessee and Kentucky. It is apparently extirpated from Mississippi, North Carolina, and Virginia. ALNHP had 2 occurrences documented in the MCR watershed on the Fort McClellan Military

Reservation, one each in the Tallaseehatchee Creek (170) and Cane Creek (190) subwatersheds in Calhoun County.

Management may be required to inhibit woody succession at sites where the species is found. Threats to this species include collecting for the nursery trade, hydrological alteration, invasive species, and habitat modification and land use change associated with timber production, strip-mining, and agricultural activities. The greatest stewardship needs identified by the NHN were careful attention to watershed protection and maintaining the hydrology near populations and isolation of sites to discourage wildflower collectors. The species is very vulnerable to local extirpations because the species is not readily able to reestablish itself following catastrophic loss due to it not being an aggressive colonizer of its habitat (Zettler and Fairey 1990). Zettler and Fairey (1990) suggested that developing methods for rapid propagation either through tissue culture or seed would assure the survival of the species.

Green Pitcher Plant

The green pitcher plant is a perennial, carnivorous herb that produces yellow-green, vase-shaped leaves 20-75 cm (8-30 in) tall, arising from moderately branched rhizomes, in early April. These pitcher-like leaves wither by late summer and are replaced by flat, prostrate leaves that persist until the following spring. The yellow flowers occur singly on a scape and bloom from mid-April to mid-May. Abundant sunlight is necessary for flowering; thin, etiolated pitchers are produced and no flowering occurs in low light conditions. The apparent optimum habitat of this species is an open, grassy seep-slope bog (Schnell 1980). The habitats of the extant populations vary somewhat, with populations found in seepage bogs and along wet, sandy streambanks (United States Fish and Wildlife Service 1994a). Fire is the primary ecological force that maintains the seepage bog habitat; green pitcher plants are fire dependent species, requiring fire for fuel reduction (old pitcher build-up and grass-sedge litter), germination sites, and competition control (Emanuel 2002).

The green pitcher plant was listed by the USFWS as a federal endangered species 21 September 1979 (United States Fish and Wildlife Service 1979), and is considered to be imperiled (rank G2/S2) by the NHN and TNC. It was considered to be an endangered species in Alabama in the unofficial listings of both Thomas (1976) and Freeman et al. (1979). Historically this species was found throughout the Coastal Plain and Piedmont of Alabama, Georgia, southwestern North Carolina, and Tennessee (United States Fish and Wildlife Service 1994a). The plant was once very common throughout its range, but is now restricted to 35 sites in northeastern Alabama, north Georgia, and southwestern North Carolina due to habitat loss from land conversion to

residential, agricultural, silvicultural, or industrial uses (Emanuel 2002). Thirty-three of the extant sites are in Alabama. ALNHP had 1 occurrence documented in the MCR watershed in the Ballplay Creek (010) subwatershed in Etowah County.

Several threats face this species throughout its range. The greatest threats to this species are development pressures, the disruption of natural ecosystem processes such as hydrological alteration and fire suppression, and over-collection by plant enthusiasts, botanists and commercial dealers (Troup and McDaniel 1980). Other threats include insect infestation hindering seed production and water quality degradation. Since its designation as an endangered species and subsequent recovery plan preparation, there has been an active recovery program for the green pitcher plant. Populations in Alabama have been monitored since 1986, and restoration efforts for many of the populations are ongoing and should be continued.

Tennessee Yellow-Eyed Grass

Photo – from Johnson and Wehrle 2004

Tennessee yellow-eyed grass is a perennial herb occurring solitary or in small dense tufts, with branched stems 30-cm (12-28 in) tall (Kral 1978). Leaves and flowering stems arise from a soft, fleshy bulbous base with shallow roots. Leaves are basal, mostly erect, 10-45 cm (4-18 in) long, with blades overlapping one another along their bases with a pink, red, or purplish coloration (United States Fish and Wildlife Service 1992c). The inflorescence consists of brown, cone-like spikes, which occur singly at the tips of the flowering stalks and contain small, pale yellow flowers. Flowering occurs from August through September, with flowers opening in late morning and closing by mid-afternoon (only 1 or 2 flowers are evident at any 1 time). The fruit is an obovoid or broadly elliptical capsule. This species occurs in seep-slopes, springy meadows or on the banks of gravelly shallows of small streams. As with all *Xyris*, the habitat is open or thinly wooded and the soils are moist to wet year-round (United States Fish and Wildlife Service 1992c). Although *Xyris* species are usually found on acidic soils, this species is restricted to circumneutral soils that thinly cover calcareous substrates, usually with seepage or flowing mineral-rich water.

Tennessee yellow-eyed grass was listed by the USFWS as a federal endangered species 26 July 1991 (United States Fish and Wildlife Service 1991d), and is considered to be imperiled globally (rank G2) and critically imperiled in Alabama (rank S1) by the NHN and TNC. The species was first described by Kral (1978) from a study on Xyridaceae, based on an examination of a 1945 specimen (identified as *Xyris caroliniana*) from Lewis County, Tennessee, and more recent collections from that county and northwest Georgia. This species is a regional endemic with fewer than 20 known extant populations in highly localized areas of Alabama, Georgia, and Tennessee. Each site occupies <0.5 ha (1.2 ac), and most sites support populations of only a few

hundred plants (United States Fish and Wildlife Service 1994b). Three historical populations have been lost and at least 4 of the remaining populations are declining due to highway construction/right-of-way maintenance and other habitat disturbances. Most of the remaining populations are on private land, necessitating private landowner involvement if the species is to be preserved. ALNHP had 3 occurrences documented in the MCR watershed in the Cane Creek (190) subwatershed in Calhoun County, 2 of which were on the Fort McClellan Military Reservation.

Suitable habitat for long-term survival of this species appears to be very limited, and active management appears to be necessary to maintain appropriate habitat for this species (United States Fish and Wildlife Service 1994b). Its habitat has been lost or degraded due to conversion to agriculture, silvicultural practices, gravel quarrying, highway construction, roadside right-of-way maintenance activities, and successional changes. While succession is a slow and natural process, it poses a threat to this species due to the small number of populations and limited amount of suitable habitat remaining (U.S. Fish and Wildlife Service 1991d). The isolated, disjunct distribution of populations makes the species very vulnerable to local extirpations. This species also is vulnerable to diversion of seep or ground water.

Human Context Information

Managed Areas

There were 12 managed areas identified within the MCR watershed: Talladega National Forest, Cheaha State Park, Choccolocco Wildlife Management Area, St. Clair Community Hunting Area, Fort McClellan Military Reservation, Mountain Longleaf National Wildlife Refuge, Anniston Ordinance Depot Military Reservation, Coosa River Depot Annex, Dry Creek Preserve, Brasher Woods Preserve, Gulf Creek Canyon Preserve, and Noccalula Falls Park and Campground (Fig. 10). Slightly more than half (51.2%) of rare occurrences documented in the MCR watershed were on managed areas. However, the majority (63.3%) of federal threatened or endangered species occurrences were not in these managed areas. Therefore, maintaining habitat for rare, threatened, and endangered species will require not only appropriate management of public lands, but also outreach to private landowners and potential public-private partnerships for private land management.

I. Talladega National Forest

The Talladega Division of the Talladega National Forest (TDTNF) is a 92,511-ha (228,600-ac) division administered by 2 ranger districts, Shoal Creek Ranger District (SCRD) and Talladega Ranger District (TDR), located in east-central Alabama in Calhoun, Cherokee, Clay, Cleburne, and Talladega counties (Fig. 10) (a map of the Talladega and Shoal Creek Ranger Districts is available online at

<http://www.r8web.com/alabama/talladega/tal-directions.htm>). TDTNF encompasses land within the Cheaha Creek (260), Middle Choccolocco Creek (6250), Talladega Creek (330), and Upper Choccolocco Creek (240) subwatersheds in the MCR watershed, but <50% of the acreage covered by the TDTNF occurs within the MCR watershed. The Talladega National Forest was created out of the Talladega and Oakmulgee Purchase Units 17 July 1936 by proclamation from President Franklin D. Roosevelt. The Talladega Unit was divided into the 2 districts 1 October 1945. The Talladega Division is managed for multiple resource values including wildlife, water, recreation, and wood products. It surrounds the southernmost extension of the Appalachian mountain chain that includes Cheaha Mountain, Alabama's highest point at 734 meters (2,407 ft).

There were 65 occurrences of 38 species documented in TDTNF (Table 5), including 4 occurrences of the federal endangered red-cockaded woodpecker, 2 occurrences of the federal endangered southern pigtoe, 2 occurrences of the federal threatened blue shiner, and 2 occurrences of the federal threatened fine-lined pocketbook. During the last several years, the Talladega Ranger District has experienced southern pine beetle (*Dendroctonus frontalis*) infestations of epidemic proportion. The Forest Service has begun to develop a five-year program of work to address declining forest health and improving red-cockaded woodpecker (RCW) habitat.

TDTNF contains 2 special designated areas in the MCR watershed that are designated as National Wilderness Areas: Cheaha Wilderness Area and Dugger Mountain Wilderness Area. TDTNF also contains 4 National Forest Inventoried Roadless Areas : Blue Mountain, Cheaha A, Cheaha B, and Oakey Mountain. All 4 areas are category 1B where road construction and reconstruction are prohibited. However, only Cheaha A and Blue Mountain Roadless Area are within the MCR watershed. In addition to these designated areas, Marshall and Wills (2003) identified 10 additional wild areas within the TDTNF in the MCR watershed they recommended be protected from further road construction, industrial timber harvests, and other intensive management activities by designating the area as a scenic area, viewshed area, scenic river, wilderness, or cultural heritage area.

A. Cheaha Wilderness

Cheaha Wilderness (CW) encompasses approximately 2,995 ha (7,400 ac) within both the Shoal Creek and Talladega Ranger Districts in Clay County (Fig. 10), and encompasses a portion of the southernmost extension of the Appalachian Mountains. CW encompasses land within the Cheaha Creek (260) and Talladega Creek (330) subwatersheds, but approximately half of CW is outside the MCR watershed boundaries. The CW was established on 3 January 1983 by Public Law 97-411, and is named for the nearby Cheaha Mountain. Elevations within CW range from 335 m (1,100 ft), along the bottom of the eastern slopes to 714 m (2,342 ft) at Odum Point, with over 405 ha (1,000 ac) above 610 m (2,000 ft) (United States Forest Service 1985).

Vegetation type is diverse and corresponds to the local soil types and moisture conditions (United States Forest Service 1985). Chestnut oak (*Quercus pinus*) and Virginia pine (*Pinus virginiana*), with scattered longleaf pine, are found on the main ridge line and side slopes of the higher elevations. Longleaf and loblolly pines grow on the lower elevation ridges, while the

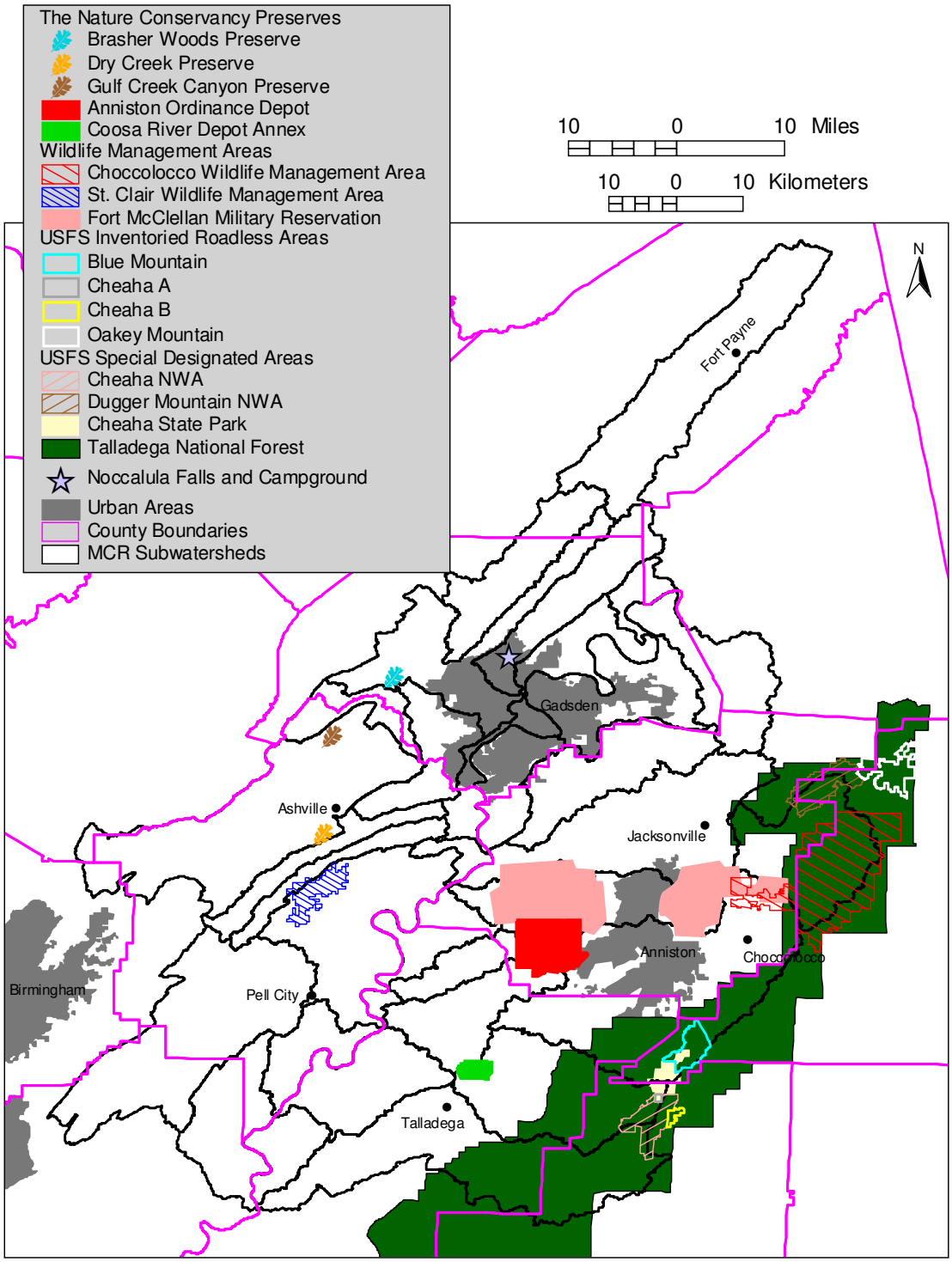

Figure 10. Managed areas within the Middle Coosa River watershed; Blount, Calhoun, Cherokee, Clay, Cleburne, De Kalb, Etowah, Jefferson, Shelby, St. Clair, and Talladega counties. The Nature Conservancy preserves and Noccalula Falls are approximate locations and do not represent precise boundaries. The Talladega National Forest boundary is the proclamation boundary and does not reflect federal ownership because there are private inholdings within the proclamation boundary. The recently formed Mountain Longleaf Pine National Wildlife Refuge is not depicted because boundaries were not available.

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Table 5. Rare, threatened, and endangered species documented by the Alabama Natural Heritage Program[SM] occurring in the Talladega Division of the Talladega National Forest, Alabama within the Middle Coosa River watershed.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]
Amphibians	*Ambystoma tigrinum*	tiger salamander	G5	S3	PS [c]		1 [d]
Amphibians	*Desmognathus aeneus*	seepage salamander	G3G4	S2			7 [ef]
Amphibians	*Plethodon websteri*	Webster's salamander	G3	S3			2 [g]
Amphibians	*Rana sylvatica*	wood frog	G5	S2			4 [fh]
Birds	*Picoides borealis*	red-cockaded woodpecker	G3	S2	LE	SP	4 [i]
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	2
Insects	*Agapetus iridis*	caddisfly	GNR	S1			1 [g]
Insects	*Agapetus pinatus*	caddisfly	GNR	S1			1
Insects	*Cheumatopsyche helma*	Helma's cheumatopsyche caddisfly	G1G3	S1			1
Insects	*Chimarra augusta*	caddisfly	GNR	S1			3 [j]
Insects	*Dolophilodes major*	caddisfly	GNR	S1			1 [g]
Insects	*Hydroptila cheaha*	caddisfly	G1	S1			1
Insects	*Hydroptila talladega*	caddisfly	GNR	S1			1 [g]
Insects	*Lepidostoma griseum*	caddisfly	GNR	S1			1 [g]
Insects	*Oxyethira michiganensis*	caddisfly	GNR	S1			1 [g]
Insects	*Pycnopsyche gentilis*	caddisfly	GNR	S1			1 [g]
Insects	*Rhyacophila teddyi*	caddisfly	GNR	S1			2 [i]
Insects	*Triaenodes taenia*	Cold Spring triaenodes caddisfly	GNR	S1			1 [g]
Mussels	*Lampsilis altilis*	fine-lined pocketbook	G2	S2	LT	SP	2 [i]
Mussels	*Pleurobema georgianum*	southern pigtoe	G1	S1	LE	SP	2 [i]
Mussels	*Strophitus subvexus*	southern creekmussel	G3	S2			2 [i]
Snails	*Elimia bullula*	snail	G1	S1S2			1 [g]
Snails	*Elimia gerhardti*	coldwater elimia	G5	S3S4			5 [j]
Vascular Plants	*Asplenium bradleyi*	Bradley's spleenwort	G4	S2			1
Vascular Plants	*Asplenium trichomanes*	maidenhair spleenwort	G5	S2S3			1
Vascular Plants	*Gentiana saponaria*	soapwort gentian	G5	S3			3 [fj]
Vascular Plants	*Gentiana villosa*	striped gentian	G4	S3			1
Vascular Plants	*Heuchera longiflora*	long-flower alumroot	G4	S1			1

Table 5. (Continued)

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]
Vascular Plants	*Isotria verticillata*	large whorled pogonia	G5	S2			1 [g]
Vascular Plants	*Jamesianthus alabamensis*	jamesianthus	G3	S3			3 [j]
Vascular Plants	*Lonicera flava*	yellow honeysuckle	G5?	S3			1 [f]
Vascular Plants	*Parnassia asarifolia*	kidneyleaf grass-of-parnassus	G4	S2			2 [gk]
Vascular Plants	*Phacelia dubia* var *dubia*	phacelia	G5T5	S1S2			1
Vascular Plants	*Platanthera lacera*	green-fringed orchid	G5	S2			1 [g]
Vascular Plants	*Pyrularia pubera*	buffalo-nut	G5	S2			1
Vascular Plants	*Sedum nevii*	Nevius' stonecrop	G5	S2			1
Vascular Plants	*Xerophyllum asphodeloides*	turkeybeard	G4	S1			1 [g]

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.
[c] *Ambystoma tigrinum stebbensi*, LE - Arizona, Mexico
[d] – 1 occurrence in the Blue Mountain Roadless Area
[e] – 3 occurrences in the Choccolocco Wildlife Management Area
[f] – 1 occurrence in Cheaha State Park
[g] – 1 occurrence in the Choccolocco Wildlife Management Area
[h] – 2 occurrences in the Blue Mountain Roadless Area
[i] – all occurrences in the Choccolocco Wildlife Management Area
[j] – 2 occurrences in the Choccolocco Wildlife Management Area
[k] – 1 occurrence in Cheaha Wilderness Area

drainages and northern settings are homes for oaks and hickories. The rock bluffs, outcrops and cliff lines have Virginia pines, many of which are dwarfed. Mountain laurel (*Kalmia latifolia*) is the predominant understory component in the drainages and north slopes. The remaining areas have very little understory, except for scattered patches of huckleberry on the southern exposures and scrubby hardwoods along drainages in high elevations (United States Forest Service 1985). The only species ALNHP has documented within CW is 1 occurrence of kidneyleaf grass-of-parnassus (*Parnassia asarifolia* – rank G4S2). However, the United States Forest Service (1985) identified many more rare species which might occur in CW, including several federally listed species. A survey of the area is needed to determine which species are present.

B. Dugger Mountain Wilderness Area

Dugger Mountain Wilderness (DMW) encompasses approximately 3,723 ha (9,200 ac) on the SCRD in Cleburne and Calhoun counties (Fig. 10). DMW is on the eastern edge of the MCR watershed in the Upper Choccolocco Creek (240) subwatershed, with approximately half of its area outside the MCR watershed. Dugger Mountain was managed as a wilderness study area beginning in 1986, and was designated by Congress as a wilderness area November 1999. Dugger Mountain is the second highest peak in Alabama with an elevation of 652 m (2,140 ft).

ALNHP had no rare species documented in DMW. However, the Alabama Environmental Council has reported the federal threatened blue shiner (*Cyprinella caerulea*) occurs there. A survey of this area is needed to verify if rare species are present.

C. Cheaha A Roadless Area

Cheaha A Roadless Area (CARA) is a 96 ha (236 ac) block within the Talladega Ranger District located in Clay County (Cheaha Creek subwatershed – 260) adjacent to Cheaha Wilderness Area (Fig. 10). This was formerly State Park land acquired by the US Forest Service (USFS) and was proposed as the CARA in the 18 July 1997 revision of the roadless area inventory. CARA includes McDill Point, a popular viewpoint that overlooks much of the Talladega National Forest and the surrounding rural communities. Terrain of the Cheaha A Roadless Area may be described as moderately steep to very steep terrain with rocky side slopes predominant in some areas (United States Forest Service 2003). These side slopes culminate on the ridge that contains McDill Point. CARA is an undeveloped and natural appearing landscape that is primarily upland areas.

ALNHP had no rare species documented in Cheaha A. However the USFS (2003) reported that the rare communities and habitat associations of CARA included mountain longleaf, mixed shortleaf/longleaf, open pine hardwood, riparian zones, loblolly flats, cliff faces, mesic hardwood, xeric oak/pine ridgetops, and talus slopes; with possible rare communities and habitat associations including springs, seeps, glades, rocky barrens chert/limestone formations, and mesic basic forests. A survey of this area is needed to verify the absence of rare species because rare species are associated with many of these community types.

D. Blue Mountain Roadless Area

Blue Mountain Roadless Area (BMRA) consists of approximately 2,018 ha (4,986 ac) on the Shoal Creek and Talladega Ranger District, with the majority of the area on the SCRD. It is

located in Cleburne County along the southeastern edge of the MCR watershed in the Middle Choccolocco Creek (250) subwatershed (Fig. 10). The area is mountainous with a highly dissected and broken terrain. Slopes are moderately steep over most of the area, but in places terrain may become very steep. Narrow finger ridges and steep drainages characterize the area, with the narrow Blue Mountain ridge being the predominant topographic feature of the area (United States Forest Service 2003). The BMRA is primarily a natural-appearing landscape over most of the area with one major exception: the Oxford-Cheaha Road, which dissects the Roadless Area and in terms of appearance should be considered a developed road (United States Forest Service 2003). The BMRA includes approximately 3 miles of 3rd order Hillabee Creek, which flows into Hillabee Lake, and is a water source for a municipal watershed lake (United States Forest Service 2003).

The only rare species documented in BMRA within ALNHP's database were 1 occurrence of tiger salamander (*Ambystoma tigrinum* – rank G5S3) and 2 occurrences of wood frog (*Rana sylvatica* – rank G5S2). However the USFS (2003) suggested the following species might be present because they inhabit the Middle Choccolocco watershed: the threatened blue shiner, threatened fine-lined pocketbook, threatened Coosa moccasinshell, endangered southern clubshell, endangered triangular kidneyshell, endangered Tulotoma snail, threatened lacy elimia, MCR watershed endemic Cheaha beloneurian stonefly (*Beloneuria jamesae*), watershed endemic ample elimia (*Elimia ampla*), Coosa River endemic walnut elimia, and regional endemic acute elimia (*Elimia acuta*). Regional Forester sensitive species they suggested might be present included: coldwater darter, coal darter (*Percina brevicauda*), bronze darter (*Percina palmaris*), a caddisfly (*Hydroptila choccolocco*), a caddisfly (*Hydroptila particiae*), Appalachian snaketail (*Ophiogomphus incurvatus*), and jamesianthus. Surveys of this area are needed to determine if these species are present. Rare communities and habitat associations of the BMRA include mountain longleaf, mixed shortleaf/longleaf, open pine hardwood, riparian zones, loblolly flats, cliff faces, mesic hardwood, xeric oak/pine ridgetops, and talus slopes (United States Forest Service 2003). Possible rare communities and habitat associations for the Blue Mountain Roadless Area include springs, seeps, glades, rocky barrens chert/limestone formations, and mesic basic forests (United States Forest Service 2003).

II. Choccolocco Wildlife Management Area

Choccolocco Wildlife Management Area (CWMA) is a 18,838 ha (46,550 ac) wildlife management area managed by the Alabama Department of Conservation and Natural Resources (ADCNR) located in Calhoun and Cleburne counties, Alabama (Fig. 10) (a map of the management area is available online at <http://www.dcnr.state.al.us/agfd/chocco_wma.jpg>). CWMA is located on the eastern edge of the MCR watershed in 2 subwatersheds: Upper Choccolocco Creek (03150106240) and Middle Choccolocco Creek (03150106250). The majority of the watershed is in the Upper Choccolocco Creek subwatershed, and a small percentage of the management area is outside the MCR watershed boundary. CWMA is located

within the Shoal Creek Ranger District of the Talladega National Forest. This area also includes a part of Fort McClellan Military Reservation and Choccolocco State Forest (owned by the State of Alabama).

Of the 65 occurrences of rare species documented in TDTNF, 36 occurrences of 23 species were documented in CWMA (Table 6), including 4 occurrences of the federal endangered red-cockaded woodpecker, 2 occurrences of the federal endangered southern pigtoe and 2 occurrences of the federal threatened fine-lined pocketbook. All rare species occurrences were in the Upper Choccolocco Creek subwatershed.

III. St. Clair Community Hunting Area

St. Clair Community Hunting Area (SCCHA) is a 2,589 ha (6,397 ac) wildlife management area located in St. Clair County (Fig. 10) that is privately owned but managed by ADCNR (a map of the management area is available online at <http://www.dcnr.state.al.us/agfd/stclair_wma.jpg>). The majority of SCCHA is in the Dye Creek subwatershed (200), but a very small area is in the Shoal Creek (150) subwatershed. The majority of SCCHA is moderate to steep slopes covered with young secondary oak-hickory or pine forests, with small floodplain valleys along the creeks. The only rare species documented in SCCHA were 1 occurrence each of running post oak and Georgia oak (*Quercus georgiana* – rank G4S2). However, there is a small wet meadow on SCCHA which potentially could support the endangered Mitchell's satyr (*Neonympha mitchellii*) and needs to be surveyed during summer emergence periods to determine if this species is present.

IV. Cheaha State Park

view from Cheaha Mountain

Cheaha State Park (CSP) is a 1,100 ha (2,719 ac) state park located in Clay and Cleburne counties along the eastern edge of the MCR watershed (Fig. 10) between Anniston and Talladega. CSP encompasses land within the Cheaha Creek (260) and Middle Choccolocco Creek (250) subwatersheds, with a small part of the park outside the MCR watershed boundaries. CSP is within the boundaries of TDTNF and connects CW and BMRA. Cheaha was acquired as a state park in 1933, with an official opening date of 7 June 1939. It includes Cheaha Mountain, Alabama's highest point at 734 meters (2,407 feet).

Of the 65 occurrences of rare species documented in TDTNF, 4 occurrences were documented in CSP: one occurrence each of the seepage salamander (*Desmognathus aeneus* – rank G3G4S2),

wood frog, yellow honeysuckle (*Lonicera flava* – rank G5?S3), and soapwort gentian *(Gentiana saponaria* – rank G5S3).

V. Fort McClellan Military Reservation

The Fort McClellan Military Reservation (FMMR) is located in Calhoun County, adjacent to the city of Anniston and approximately 105 km (65 mi) east of Birmingham. FMMR encompasses land within the Cane Creek (190), Middle Choccolocco Creek (250), Tallasseehatchee Creek (170), and Upper Choccolocco Creek (240) subwatersheds (Figure 10). FMMR consisted of 3 parcels in the foothills of the Appalachian Mountains: the Main Post, Choccolocco Corridor, and Pelham Range. Fort McClellan was established in 1917 when the federal government purchased land in Calhoun County for use as an artillery range that became the Main Post parcel. During World War II, land previously known as Morrisville Maneuver Area was acquired and renamed Pelham Range, and the parcel known as Choccolocco Corridor was acquired by a long-term lease. In 1995, the Base Realignment and Closure Commission recommended that Fort McClellan be closed, and on 20 September 1999 Fort McClellan (FM) was closed with the Army having the property in a caretaker status until it was transferred or conveyed. All property has now been transferred.

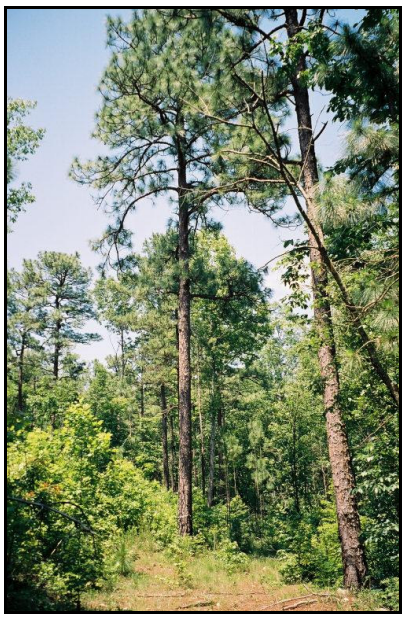
The Main Post (MP) consisted of approximately 7,660 ha (18,929 ac) adjacent to the city of Anniston and extending approximately 10 km (6 mi) to the northeast towards Jacksonville, with approximately 6,070 ha (15,000 ac) characterized as undeveloped mountain habitat. The remainder was nonforested, and included roads and developed areas with buildings, open fields, manmade reservoirs, firebreaks, recreation areas, and other developed land. There are dramatic contrasts in topography and geology in a small area within the Main Post, with elevations ranging from 213 to 793 m (700 to 2,603 ft). MP straddles 2 physiographic provinces: the Ridge and Valley and the Blue Ridge. ALNHP (1994) identified 13 special interest natural areas on MP, including a caddisfly stream, various seeps, mountain longleaf community complex, chestnut oak forest, and several species-specific sites. Upon the base closure in 1999, approximately 117 ha (290 ac) of MP were transferred to the Alabama Army National Guard (ALANG) to form the ALANG Enclave portion of the Fort McClellan Army National Guard Training Center. ALANG has proposed construction of new training facilities and/or enhancement of existing training facilities at this site (Alabama Army Nation Guard 2003). A large proportion of the MP parcel was transferred to the USFWS in 2003 to form the Mountain Longleaf National Wildlife Refuge. The final remaining 2,008 ha (4,962 ac) were transferred from the Army to the Anniston-Calhoun County Development Joint Powers Authority September 2003.

The Choccolocco Corridor consisted of approximately 1,816 ha (4,488 ac) east of the Main Post, leased from the Alabama Forestry Commission, connecting Fort McClellan with the TDTNF. Under the provisions of the base closure, the Choccolocco Corridor lease was not renewed and the land remained with the State of Alabama as part of the Choccolocco Wildlife Management Area. The area is mostly forest with pine or oak-hickory pine forests.

Pelham Range (PR) consisted of approximately 9,003 ha (22,246 ac) located about 13 km (8 mi) due west of the MP, and was used for artillery firing, smoke training operations, and field training exercises. Along with the ALANG Enclave, PR was licensed to the Alabama Army National Guard to form the Fort McClellan Army National Guard Training Center, and serves as a multi-purpose military training area. PR is predominantly undeveloped and forested with the exception of a relatively small cantonment area (approximately 34 ha (85 ac)) in the northeast portion of PR (Alabama Army National Guard 2003). The proposed enhancement for training and operations (Alabama Army National Guard 2003) would involve construction of additional facilities throughout PR. PR is characterized by moderately rolling hills with numerous valleys, and elevations ranging from 152 to 288 m (500 to 945 ft). Cane Creek, which flows east to west through PR, is the main stream flowing through PR and drains the majority of its land area.

There were 55 occurrences of 45 species documented on the former FMMR (Table 6), including the federal threatened blue shiner, federal threatened fine-lined pocketbook, federal threatened Mohr's Barbara's button, federal endangered Tennessee yellow-eyed grass, federal candidate white fringeless orchid, and state protected coldwater darter. The federal endangered red-cockaded woodpecker occurred historically on FMMR, but the last active cluster was recorded in 1968. Appalachian cottontails (*Sylvilagus obscurus*) also likely occurred historically on FMMR. Although ALNHP (1994) reported that it was fairly reasonable to assume that the species occurs on the Main Post, no specimens were collected in limited sampling. An indeterminate specimen with skull characteristics between an Appalachian cottontail and eastern cottontail (*S. floridanus*) was collected in 1992. Further investigation into the presence of the species in this area is encouraged. Gray bats have been documented on FMMR during mid- and late-summer in low numbers (United States Army Corps of Engineers 1997). However, no areas on or adjacent to FMMR have been designated as gray bat critical habitat, and there are no known caves used as maternity or winter roosts on FMMR.

VI. Mountain Longleaf National Wildlife Refuge



The Mountain Longleaf National Wildlife Refuge (MLNWR) was established 1 June 2003 by the U.S. Fish & Wildlife Service, and was dedicated 30 June 2003 in Anniston (United States Fish and Wildlife Service 2003c). The refuge was created through an amendment in the 2003 Defense Authorization Bill to establish the refuge at the Fort McClellan Army reservation. MLNWF consists of 3,649 ha (9,016 ac) on the former military training lands of Fort McClellan Main Post in Calhoun County, north of Anniston, and is currently closed to the public except for prescheduled tours. The Army transferred 3,140 ha (7,759 ac), and the Joint Powers Authority, which is managing the fort's redevelopment, transferred 509 ha (1,257 ac). MLNWR is the first mountain national wildlife refuge in the southeastern United States, and is home to the largest remaining stands of old growth mountain longleaf pine forests.

Table 6. Rare, threatened, and endangered species documented by the Alabama Natural Heritage Program[SM] occurring on Fort McClellan Military Reservation (FMMR), Calhoun County, Alabama.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	1[c]
Fish	*Etheostoma ditrema*	coldwater darter	G1G2	S1		SP	1[d]
Insects	*Agapetus iridis*	caddisfly	GNR	S1			1[c]
Insects	*Cheumatopsyche harwoodi*	caddisfly	GNR	S2			1[e]
Insects	*Heteroplectron americanum*	caddisfly	GNR	S2			1[e]
Insects	*Hydroptila consimilis*	caddisfly	GNR	S2S3			1[e]
Insects	*Hydroptila setigera*	caddisfly	G1	S1			1[e]
Insects	*Hydroptila talladega*	caddisfly	GNR	S1			1[e]
Insects	*Ironoquia punctatissima*	caddisfly	GNR	S2			1[e]
Insects	*Molanna blenda*	caddisfly	GNR	S2			1[e]
Insect	*Ochrotrichia confusa*	caddisfly	GNR	S2			1[e]
Insects	*Polycentropus carlsoni*	Carlson's polycentropus caddisfly	G1G3	S1			2[e]
Insects	*Protoptila maculata*	caddisfly	GNR	S2			1[d]
Insects	*Psilotreta frontalis*	caddisfly	GNR	S2			1[e]
Insects	*Pycnopsyche gentilis*	caddisfly	GNR	S1			1[e]
Insects	*Pycnopsyche lepida*	caddisfly	GNR	S2			1[e]
Insects	*Pycnopsyche luculenta*	caddisfly	GNR	S2			2[e]
Insects	*Rhyacophila glaberrima*	caddisfly	GNR	S2			2[e]
Insects	*Rhyacophila nigrita*	caddisfly	GNR	S2			2[e]
Insects	*Rhyacophila torva*	caddisfly	GNR	S2			2[e]
Insects	*Speyeria diana*	Diana	G3	S2?			1[e]
Insects	*Triaenodes taenia*	Cold Spring triaenodes caddisfly	GNR	S1			1[e]
Mussels	*Lampsilis altilis*	fine-lined pocketbook	G2	S2	LT	SP	1[c]
Mussels	*Villosa nebulosa*	Alabama rainbow	G3	S3			1[d]
Reptiles	*Pituophis melanoleucus melanoleucus*	northern pine snake	G4T4	S3			1[c]
Snails	*Elimia gerhardti*	coldwater elimia	G5	S3S4			3[f]
Vascular Plants	*Aster oolentangiensis var oolentangiensis*	sky blue aster	G5T5	S1			1 e
Vascular Plants	*Cypripedium acaule*	pink lady's-slipper	G5	S3			1 e
Vascular Plants	*Echinacea pallida*	pale-purple coneflower	G4	S2			1 e
Vascular Plants	*Equisetum arvense*	field horsetail	G5	S2			1 d
Vascular Plants	*Gentiana saponaria*	soapwort gentian	G5	S3			2 g

Table 6. Continued.

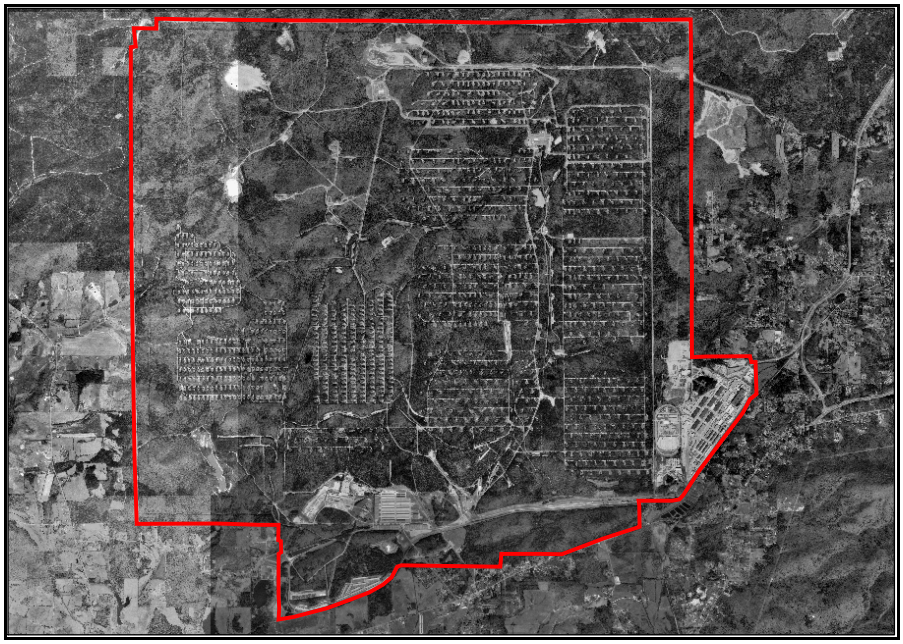
Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]
Vascular Plants	*Juniperus communis*	ground juniper	G5	S1			1 [e]
Vascular Plants	*Lonicera flava*	yellow honeysuckle	G5?	S3			1 [e]
Vascular Plants	*Lysimachia fraseri*	Fraser's loosestrife	G2	S1			1 [e]
Vascular Plants	*Marshallia mohrii*	Mohr's Barbara's buttons	G3	S3	LT		1 [d]
Vascular Plants	*Monotropa hypopithys*	pinesap	G5	S2			1 [d]
Vascular Plants	*Platanthera flava* var *flava*	southern rein orchid	G4T4?Q	S2S3			1 [d]
Vascular Plants	*Platanthera integrilabia*	white fringeless orchid	G2G3	S2	C		2 [e]
Vascular Plants	*Sabatia capitata*	rose gentian	G2	S2			1 [e]
Vascular Plants	*Salix humilis*	tall prairie willow	G5	S2S3			1 [e]
Vascular Plants	*Scutellaria alabamensis*	Alabama skullcap	G2	S2			2 [d]
Vascular Plants	*Trillium lancifolium*	narrow-leaved trillium	G3	S2S3			1 [d]
Vascular Plants	*Xyris tennesseensis*	Tennessee yellow-eyed grass	G2	S1	LE		2 [d]
Vascular Plants	*Zigadenus leimanthoides*	crow-poison	G4Q	S1			1 [e]

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.
[c] Occurs on the Choccolocco Corridor parcel.
[d] Occurs on the Pelham Range parcel.
[e] Likely occurs within the boundaries of the newly designated Mountain Longleaf National Wildlife Refuge.
[f] 2 occurrences on the Pelham Range parcel, 1 on the Choccolocco Corridor parcel.
[g] 1 occurrence on the Pelham Range parcel, 1 occurrence on Main Post (likely within MLNWR boundaries).

It represents a unique inland extension of longleaf pine forest into the mountain provinces of northeast Alabama and northwest Georgia (United States Fish and Wildlife Service 2003c), and contains the only known frequently-burned old-growth longleaf pine stands in the Mountain Province. The primary objective in establishing the refuge was the protection and management of the mountain longleaf forests, which are considered endangered. This type of forested habitat has undergone a rapid loss in the southeastern United States, and MLNWR's remnant population is believed to represent the largest and most pristine example of the disappearing montane longleaf pine forest (United States Fish and Wildlife Service 2000).

Boundaries for the refuge were not available as a GIS file, but it is likely that 35 of the occurrences documented on FMMR were within MLNWR's designated boundaries, including 2 occurrences of the federal candidate white fringeless orchid (Table 6). Red-cockaded woodpeckers historically inhabited the refuge area, and potentially could pioneer from nearby lands or be reestablished in the future with appropriate management (United States Fish and Wildlife Service 2003c).

VII. Anniston Ordinance Depot Military Reservation



Anniston Army Depot boundary

The Anniston Ordinance Depot Military Reservation (AODMR), or Anniston Army Depot, consists of approximately 6,184 ha (15,280 ac) located in Calhoun County west of Anniston and south of FMMR Pelham Range (Fig. 10). AODMR encompasses land within 4 subwatersheds: Blue Eye Creek (220), Cane Creek (190), Lower Choccolocco Creek (270), and Middle Choccolocco Creek (250) AODMR has transformed from its origin in 1942 as a storage depot into a state-of-the-market maintenance facility, and is the only Army depot capable of performing maintenance on both heavy and light-tracked combat vehicles and their components. Additionally, the maintenance and storage of conventional ammunition and missiles as well as the storage of chemical munitions are significant parts of the overall mission and capabilities. The Anniston Chemical Agent Disposal Facility, located within the AODMR, includes a large-scale incinerator for the disposal of military chemical munitions.. The only rare species documented on AODMR was 1 occurrence of the federal endangered Tennessee yellow-eyed grass. Although no bird species tracked by ALNHP were documented on AODMR, the

installation provides habitat for numerous common bird species, including at least 15 Neotropical migrants that are declining in the region (Bailey 1997). Godwin et al. (1994) identified 2 exceptional natural areas on AODMR: The Burning Ground Seep (a grass-sedge seep) and Fish Hatchery Cave. They also suggested several rare terrestrial vertebrate species could potentially occur on the property, but the surveys to detect these species have not been conducted.

VIII. Coosa River Depot Annex

Coosa River Depot Annex boundary

The Coosa River Depot Annex (CRDA) consists of approximately 1,147 ha (2,834 ac) located in Talladega County roughly 19 km (12 mi) southwest of AODMR (Fig. 10). The majority of CRDA is within the Cheaha Creek subwatershed (260), with a small percentage in the Lower Choccolocco Creek (270) subwatershed. CRDA previously was an inactive ammunition storage area for AODMR. CRDA was closed as an ammunition storage annex in 1988, with the material relocated to AODMR. The Alabama National Guard assumed use of the annex in 1990. CRDA is a CERCLIS Hazardous Waste site, but is not on Superfund's National Priority List. There were no rare species documented on the CRDA, but Godwin et al. (1994) identified 1 exceptional natural area on the property: a dry pine-oak-hickory interior upland forest on Gent's Mountain. They also suggested rare terrestrial vertebrate species such as the state protected spiny softshell turtle (*Apalone spinifera*), state protected common snapping turtle (*Chelydra serpentina*), southern hognose snake, Appalachian cottontail, state protected box turtle (*Terrapene carolina*), and meadow jumping mouse (*Zapus hudsonius*) could potentially occur on the property, but the surveys to detect these species have not been conducted.

IX. The Nature Conservancy Preserves

TNC's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. They operate the largest system of private nature sanctuaries in the world with 1,600 preserves worldwide. TNC has 3 preserves within the MCR watershed: Brasher Woods Preserve (BWP), Dry Creek Preserve (DCP), and Gulf Creek Canyon Preserve (GCCP).

A. Brasher Woods Preserve

Croomia pauciflora at Brasher Woods
© The Nature Conservancy

Brasher Woods Preserve (BWP) is a 10 ha (25 ac) private preserve located in Etowah County in the Lower Big Wills Creek (070) subwatershed (Fig. 10). There were 14 occurrences of 13 species documented for BWP, all of which were rare plants, except one, (most ranked S1 or S2). However, none of these species have state or federal protection (Table 7).

B. Dry Creek Preserve

Clematis socialis at Dry Creek Preserve

Dry Creek Preserve (DCP) is a 11 ha (26 ac) private preserve located in a semi-residential area in St. Clair County in the Upper Big Canoe Creek (100) subwatershed (Fig. 10). DCP is a boggy area with a moderate slope and soils characterized by very poor drainage, and contains upland oak/hickory forest and bottomland hardwoods along the banks of Dry Creek. This site was selected by TNC as a preserve because of its importance for the preservation of the federal endangered and regional endemic Alabama leather flower. The site is essential for the preservation of this species because the vast majority of known plants occur in this area, and it is 1 of only 7 sites in which it is known to grow. Other rare species documented on the site are 1 occurrence each of rose gentian and eastern bishop-weed (*Ptilimnium costatum* – rank G3G4S1).

C. Gulf Creek Canyon Preserve

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Gulf Creek Canyon Preserve (GCCP) is a 32 ha (80 ac) private preserve located in St. Clair County on Chandler Mountain, near Horse Pens Forty, in the Upper Big Canoe Creek (03150106100) subwatershed (Fig. 10). The preserve is on the mountain slopes covered with mature hardwoods. Gulf Creek flows through the preserve in the canyon several hundred feet below. There was 1 occurrence each of smooth veiny peavine (*Lathyrus venosus* – rank G5S1) and decumbent trillium (*Trillium decumbens* – rank G4S3S4) documented on GCCP.

Table 7. Rare, threatened, and endangered species documented by the Alabama Natural Heritage Program[SM] occurring in the Brasher Woods Preserve, Etowah County, Alabama. None of the species have state or federal protection.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]
Insects	*Speyeria diana*	Diana	G3	S2?	1
Vascular Plants	*Aplectrum hyemale*	puttyroot	G5	S2	1
Vascular Plants	*Aralia racemosa*	American spikenard	G4G5	S1	1
Vascular Plants	*Asplenium trichomanes*	maidenhair spleenwort	G5	S2S3	1
Vascular Plants	*Celastrus scandens*	climbing bittersweet	G5	S2	1
Vascular Plants	*Croomia pauciflora*	croomia	G3	S2	1
Vascular Plants	*Erythronium umbilicatum*	dimpled fawn-lily	G5	S?	1
Vascular Plants	*Listera australis*	southern twayblade	G4	S2	1
Vascular Plants	*Monarda clinopodia*	basil bee-balm	G5	S2	1
Vascular Plants	*Orobanche uniflora*	one-flower broomrape	G5	S2	2
Vascular Plants	*Trillium decumbens*	decumbent trillium	G4	S3S4	1
Vascular Plants	*Trillium flexipes*	nodding trillium	G5	S2S3	1
Vascular Plants	*Triosteum angustifolium*	yellowleaf tinker's-weed	G5	S1	1

[a] See Appendix B for an explanation of Global and State Ranks
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of March 2003.

X. Noccalula Falls and Campground

Noccalula Falls

Noccalula Falls and Campground (NFC) is a park maintained by the City of Gadsden Parks & Recreation Department. The park contains a 27-m (90-ft) waterfall, along Black Creek, that serves as one of the largest tourist attractions in the area. The park also contains many scenic and historic sites including a historic gorge trail, Native American and civil war carvings, an old aboriginal fort, Chalybeate Springs, caves and unusual rock formations, and a pioneer village. Also in the park are botanical gardens, including over 25,000 azaleas, which surround the entire park.

There were 6 occurrences of rare species and natural communities within 100m of Black Creek below the falls; one occurrence each of Nuttall's rayless goldenrod, Harper's dodder, Piedmont pimpernel, Bradley's spleenwort, dwarf filmy-fern, and a sandstone glade natural community. There were 2 additional occurrences of the sandstone glade natural community containing Nuttall's rayless goldenrod within 1 km of Black Creek below the falls.

Land Cover

Land cover within the watershed was predominately forest (Fig. 11), mixed with pasture and, to a lesser extent, rowcrop and urban (Tables 8 & 9). The land cover percentages estimated from ASWCC data differ from those reported by ADEM (2002b) from the same source. The reason for this discrepancy is unclear. Although the majority of the overall watershed was forested, individual subwatersheds ranged from 40.0 to 85.9 % forested from ASWCC estimates and 51.5 to 91.8 % forested from NLCD calculations (Tables 8 & 9).

Overall, land cover percentages were similar between the ASWCC estimates and estimates obtained from NLCD calculations (Tables 8 & 9). The percentage of the watershed classified as urban was much lower for the NLCD estimate (2.4%) than for the ASWCC estimates (6.3%). This is likely a reflection of errors within the data set, and the fact that the images used to estimate land cover for the NLCD are somewhat dated (early 1990s) and do not depict the increased urbanization that has occurred in the watershed since. The accuracy of the classification is strongly related to the homogeneity of the land use (Zhu et al. 2000). Classification accuracy tends to decrease with increased heterogeneity in the landscape, particularly if the different land use parcels are small. Much of the landscape in the MCR watershed outside the large public land blocks exhibits this heterogeneous nature, which can lead to difficulties with the classification. Although the NLCD data is widely used, it is recognized to

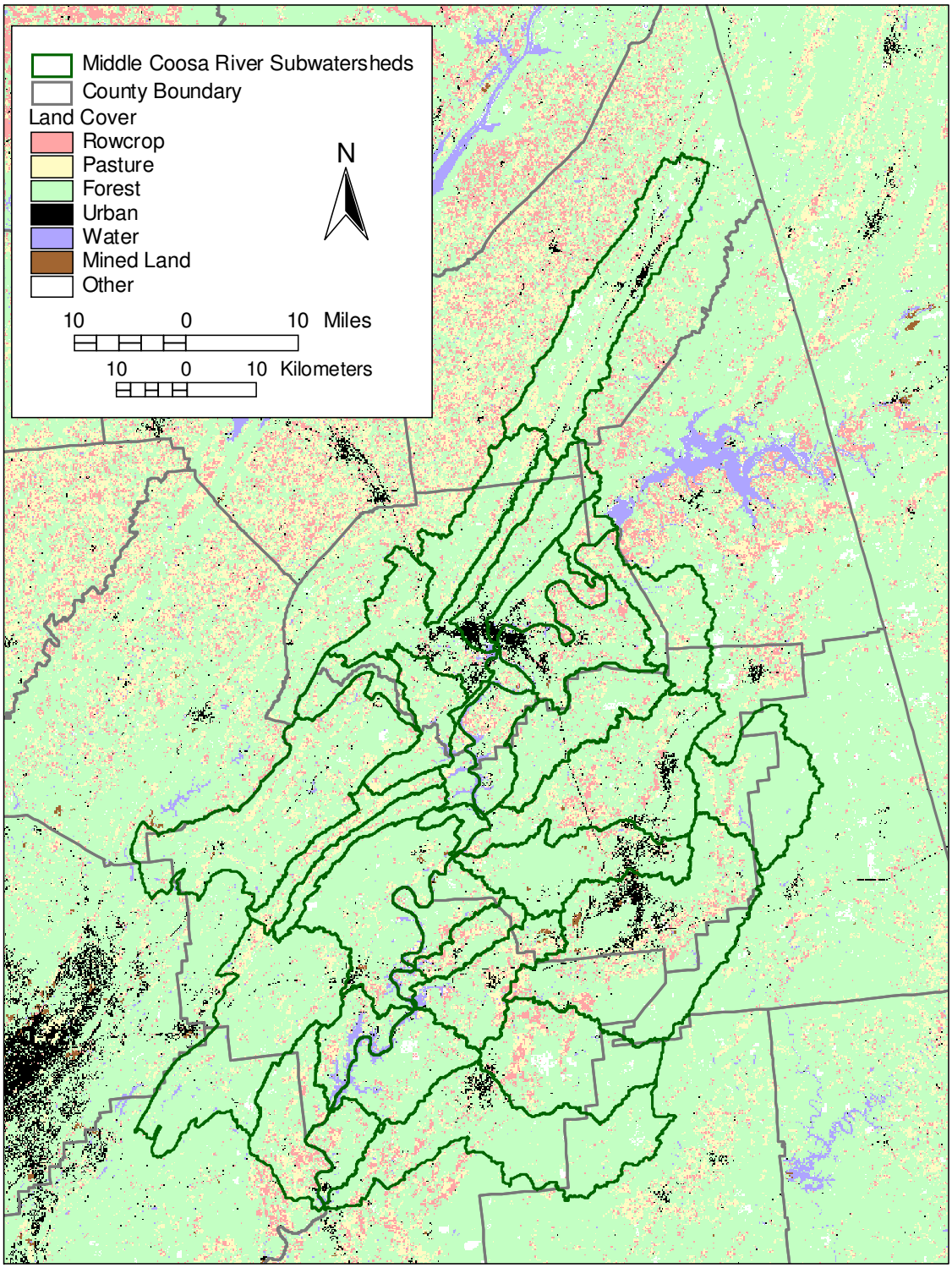

Figure 11. Land cover within the Middle Coosa River watershed as indicated from a reclassification of the USGS National Land Cover Data.

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Table 8. Area (ha) and land use (%) for Middle Coosa River subwatersheds as estimated by the Alabama Soil and Water Conservation Committee (1998) and local soil and water conservation districts. Data was not available for the Coosa River subwatershed (230) in Talladega County. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Subwatershed				Land Use						
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other
Ball Play Creek	010	Calhoun, Cherokee, Etowah	18,820	10.2	7.7	78.7	0.2	0.7	0.8	1.7
Coosa River	020	Etowah	2,683	15.0	24.6	54.0	0.0	1.0	0.4	5.0
Big Cove Creek	030	Etowah	20,637	15.0	20.0	50.0	6.0	1.5	1.0	6.5
Town Creek	040	Etowah	9,970	20.0	13.9	55.0	4.0	1.5	0.6	5.0
Upper Big Wills Creek	050	DeKalb	36,459	5.8	25.0	56.3	11.1	0.3	0.3	1.2
Middle Big Wills Creek	060	DeKalb, Etowah	16,890	8.8	27.9	56.2	0.3	0.6	0.7	5.6
Lower Big Wills Creek	070	Etowah	24,023	7.5	22.6	60.0	3.0	0.4	0.5	6.0
Black Creek	080	Etowah	13,870	10.0	25.0	45.2	15.0	1.0	0.8	3.0
Coosa River-Neely Henry	090	Etowah, St. Clair	7,023	5.9	12.7	68.1	7.0	0.4	1.5	4.4
Upper Big Canoe Creek	100	Jefferson, St. Clair	49,195	2.9	21.0	68.0	1.2	1.0	0.0	5.9
Little Canoe Creek	110	Etowah, St. Clair	8,293	2.8	28.7	63.8	0.0	1.0	0.8	3.6
Lower Big Canoe Creek	120	Etowah, St. Clair	13,165	1.2	16.6	76.0	1.8	1.4	0.2	2.8
Greens Creek	130	Calhoun, Etowah	10,891	16.1	26.3	50.2	4.5	0.6	0.1	2.3
Beaver Creek	140	St. Clair	9,413	4.0	36.4	50.0	2.1	1.3	0.3	5.9
Shoal Creek	150	St. Clair	7,352	1.1	26.6	70.0	0.0	0.6	0.1	1.7
Ohatchee Creek	160	Calhoun	19,534	3.0	28.0	65.0	2.0	1.0	0.5	0.5
Tallasseehatchee Creek	170	Calhoun	39,717	5.0	30.0	40.0	16.9	2.0	1.0	2.0
Bridge Creek	180	St. Clair	2,975	1.4	6.8	79.1	0.0	10.0	1.4	1.4
Cane Creek	190	Calhoun	24,174	1.0	5.0	60.0	25.0	1.0	1.0	7.0
Dye Creek	200	St. Clair	32,245	1.9	10.8	80.0	2.0	0.6	0.7	4.0
Acker Creek	210	Calhoun, Talladega	9,559	1.8	21.9	59.5	3.7	5.1	0.6	6.2
Blue Eye Creek	220	Talladega	6,548	4.0	10.0	72.0	4.0	1.0	1.0	10.0
Upper Choccolocco Creek	240	Calhoun, Cleburne	24,033	1.8	10.2	85.9	0.9	0.8	0.0	0.4
Middle Choccolocco Creek	250	Calhoun, Cleburne, Talladega	60,104	2.7	15.1	71.0	8.3	0.8	0.5	1.2
Cheaha Creek	260	Clay, Talladega	29,050	4.4	8.9	79.3	1.5	0.7	<0.1	5.2
Lower Choccolocco Creek	270	Calhoun, Talladega	17,191	3.3	8.9	58.2	16.7	8.0	0.9	4.0
Clear Creek	280	Talladega	18,319	5.0	10.0	60.0	5.0	10.0	1.0	10.0
Easonville Creek	290	St. Clair	9,847	8.2	25.0	57.2	4.0	0.6	0.0	5.0
Upper Kelly Creek	300	Shelby, St. Clair	45,036	0.7	9.6	85.0	1.3	0.7	0.2	2.5
Lower Kelly Creek	310	Shelby, St. Clair	17,783	15.0	16.2	60.7	6.5	0.6	0.0	0.9
Flipper Creek	320	Talladega	7,798	3.0	20.0	62.0	2.0	10.0	1.0	1.0

Table 8. Continued.

Subwatershed				Land Use						
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other
Talladega Creek	330	Clay, Talladega	45,031	2.8	11.0	61.5	11.2	0.7	0.7	4.4
MCR Watershed			657,630	5.0	17.2	65.1	6.3	1.5	0.5	3.7

Table 9. Area (ha), land use (%), and road density (m/ha) for Middle Coosa River subwatersheds calculated from National Landcover Data (NLCD). The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds. Area estimates and road densities are from calculations in ArcView.

Subwatershed				Land Use							
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other	Road Density
Ball Play Creek	010	Calhoun, Cherokee, Etowah	18,888	5.8	11.4	79.8	0.3	1.2	<0.1	1.4	11.5
Coosa River	020	Etowah	4,196	9.3	12.6	75.7	0.1	2.0	0.0	0.3	14.3
Big Cove Creek	030	Etowah	20,736	10.7	11.0	66.0	8.1	2.7	0.2	0.6	29.1
Town Creek	040	Etowah	10,037	11.4	11.9	64.7	7.6	4.1	0.0	0.3	26.9
Upper Big Wills Creek	050	DeKalb	36,280	5.1	14.4	74.7	2.9	0.3	<0.1	2.7	22.5
Middle Big Wills Creek	060	DeKalb, Etowah	16,970	4.6	14.3	79.5	0.6	0.4	0.0	0.6	16.3
Lower Big Wills Creek	070	Etowah	25,002	5.4	10.6	76.6	5.9	0.8	0.1	0.6	26.2
Black Creek	080	Etowah	16,524	5.9	4.9	79.2	8.2	1.0	0.0	0.8	27.0
Coosa River-Neely Henry	090	Etowah, St. Clair	6,980	6.0	9.5	61.7	1.9	19.2	0.3	1.4	20.0
Upper Big Canoe Creek	100	Jefferson, St. Clair	50,084	4.4	12.8	80.9	0.7	0.5	0.1	0.6	16.9
Little Canoe Creek	110	Etowah, St. Clair	8,223	3.3	10.7	85.2	0.1	0.4	0.0	0.2	14.2
Lower Big Canoe Creek	120	Etowah, St. Clair	13,169	4.2	11.8	79.1	1.4	3.0	0.2	0.3	16.8
Greens Creek	130	Calhoun, Etowah	11,092	8.2	14.7	63.3	2.4	9.8	0.1	1.6	24.7
Beaver Creek	140	St. Clair	9,273	5.8	17.3	76.3	0.3	0.1	0.2	<0.1	17.3
Shoal Creek	150	St. Clair	7,501	3.0	9.8	86.9	0.1	0.1	0.0	0.1	12.9
Ohatchee Creek	160	Calhoun	20,802	3.9	7.5	86.8	0.5	0.2	<0.1	1.1	15.3
Tallasseehatchee Creek	170	Calhoun	39,450	8.1	12.4	75.3	3.1	0.5	0.1	0.4	22.7
Bridge Creek	180	St. Clair	2,981	1.0	2.5	91.8	0.2	4.0	0.0	0.5	13.5
Cane Creek	190	Calhoun	23,937	3.5	5.2	84.5	5.7	0.2	0.5	0.4	29.3
Dye Creek	200	St. Clair	32,371	2.5	6.6	84.6	1.4	3.4	0.5	1.0	18.7
Acker Creek	210	Calhoun, Talladega	9,597	7.8	8.1	76.5	0.3	5.6	0.2	1.9	15.0
Blue Eye Creek	220	Talladega	7,639	12.9	17.6	65.6	1.9	1.4	0.0	0.6	27.0
Coosa River	230	Talladega	1,410	7.1	11.4	51.5	0.2	27.9	0.0	1.9	19.4
Upper Choccolocco Creek	240	Calhoun, Cleburne	24,369	2.4	5.3	91.5	0.1	0.5	0.0	0.3	10.1
Middle Choccolocco Creek	250	Calhoun, Cleburne, Talladega	60,921	6.7	10.1	76.6	5.5	0.3	0.4	0.4	24.8
Cheaha Creek	260	Clay, Talladega	29,450	8.5	8.3	79.1	0.7	0.3	0.0	3.1	16.4
Lower Choccolocco Creek	270	Calhoun, Talladega	17,633	10.4	17.8	65.5	2.4	2.9	0.5	0.5	24.8
Clear Creek	280	Talladega	17,690	4.3	4.6	80.5	0.4	7.5	0.0	2.8	19.0
Easonville Creek	290	St. Clair	9,792	6.5	13.2	57.7	1.3	20.9	0.0	0.5	28.2
Upper Kelly Creek	300	Shelby, St. Clair	45,410	2.5	7.7	87.8	0.6	0.7	0.0	0.8	19.3
Lower Kelly Creek	310	Shelby, St. Clair	17,893	10.5	16.6	69.9	0.6	1.6	0.0	0.9	18.3

Table 9. Continued.

Subwatershed				Land Use (%)							
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other	Road Density
Flipper Creek	320	Talladega	7,867	7.4	7.5	80.0	2.0	2.5	<0.1	0.6	17.6
Talladega Creek	330	Clay, Talladega	45,305	4.7	5.9	86.3	2.0	0.2	<0.1	0.9	17.3
MCR Watershed			669,472	5.8	10.1	78.7	2.4	1.9	0.1	1.0	20.2

have errors within the data, with widely varying accuracy for the various classes. Overall accuracy of the classification for Region 4 was estimated to be 62 to 81% depending on the accuracy assessment technique used (United States Geological Survey 2004). In general, water, urban, and forest are well mapped with the NLCD, whereas forested wetlands, hay/pasture, and crops are more confused (Zhu et al. 2000, Yang et al. 2001).

One important land cover class not included in the ASWCC estimates was wetlands. Although the MCR watershed does not have the large emergent wetlands or extensive bottomland floodplains found elsewhere in the state, wetlands are an important component of the landscape in the watershed. The values and functions of wetlands are well recognized, and wetlands are considered beneficial natural resources which need protection and/or preservation because of their pivotal role in the landscape (Reddy and Gale 1994, World Wildlife Fund 2004). Wetlands provide many ecosystem functions that protect both aquatic and terrestrial systems: sedimentation and filtration of runoff, providing environments for nutrient assimilation and recycling, diverting and dissipating floodwater volume and energy thereby reducing erosion, filtering toxic heavy metals and other pollutants from water, supporting groundwater recharge, providing important fish and wildlife habitat, providing food chain support and human food resources, and providing recreational opportunities (Reddy and Gale 1994, Patrick 1994, World Wildlife Fund 2004). Many of these functions have a significant economic value, and the World Wildlife Fund (2004) conservatively estimated the total economic value of wetlands in North America to be $30/ha. The NLCD contains 2 wetland classifications: emergent wetlands and woody wetlands. Emergent wetlands were grouped within the other class and woody wetlands were grouped in forest in the reclassified NLCD to give the percentages reported in the summary tables. The amount of wetlands in the subwatersheds as classified in the NLCD data ranged from 0 to 10 %, with 9 subwatersheds (050, 060, 100, 110, 160, 170, 240, 250, and 260) containing <1% of the land cover as wetlands. The Cheaha Creek subwatershed (260) was the only one with no pixels classified as wetlands. Many of the wetland types, such as seepage springs and bogs, found in the MCR watershed would be incorrectly classified in the NLCD data because they are too small for the course resolution of the classification. Although these wetland areas cover a small percentage of the landscape, they support many rare species. Maintaining the existing wetlands in the watershed is important to maintaining and improving water quality as well as maintaining the biodiversity of the watershed.

Road densities within the subwatersheds ranged from 10.1 to 29.3 m/ha with an overall road density in the MCR watershed of 20.2 m/ha (Table 9). The subwatersheds with road densities below the median (18.7 m/ha) tended to be in the western half of the watershed. However, road densities within the westernmost subwatersheds are likely to increase if sprawl from Birmingham continues eastward and reaches them. The subwatersheds with the highest road densities tended to be those intersected by the municipalities of Gadsden or Anniston (Fig. 12).

Population & Demographics

There were 441 populated place locations in the MCR watershed as identified from EPA's BASINS dataset (Appendix H). Two urbanized areas and 3 urban clusters identified from the Census 2000 TIGER/Line Data (U.S. Census Bureau 2000a) occurred completely within the boundaries of the MCR watershed (Fig. 13). An urban cluster consisted of densely settled territory that has at least 2,500 people but fewer than 50,000 people, while an urbanized area

consisted of densely settled territory that contains 50,000 or more people (United States Census Bureau 2001). The 2 urbanized areas were Gadsden (population 38,978) and Anniston (population 24,276); 88 populated place locations were within the boundaries of these 2 cities as delineated. The 3 urban clusters were Fort Payne (population 12,938), Pell City (population 9,565), and Talladega (population 15,143); 18 populated place locations were within the delineated boundaries of these urban clusters. Only 17 rare species occurrences were within the area delineated for the urbanized areas or urban clusters; 15 within the Gadsden urbanized area and 2 in Anniston (Appendix H). Except for 1 fish at Glencoe Springs and 1 amphibian in Anniston, all of these rare occurrences were either vascular plants or natural communities. Five Gadsden and both Anniston rare species occurrences were historic occurrences which may no longer be extant at that site. An additional 60 occurrences, including 17 occurrences of federal or state protected species, were within 1 km of these urban areas or populated places within the watershed (Appendix H). Eighteen of these occurrences were historical occurrences and 9 were occurrences lacking a date last observed that need to be revisited to determine if the population is still extant.

One additional urban cluster (Childersburg) and urbanized area (Birmingham – population 242,820) intersect the watershed but have the majority of their area outside the watershed. The Birmingham city limit is <3 km (1.9 mi) from the southwestern edge of the watershed, but development outside the city limits has begun to encroach into the watershed and 2 populated place locations in the watershed are within the delineated boundary for the Birmingham urbanized area. Continued developmental encroachment from Birmingham is a potential threat in the watershed.

Total population within the 2000 Census block groups encompassed by the MCR watershed was 386,143 (Environmental Systems Research Institute 2000). The population within the watershed is smaller because the area covered by the block groups includes area outside the watershed, and has been estimated at approximately 330,000 (Alabama Clean Water Partnership 2003). Every county in the watershed except Calhoun County experienced population growth between 1990 and 2000, with over half experiencing larger growth than the state average of 10.1% (United States Census Bureau 2000b). Shelby County was the fastest growing and St. Clair was the third fastest growing county in the state between 1990 and 2000, with population increases of 44.2% and 30% respectively. These trends are expected to continue which will continue to place pressure on rare and sensitive species in the watershed.

Land within the Middle Coosa River watershed is a mixture of rural and urban areas, with mostly rural areas outside the urban areas identified above. Although there currently is no large metropolitan area in the watershed, Birmingham is beginning to encroach into the watershed in its northeastern sprawl. However, urbanization and development pressures are increasing and could cause extirpations for some populations. Population density is relatively low outside the urban areas with much of the watershed having a population density <0.5 people/ha (Fig. 14). Most of the rare species occurrences were in the portions of the watershed that remain rural. Only 61 of the 261 census block groups contained a rare species occurrence. All occurrences were in the lower density block groups; all were below the mean census block group density of 3.05 and only 4 block groups containing a rare occurrence had a density greater than the median

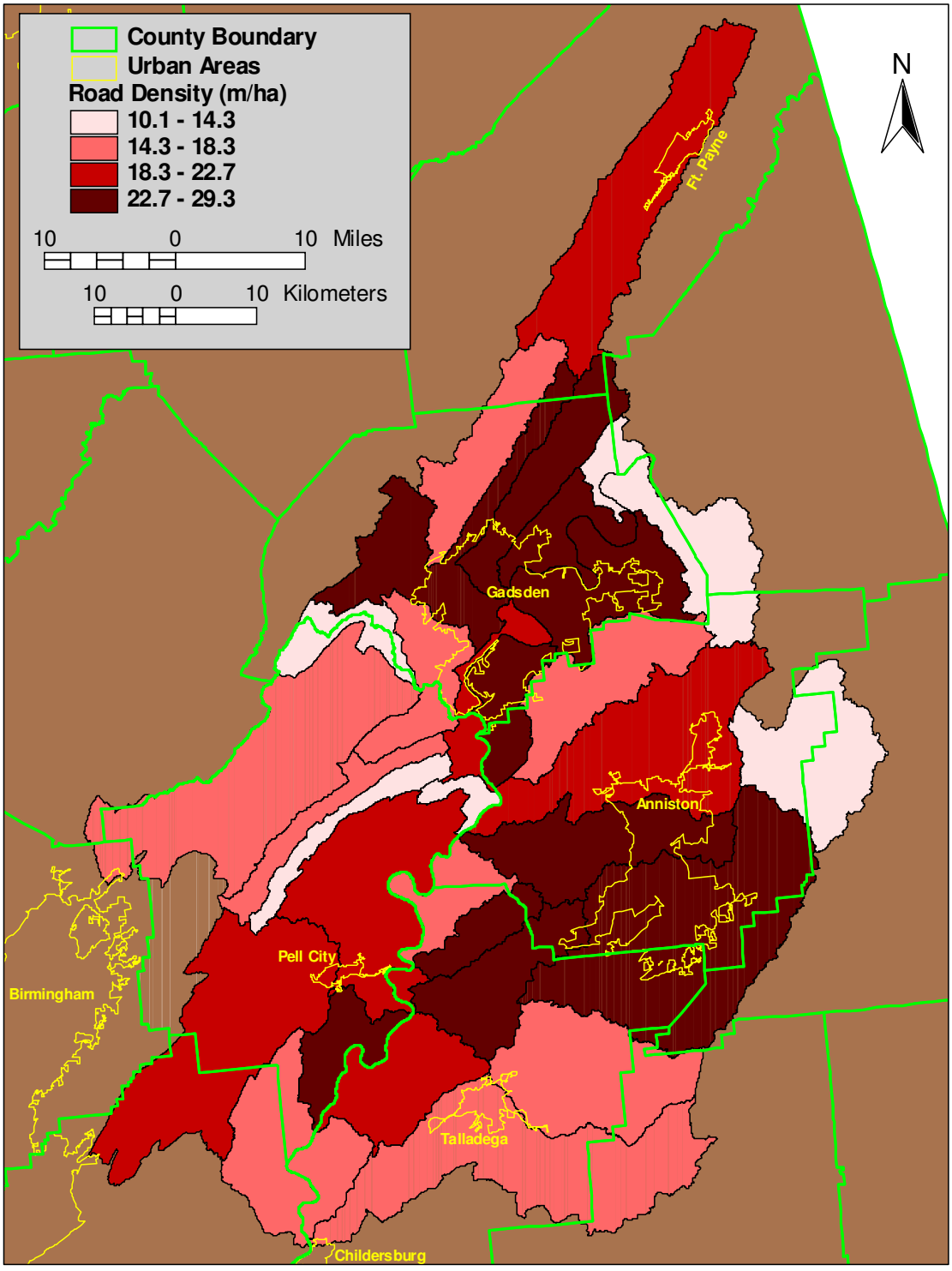

Figure 12. Road density (m/ha) for subwatersheds within the Middle Coosa River watershed. Road density was classified using natural breaks.

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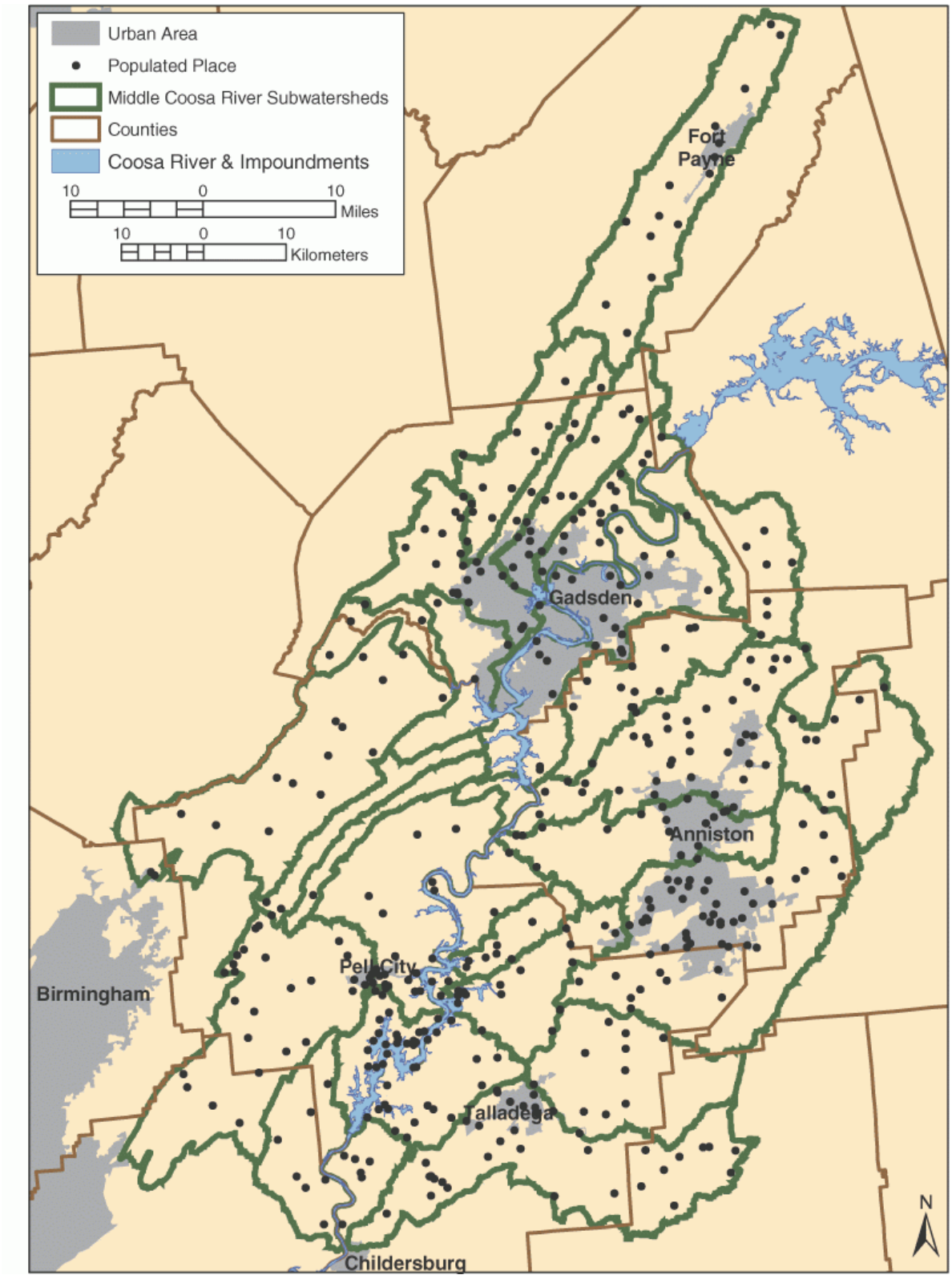

Figure 13. Urban areas and populated place locations as identified from the EPA BASINS and Census 2000 TIGER/line files within the Middle Coosa River watershed, Alabama.

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population density of 1.188 persons/ha. The vast majority of census block groups containing a rare occurrence (70.5%) had a population density <0.5 persons/ha.

Potential Pollution Sources

ADEM (2002b) estimated the nonpoint source impairment potential in the MCR watershed was low for 16 subwatersheds, moderate for 12 subwatersheds, high for 4 subwatersheds, and not determined for 1 subwatershed.

Agricultural and Animal Production

Agricultural production is an important component of the economy within the MCR watershed, particularly in DeKalb and Blount counties. Agricultural production has the potential to be a large contributor to NPS pollution and agricultural activities (animal production, pasture, and row crops) have been cited as primary NPS concerns within the MCR watershed. The amount and type of animal production varies greatly within the subwatersheds (Table 10). Cattle production is the only animal production activity that occurs in every subwatershed, but poultry and, to a lesser extent, swine production are substantial contributors to animal production activities in many subwatersheds. Poultry production tends to be the single largest animal production activity in those subwatersheds in which it occurs.

Permitted Sites

There were 66 active and 29 inactive National Pollutant Discharge Elimination System (NPDES) permitted discharge sites (Fig. 15), 105 Industrial Facilities Discharge (IFD) sites (Fig. 16), 265 hazardous and solid waste (HSW) sites (Fig. 16), 67 toxic release inventory (TRI) sites (Fig. 17), and 439 mines (Fig. 18) identified in the watershed within BASINS (Appendix I). The status of the mines in the MCR watershed was 22 current producers, 107 past producers, 60 experimental prospects, 3 development deposits, 68 raw prospect, and 179 unknown. There was 1 Superfund site (Anchor Metals) in Anniston, Calhoun County (Fig. 15) identified in the watershed from the BASINS data, but this site is not on Superfund's National Priority List (NPL). However, there was 1 NPL site (Anniston Army Depot – Southeast Industrial Area) and 22 other non-NPL sites, including the much publicized Monsanto Co. PCB site, in Anniston listed in the CERCLIS database (United States Environmental Protection Agency 2003) that were not included in the BASINS dataset. The Anchor Metals site was >5 km from the nearest rare species occurrence.

There were 76 rare species occurrences documented at 50 locations within 1 km of these sites (Appendix I). Eleven rare species occurrences were documented within 1 km of NPDES sites, including 3 occurrences of the state protected coldwater darter, 2 occurrences of the global critically imperiled walnut elimia, and 1 occurrence each of the federal threatened pygmy sculpin, the federal threatened blue shiner, the federal threatened lacey elimia, and the federal threatened painted rocksnail. There were 5 rare species occurrences documented within 1 km of IFD sites, including 1 occurrence each of the state protected coldwater darter (also within 1 km of a NPDES site) and a global critically imperiled ground beetle (*Pseudanophthalmus alabamae*). There were 21 rare species occurrences documented within 1 km of HSW sites, including 2 occurrences of a global critically imperiled ground beetle (*Pseudanophthalmus*

alabamae) and 1 occurrence each of the federal threatened blue shiner, the state protected coldwater darter, the global critical imperiled walnut elimia, and a global critically imperiled snail (*Antrorbis breweri*). One occurrence of decumbent trillium was the only rare species occurrence within 1 km of a TRI site. There were 43 rare species occurrences within 1 km of mines including 2 occurrences of the federal threatened blue shiner, 3 occurrences of the state protected coldwater darter, and 1 occurrence each of the federal threatened pygmy sculpin, federal threatened painted rocksnail, federal endangered Alabama livebearing snail, federal candidate white fringeless orchid, state protected southern hognose snake, state protected southern cavefish (*Typhlichthys subterraneus*), and global critically imperiled walnut elimia. However, only 7 occurrences were within 1 km of mines classified as current producers, including 2 occurrences of the state protected coldwater darter and 1 occurrence of the federal threatened pygmy sculpin (Appendix I). One of the occurrences of coldwater darter is the same as that within 1 km of a NPDES and IFD site. In addition, another of the coldwater darter occurrences and the pygmy sculpin and *Pycnopsyche virginica* (a caddisfly) occurrence were at one location that was within 1 km of a NPDES site. There were 55 1,000 ha rare species areas containing potential source sites; 13 contained NPDES sites (Fig. 15), 11 contained IFD sites (Fig. 16), 13 contained HSW sites (Fig. 17), 4 contained TRI sites (Fig. 17), and 37 contained mines (Fig. 18). However, only 32 of the rare species areas with potential source sites within the boundary of the hexagon contained EORs within 1 km of a site, and 5 EORs within 1 km of a site were in rare species areas that did not contain a potential source site.

Septic Systems

The estimated number of septic systems and failing septic systems was relatively low in the majority of subwatersheds in the MCR watershed (Table 11). The Alabama Department of Environmental Management (2002b) estimated NPS impairment potential from non-rural sources, including septic systems, as low in 17 subwatersheds, moderate in 12 subwatersheds, and high in 3 subwatersheds (Table 11).

Other Sources

The Consortium of Alabama Environmental Groups (2003) identified 41 potential sources of point and nonpoint source pollution in the MCR watershed (Fig. 19) using low-flying aircraft and documenting the sites with photographs of each site (Appendix J). The main potential problems identified were nutrient and/or sediment runoff, with many of the sites identified being agricultural activities. Only 1 potential source (TALD06) was within a 100-ha rare species area: an automobile junk yard in Talladega county. The rare species area was a critical area (hexagon id - 6298) containing 4 species: the federal threatened blue shiner (G2/S1), walnut elimia (G1/S1), coldwater elimia (G5/S3S4), and federal threatened painted rocksnail (G1/S1). Two additional sites in Calhoun County were within 1 km of a rare species occurrence: a sod farm (CALH04) along Choccolocco Creek and a quarry (CALH10) along Tallasseehatchee Creek. The sod farm was approximately 430 m (1,410 ft) upstream from an occurrence of the federal protected blue shiner and state protected coldwater darter (G1G2/S1). The quarry was approximately 750 m (2,460 ft) downstream from an occurrence of state protected coldwater darter.

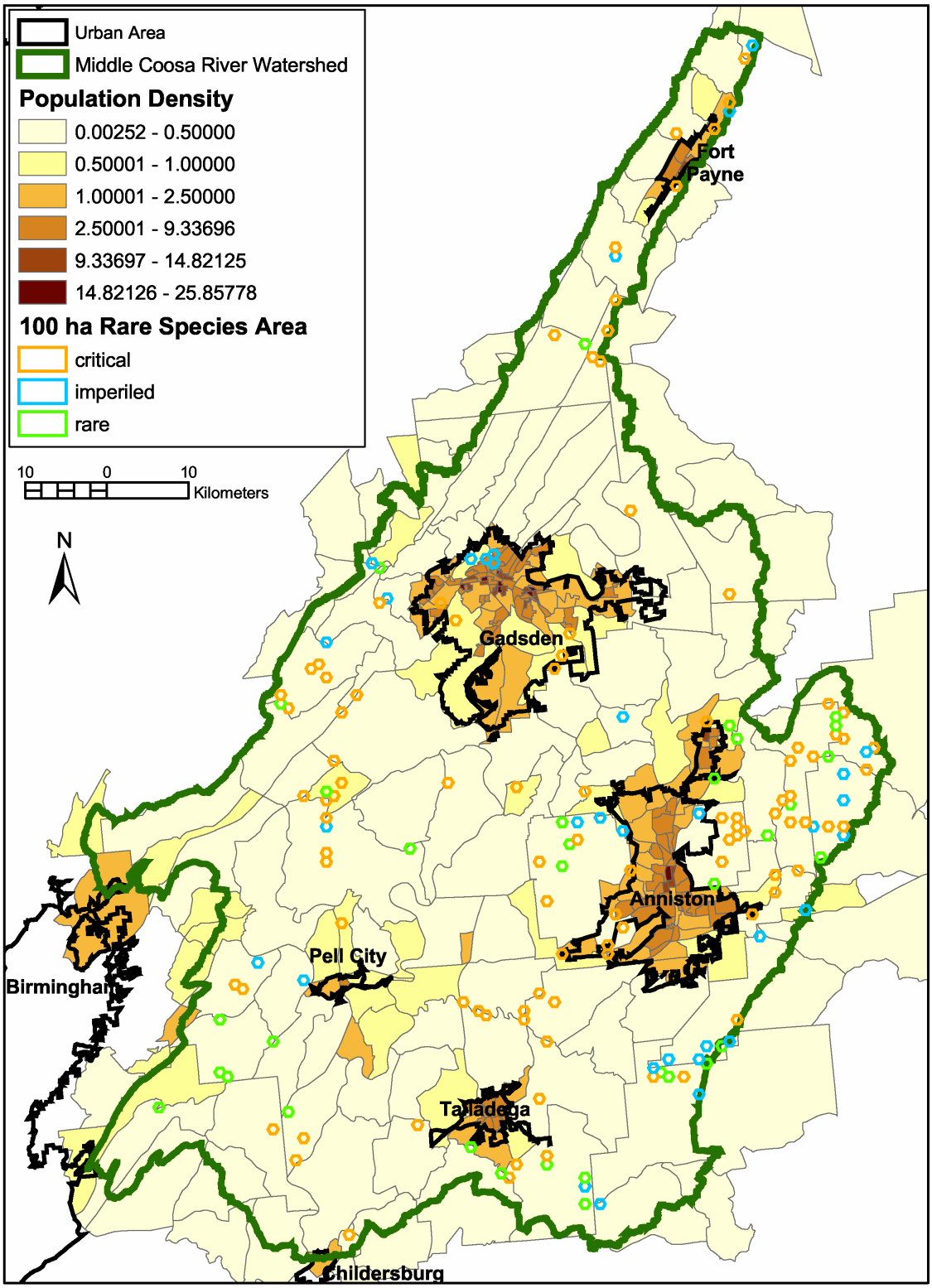

Figure 14. Population density (persons/ha) by 2000 census block groups for the Middle Coosa River watershed, Alabama.

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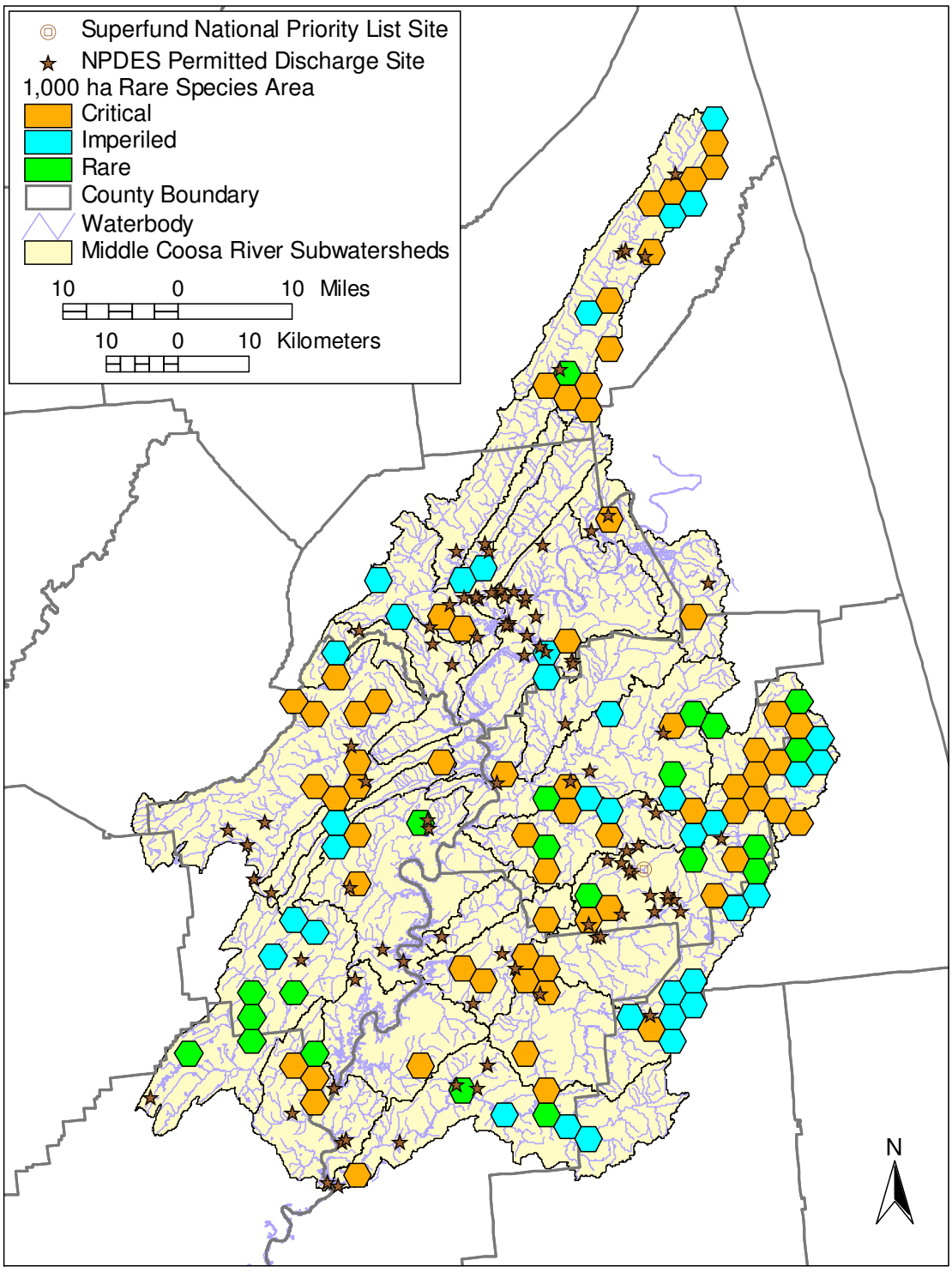

Figure 15. National Pollutant Discharge Elimination System (NPDES) permitted discharge and Superfund National Priority List sites identified from BASINS data in the Middle Coosa River watershed, Alabama.

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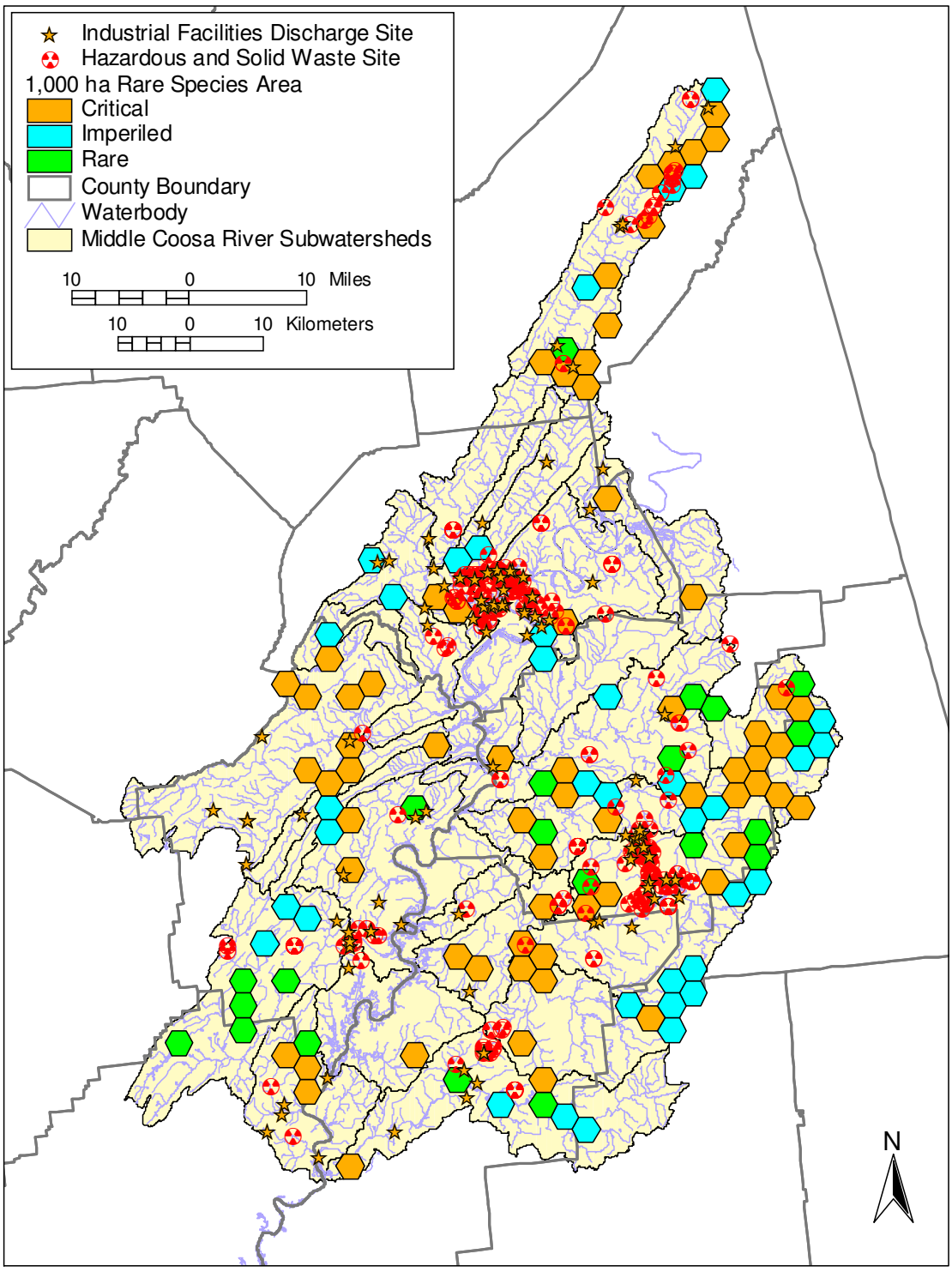

Figure 16. Industrial Facilities Discharge sites and Hazardous and Solid Waste sites identified from BASINS data in the Middle Coosa River watershed, Alabama.

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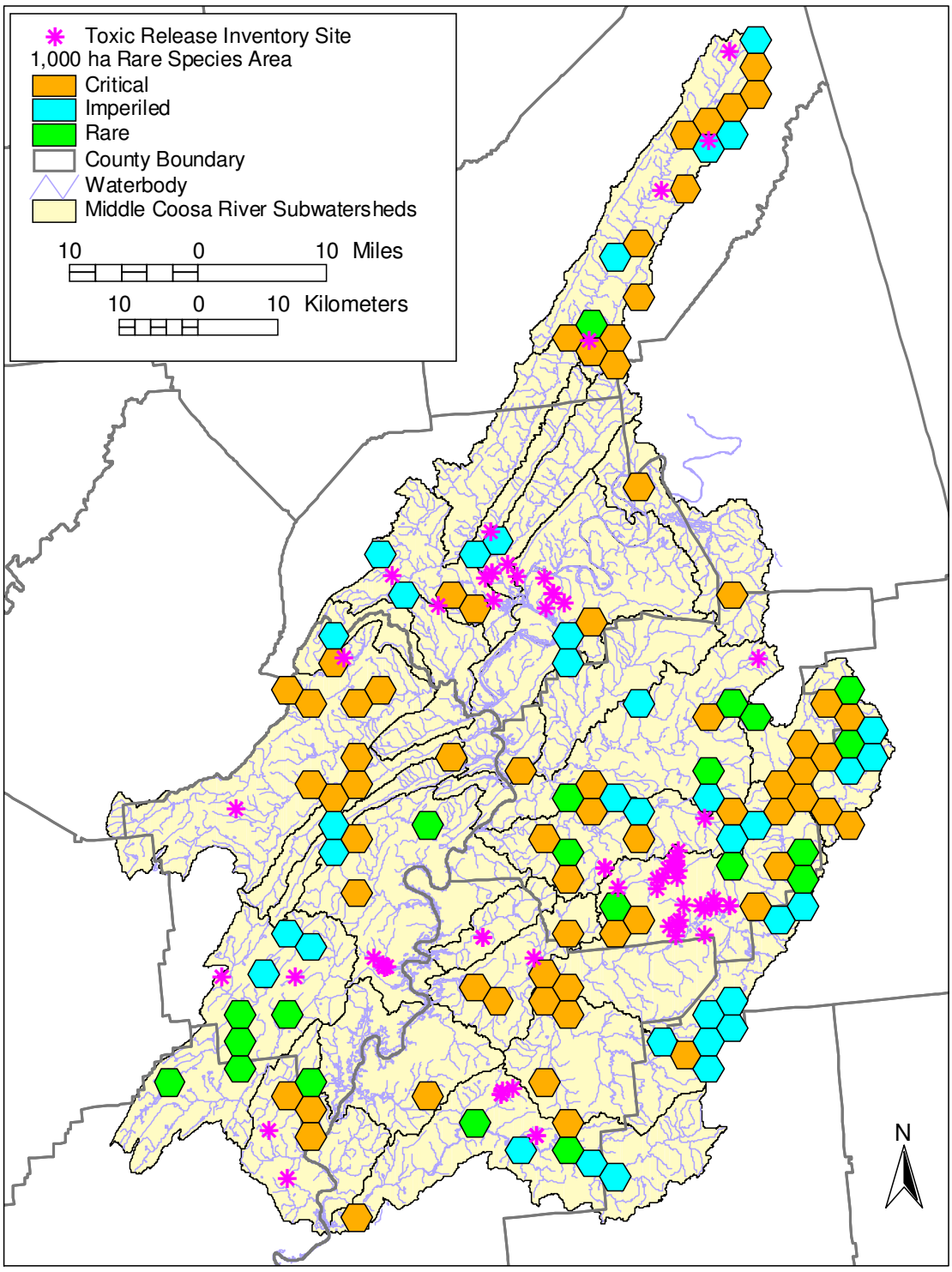

Figure 17. Toxic Release Inventory sites identified from BASINS data in the Middle Coosa River watershed, Alabama.

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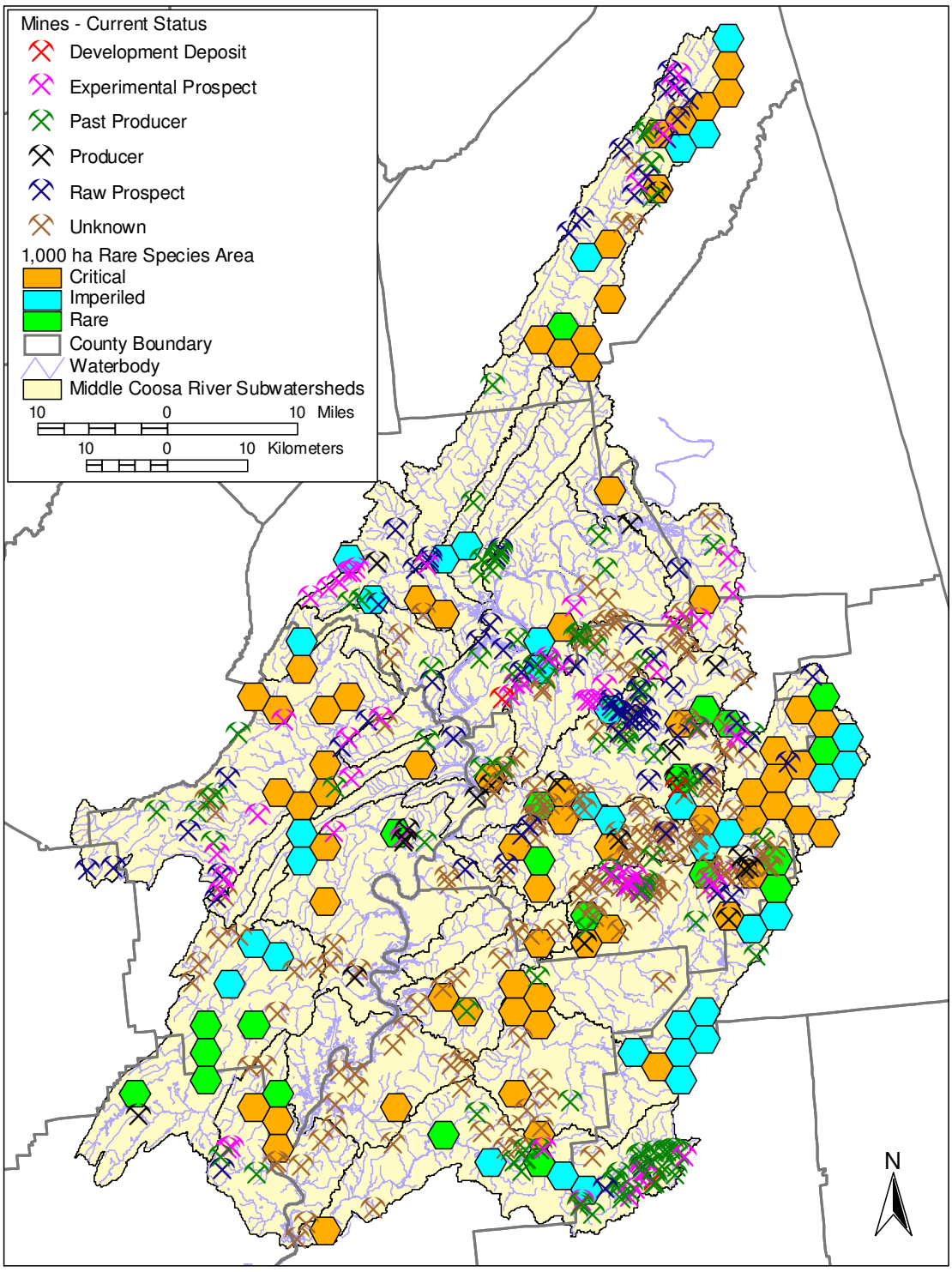

Figure 18. Mines identified from BASINS data in the Middle Coosa River watershed, Alabama.

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Table 10. Number of animals and animal units for cattle, dairy, swine, poultry, and catfish production in the Middle Coosa River watershed, Alabama. Estimates are from the Alabama Soil and Water Conservation Committee (1998). The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Subwatershed	HUC	Total Area	# of Cattle in Watershed	Cattle AU	Number of Dairies	Dairy AU	Number of swine	Swine AU	Number of Broilers	Broiler – Poultry AU	Number of Layers	Layer-Poultry AU	# of Catfish Acres
Acker Creek	210	9,597	1,345	1,345	0	0	33	13.2	3,971,550	31,772	0	0	300
Ball Play Creek	010	18,888	2,060	2,060	280	280	0	0	42,000	336	0	0	0
Beaver Creek	140	9,273	1,700	1,700	0	0	2,500	1,000	0	0	0	0	0
Big Cove Creek	030	20,736	2,600	2,600	0	0	0	0	62,628	504	0	0	0
Black Creek	080	16,524	2,080	2,080	0	0	0	0	0	0	0	0	0
Blue Eye Creek	220	7,639	2,700	2,700	0	0	165	66	1,624,600	12,997	1	<1	450
Bridge Creek	180	2,981	170	170	0	0	0	0	0	0	0	0	0
Cane Creek	190	23,937	2,987	2,987	0	0	12,000	4,800	0	0	0	0	0
Cheaha Creek	260	29,450	1,210	1,210	0	0	0	0	0	0	0	0	90
Clear Creek	280	17,690	3,168	3,168	0	0	77	30.8	1,218,450	9,748	0	0	300
Coosa River	020	4,196	494	494	0	0	0	0	0	0	0	0	0
Coosa River	230	1,410											
Coosa River-Neely Henry	090	6,980	600	600	0	0	0	0	0	0	0	0	0
Dye Creek	200	32,371	1,700	1,700	0	0	0	0	718,124	5,745	0	0	0
Easonville Creek	290	9,792	850	850	0	0	0	0	0	0	0	0	0
Flipper Creek	320	7,867	900	900	0	0	66	26.4	0	0	0	0	90
Greens Creek	130	11,092	1,544	1,544	180	252	0	0	0	0	0	0	0
Little Canoe Creek	110	8,223	900	900	0	0	0	0	529,144	4,233	0	0	0
Lower Big Canoe Creek	120	13,169	1,630	1,630	0	0	0	0	449,178	3,593	0	0	0
Lower Big Wills Creek	070	25,002	3,640	3,640	0	0	0	0	438,396	3,507	0	0	0
Lower Choccolocco Creek	270	17,633	2,254	2,254	150	210	165	66	1,218,450	9,748	0	0	150
Lower Kelly Creek	310	17,893	1,340	1,340	500	700	0	0	0	0	0	0	0
Middle Big Wills Creek	060	16,970	4,975	4,975	0	0	2,500	1,000	761,024	6,088	20,000	160	0
Middle Choccolocco Creek	250	60,921	5,900	5,900	100	140	66	26.4	5,596,150	44,769	119,000	952	90
Ohatchee Creek	160	20,802	2,413	2,413	0	0	0	0	0	0	0	0	0
Shoal Creek	150	7,501	1,700	1,700	0	0	5,000	2,000	188,980	1,511	0	0	0

Table 11. Continued.

Subwatershed	HUC	Total Area	# of Cattle in Watershed	Cattle AU	Number of Dairies	Dairy AU	Number of swine	Swine AU	Number of Broilers	Broiler – Poultry AU	Number of Layers	Layer-Poultry AU	# of Catfish Acres
Talladega Creek	330	45,305	2,850	2,850	0	0	660	264	0	0	0	0	117
Tallasseehatchee Creek	170	39,450	4,907	4,907	0	0	4,000	1,600	3,159,250	25,274	0	0	0
Town Creek	040	10,037	1,560	1,560	0	0	0	0	0	0	0	0	0
Upper Big Canoe Creek	100	50,084	1,700	1,700	0	0	15,000	6,000	1,095,225	8,761	0	0	0
Upper Big Wills Creek	050	36,280	11,200	11,200	300	420	13,500	5,400	1,034,000	8,272	110,000	880	0
Upper Choccolocco Creek	240	24,369	1,371	1,371	0	0	0	0	3,159,250	25,274	0	0	0
Upper Kelly Creek	300	45,410	1,500	1,500	0	0	0	0	0	0	0	0	0

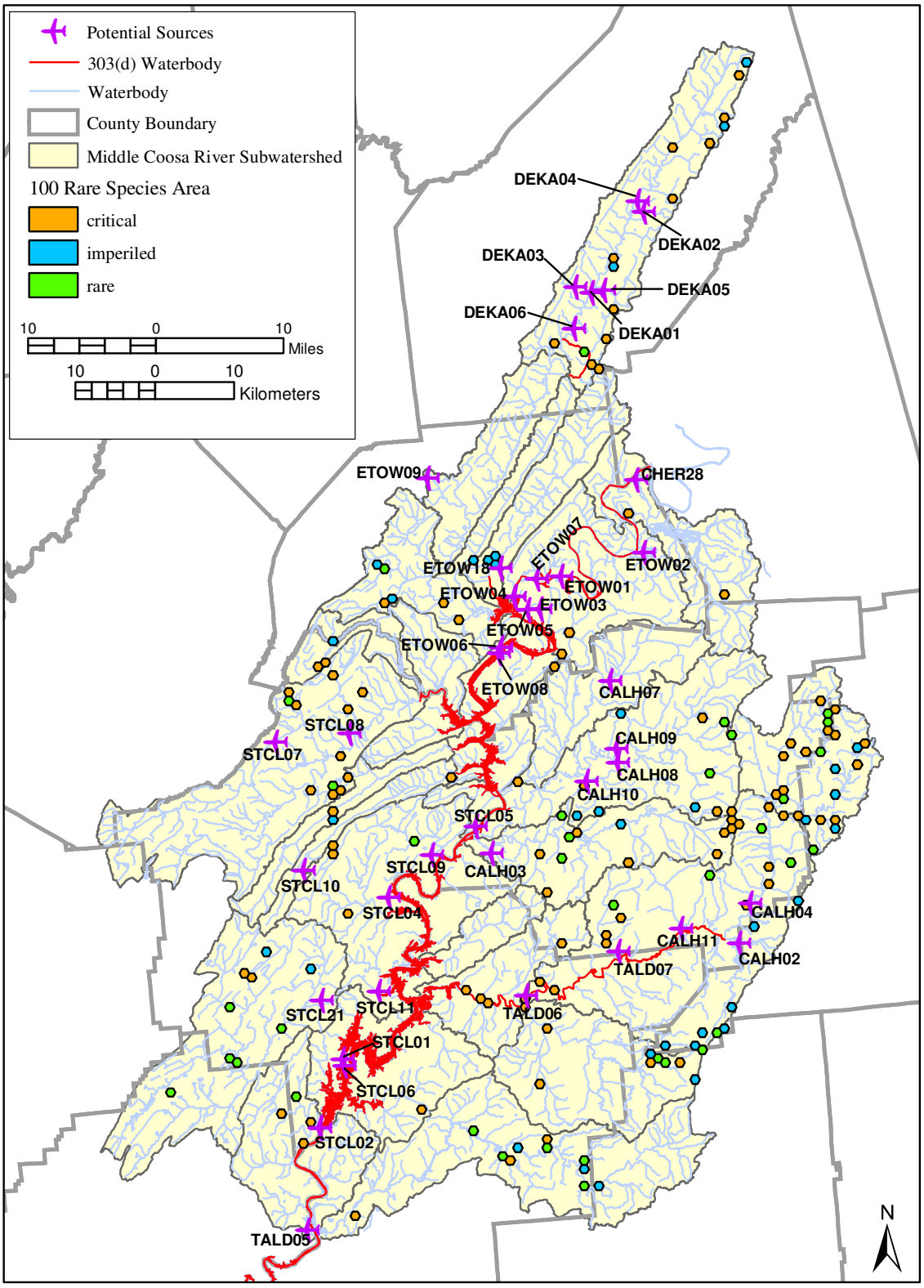

Figure 19. Potential point and nonpoint pollution sources in the Middle Coosa River watershed, Alabama, identified by the Consortium of Alabama Environmental Groups (2003) using low-flying aircraft.

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Table 11. Estimated number of septic systems and failing septic systems within the subwatersheds of the Middle Coosa River watershed, Alabama, as published by the Alabama Soil and Water Conservation Committee (1998). The potential impairment rating is the non-rural potential estimated by the Alabama Department of Environmental Management (2002b). The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Hydrologic Unit Code (HUC)	Subwatershed Name	Area (ha)	Estimated Number of Septic Systems	Estimated Number of Septic Systems Failing	Potential Impairment Rating
210	Acker Creek	9,597	0	0	low
010	Ballplay Creek	18,888	600	189	moderate
140	Beaver Creek	9,273	1,200	96	moderate
030	Big Cove Creek	20,736	4,681	1,170.25	high
080	Black Creek	16,524	1,800	360	moderate
220	Blue Eye Creek	7,639	0	0	low
180	Bridge Creek	2,981	50	1	low
190	Cane Creek	23,937	0	0	low
260	Cheaha Creek	29,450	20	1	low
280	Clear Creek	17,690	0	0	low
020	Coosa River	4,196	75	11.25	low
230	Coosa River	1,410			
090	Coosa River/Neely Henry Reservoir	6,980	2,524	373	high
200	Dye Creek	32,371	3,200	320	moderate
290	Easonville Creek	9,792	4,000	80	moderate
320	Flipper Creek	7,867	0	0	low
130	Greens Creek	11,092	2,856	428.4	high
110	Little Canoe Creek	8,223	250	32.5	low
120	Lower Big Canoe Creek	13,169	500	93	moderate
070	Lower Big Wills Creek	25,002	2,582	309.84	moderate
270	Lower Choccolocco Creek	17,633	0	0	low
310	Lower Kelly Creek	17,893	2,280	99.6	low
060	Middle Big Wills Creek	16,970	1,550	173.5	moderate
250	Middle Choccolocco Creek	60,921	0	0	low
160	Ohatchee Creek	20,802	0	0	low
150	Shoal Creek	7,501	150	12	low
330	Talladega Creek	45,305	400	20	low
170	Tallasseehatchee Creek	39,450	0	0	low
040	Town Creek	10,037	1,250	250	moderate
100	Upper Big Canoe Creek	50,084	5,600	840	moderate
050	Upper Big Wills Creek	36,280	2,508	501.6	moderate
240	Upper Choccolocco Creek	24,369	0	0	low
300	Upper Kelly Creek	45,410	1,600	80	moderate

303 (d) Listed Waters

Alabama's 2000 Final 303 (d) list of impaired waters (Alabama Department of Environmental Management 2000) included 3 stream reaches in the MCR watershed that do not support their water use classifications (Fig. 20): Black Creek, Choccolocco Creek, and Little Wills Creek (Table 12). Lakes Martin Logan and Neely Henry and the rest of the main stem Coosa River in the MCR watershed also were listed (Table 12). The main stem of the Coosa River below Logan Martin Dam was included in the listing of Lay Lake.

No rare species were within 1 km of the listed stream reach of Black Creek (Fig. 21) or Neely Henry Lake. However there were 3 occurrences of 2 rare species and 1 occurrence of a natural feature within 1 km of Little Wills Creek and 13 occurrences of 7 rare species within 1 km of Choccolocco Creek (Fig. 21), including 1 federal endangered snail (Alabama livebearing snail) and 3 federal threatened species (blue shiner, lacey elimia, and painted rocksnail) in Choccolocco Creek (Table 13). There was 1 plant [field horsetail (*Equisetum arvense*)] within 1 km of Logan Martin Lake. In addition, 3 of the snail occurrences in Choccolocco Creek were within 1 km of Logan Martin Lake, including the federal threatened painted rocksnail. There was 1 federal endangered snail (Alabama livebearing snail) within 1 km of the Coosa River section included in the Lay Lake listed area (Fig. 22).

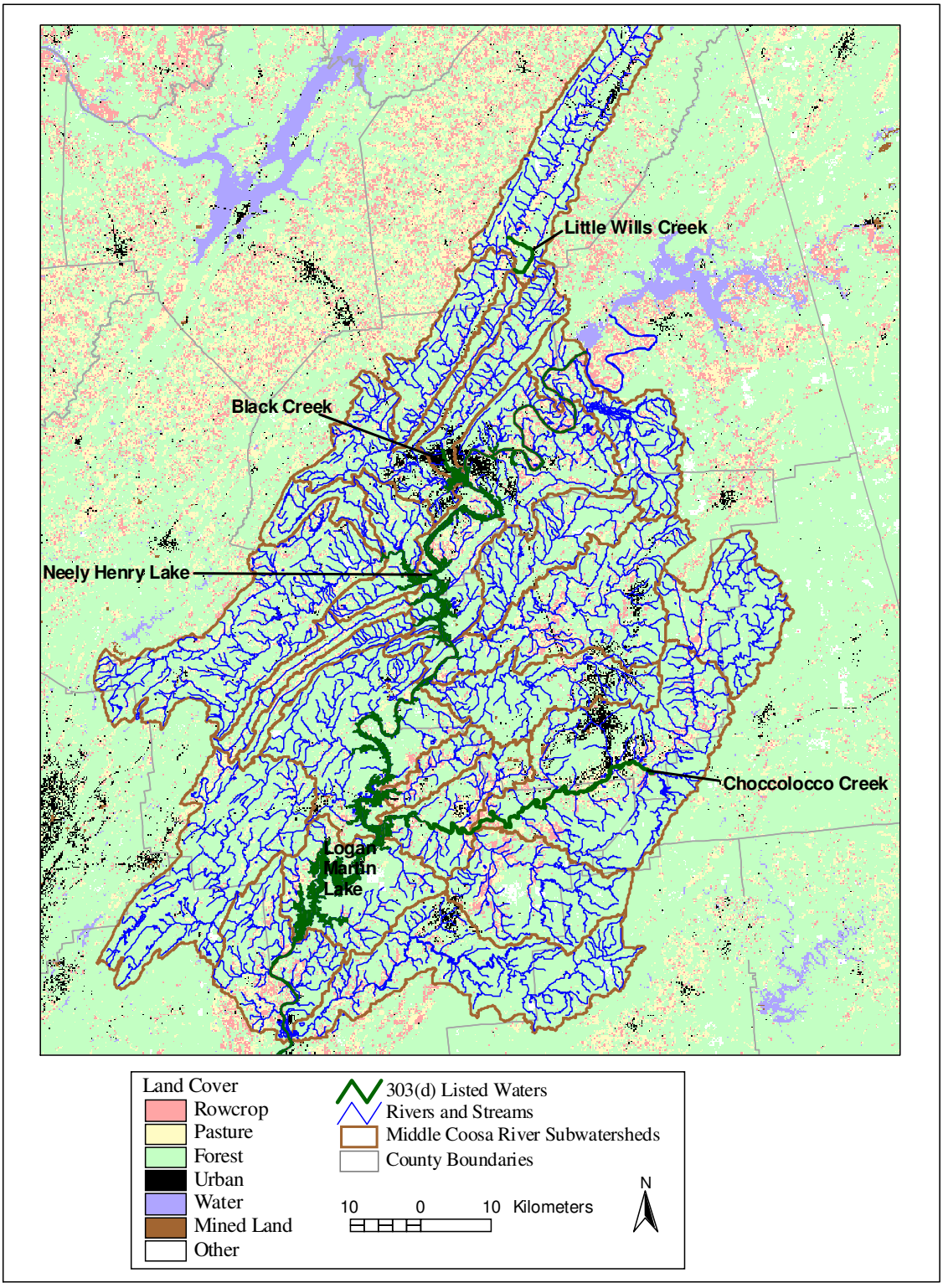

Figure 20. Stream reaches on Alabama's final 2000 303 (d) list in the Middle Coosa River watershed, Alabama.

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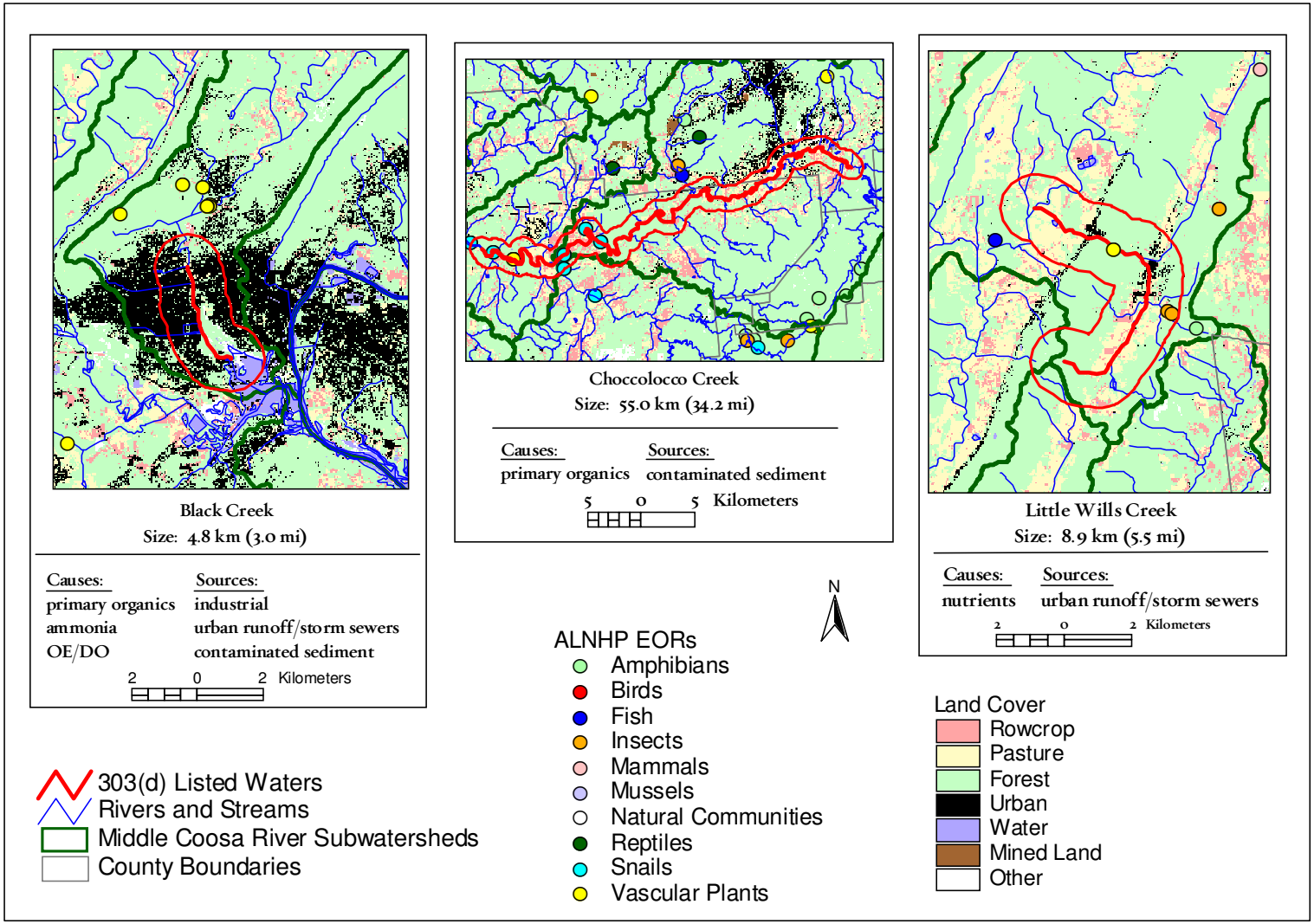

Figure 21. Rare, threatened, and endangered species and ecological features associated with stream reaches on Alabama's final 2000 303 (d) list in the Middle Coosa River watershed, Alabama. A 1-km buffer around the listed stream is indicated by the green line circling the listed stream.

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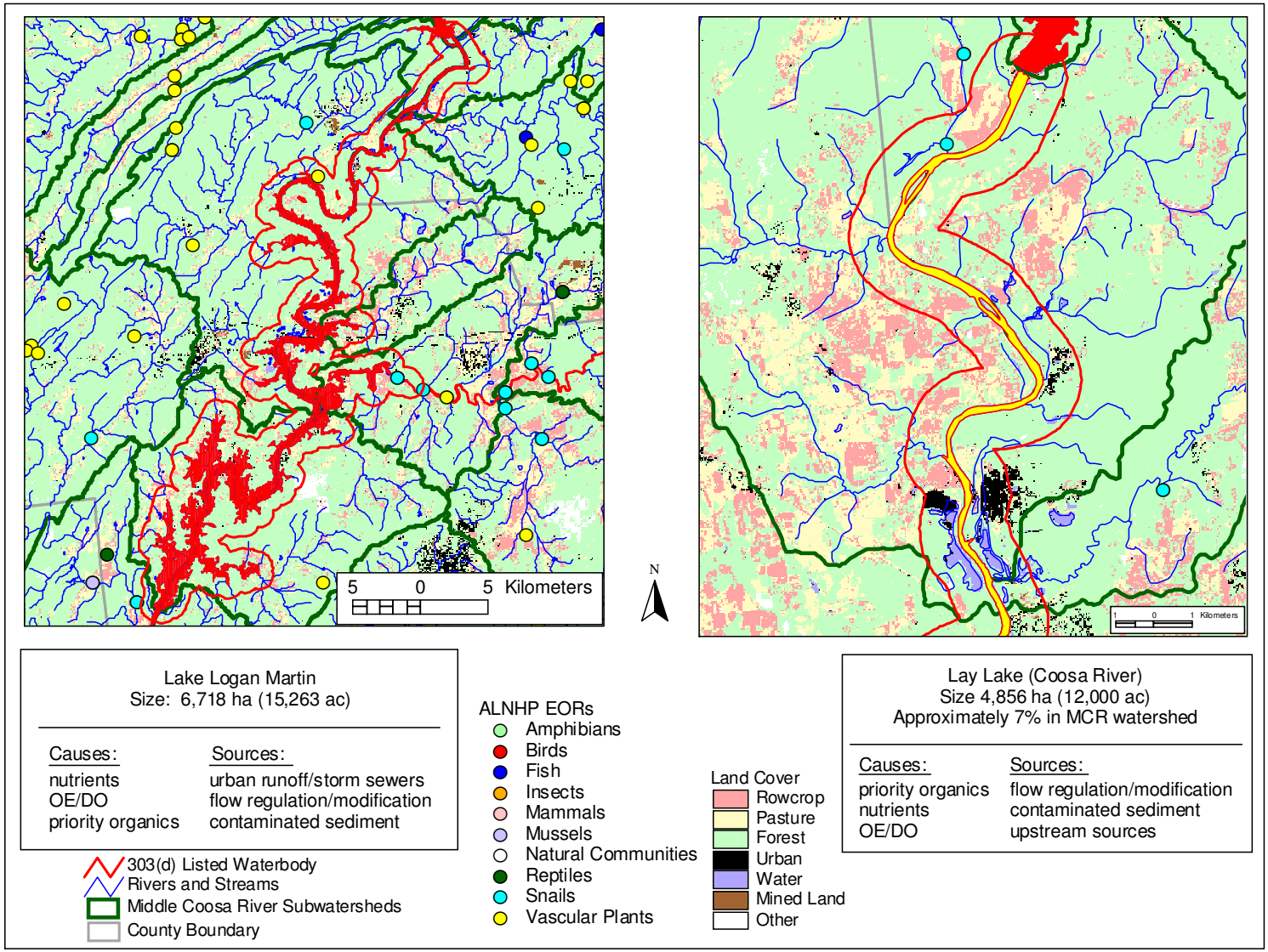

Figure 22. Rare, threatened, and endangered species associated with lakes and the main stem Coosa River on Alabama's final 2000 303 (d) list in the Middle Coosa River watershed, Alabama. A 1-km buffer around the listed waterbody is indicated by the green line circling the listed waterbody.

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Table 12. Middle Coosa River watershed waters listed on Alabama's final 303(d) list of impaired waters.

Waterbody ID	Waterbody Name	County	Support Status	Uses	Causes	Sources	Date of Data	Size	Downstream/ Upstream Location
AL/03150106 -050_01	Little Wills Creek	DeKalb	partial	fish & wildlife	nutrients	urban runoff/ storm sewers	1993	5.5 miles	Big Wills Creek/ Its Source
AL/03150106 -080_01	Black Creek	Etowah	non	agriculture & industry	priority organics[a] ammonia OE/DO	industrial urban runoff/storm sewers contaminated sediments	1994 1997	3.0 miles	Big Wills Creek/ Forest Avenue
AL/03150106 -270_01	Choccolocco Creek	Talladega	non	fish & wildlife	priority organics	contaminated sediments	1993-97	34.2 miles	Lake Logan Martin/ Hillabee Creek
AL/Logan Martin Res_01	Lake Logan Martin	St. Clair	partial	fish & wildlife swimming	nutrients OE/DO priority organics	urban runoff/ storm sewers flow regulation/modification contaminated sediments	1991-93 1994-97 1995-97	15,263 acres	Logan Martin Dam/ Neely Henry Dam
AL/Neely Henry Res_01	Lake Neely Henry[b]	Etowah	partial	public water supply swimming fish & wildlife	nutrients pH OE/DO	industrial municipal flow regulation/modification upstream sources	1992-95 1994-97	11,235 acres	Neely Henry Dam/ Weiss Dam
AL/Lay Res_01[c]	Lay Lake	Talladega	partial	public water supply swimming fish & wildlife	priority organics nutrients OE/DO	flow regulation/modification contaminated sediments upstream sources	1990-91 1992-97	12,000 acres	Lay Dam/ Logan Martin Dam

[a] Priority organics for Black Creek are removed from the Draft 2002 303(d) List for Alabama.

[b] Lake Neely Henry is also listed as non-supporting for priority organics (PCBs) from contaminated sediment from Big Wills Creek to Weiss Dam Powerhouse (9,372 ac) in the Draft 2002 303(d) List for Alabama.

[c] Lay Lake is outside the MCR watershed but the main stem of the Coosa River below Logan Martin Dam is included in the Lay Lake listing; approximately 7% of the listed area is within the MCR watershed.

Table 13. Rare, threatened, and endangered species and ecological features associated with Alabama's 2000 303 (d) listed streams within the Middle Coosa River watershed, Alabama.

Waterbody	Major Group	Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Distance to Stream (m)
Choccolocco Creek	Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	0
Choccolocco Creek	Snails	*Elimia bellula*	walnut elimia[a]	G1	S1			0
Choccolocco Creek	Snails	*Elimia crenatella*	lacey elimia	G1	S1	LT	SP	0
Choccolocco Creek	Snails	*Elimia gerhardti*	coldwater elimia[b]	G5	S3S4			0
Choccolocco Creek	Snails	*Leptoxis taeniata*	painted rocksnail[c]	G1	S1	LT	SP	0
Choccolocco Creek	Snails	*Tulotoma magnifica*	Alabama livebearing snail	G1	S1	LE	SP	0
Choccolocco Creek	Vascular Plants	*Hymenocallis coronaria*	shoals spider-lily	G2Q	S2			69
Lake Logan Martin	Vascular Plants	*Equisetum arvense*	field horsetail	G5	S2			129
Lay Lake (Coosa River)	Snails	*Tulotoma magnifica*	Alabama livebearing snail	G1	S1	LE	SP	216
Little Wills Creek	Natural Feature		AL DeKalb county cave					787
Little Wills Creek	Insects	*Pseudanophthalmus alabamae*	Alabama ground beetle	G1G2	SNR			646
Little Wills Creek	Insects	*Pseudanophthalmus alabamae*	Alabama ground beetle	G1G2	SNR			787
Little Wills Creek	Vascular Plants	*Trillium decumbens*	decumbent trillium	G4	S3S4			65

[a] 3 occurrences within the listed stream
[b] 4 occurrences within the listed stream
[c] 2 occurrences within the listed stream

RESULTS AND DISCUSSION – UPPER COOSA RIVER

Rare, Threatened, and Endangered Species

There were 241 occurrences of rare plant and animal species and natural communities documented in the UCR watershed (Appendix K). The majority (83%) of occurrences documented were plants. This is a reflection of survey effort more than abundance of rare species. Areas such as Little River Canyon have undergone a thorough botanical survey but less effort has been expended in faunal surveys. Forty-one of the rare species occurrences documented in the UCR were historical: occurrences last observed prior to 1980. Some of these historical populations have been extirpated from the watershed as habitat conditions have changed. However, some populations may still be extant because the historical occurrence status may reflect the absence of survey work since last observed rather than a loss of the population. Therefore, if the habitat still exists, these historical occurrences need to be revisited to determine if the population is still extant.

The majority (approximately 76%) of the rare species documented in the UCR watershed occurred in 3 subwatersheds: West Fork of the Little River (80), Bear Creek (110), and Little River (120). This is most likely an artifact of survey effort, with more survey work conducted in these subwatersheds than the others. More species likely would be detected in the other subwatersheds with additional surveys. No rare occurrences were documented in 4 of the 16 subwatersheds: Coosa River (270), Hurricane Creek (240), Lower Chattooga River (060), and Mills Creek (050). Surveys of these subwatersheds are needed to verify the absence of rare species.

The rare species documented in the UCR watershed included 59 occurrences of 13 species that are federal or state protected species (Table 14). These protected species included 1 amphibian, 1 bird, 2 fish, 3 mussels, and 6 vascular plants. There were an additional 77 occurrences of 15 species considered globally imperiled by Natural Heritage ranks (G1 or G2) that are not state or federally protected (Table 15), and 63 occurrences of 36 species without state or federal protection considered state imperiled (rank S1 or S2) but not globally imperiled (Table 16).

A large number of the rare occurrences were associated with water bodies (lakes, rivers, and streams) in the watershed; 97.5% of all occurrences were within 500 m of a water body and 63.5% were within 100m. Occurrences were not evaluated for association at 1 km because 98.8% of the area covered by the watershed is within 1 km of a waterbody. The association with water bodies is partly a reflection of the abundance of water in the watershed and sampling effort. Eighty-one percent of the area covered by the watershed is within 500 m of a waterbody . However, only 23.7% of the watershed is within 100m of a waterbody. Despite the strong association of rare species occurrences with waterbodies, few occurrences were associated with the main stem Coosa River (Fig. 23). Sixty-three stream segments had EORs within 100 m of the stream, and 15 stream reaches had $\geq$5 EORs within 100 m of the stream (Table 17, Appendix L). Only 4 EOR-rich stream segments included aquatic fauna within the 100-m buffer: the Little River below DeSoto State Park, a segment of the Little River in Little River Wildlife Management Area and an unnamed tributary to this segment, and Bear Creek (Table 17). All of the EOR-rich stream segments were along the Little River or its tributaries (Fig. 23). This is

Table 14. Federal listed endangered and threatened species and state protected species documented by the Alabama Natural Heritage Program[SM] occurring in the Upper Coosa watershed, Alabama. The hydrologic unit code (HUC) is the 3 digit subwatershed code of the 11-digit HUC; the first 8 digits are the same (03150105) for all UCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Federal Status[a]	State Protected[a]	Number of Occurrences[b]	HUC
Amphibians	*Aneides aeneus*	green salamander	G3G4	S3		SP	1[c]	100
Birds	*Haliaeetus leucocephalus*	bald eagle	G4	S3B	PS [d]	SP	2	140, 200
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	2 [e]	120, 130
Fish	*Etheostoma ditrema*	coldwater darter	G1G2	S1		SP	2	220
Mussels	*Epioblasma metastriata*	upland combshell	GH	SH	LE	SP	1 [c]	250
Mussels	*Lampsilis altilis*	fine-lined pocketbook	G2	S2	LT	SP	1 [c]	250
Mussels	*Pleurobema decisum*	southern clubshell	G1G2	S1S2	LE	SP	1	140
Vascular Plants	*Clematis socialis*	Alabama leather-flower	G1	S1	LE		2	250
Vascular Plants	*Helianthus verticillatus*	whorled sunflower	G1Q	S1	C		2	180
Vascular Plants	*Marshallia mohrii*	Mohr's Barbara's buttons	G3	S3	LT		7 [f]	180, 200, 250, 260
Vascular Plants	*Ptilimnium nodosum*	harperella	G2	S1	LE		5	110, 120
Vascular Plants	*Sagittaria secundifolia*	Little River arrow-head	G1	S1	LT		4	80, 110, 120
Vascular Plants	*Sarracenia oreophila*	green pitcher plant	G2	S2	LE		28[fe]	80, 110, 120, 200

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of September 2003.
[c] The occurrence was historic.
[d] *Haliaeetus leucocephalus*, LT throughout range; proposed for delisting 6 July 1999. Federal status is categorized by state/region, rather than by subspecies. Listed as Threatened in the coterminous U.S.; not federally classified as Endangered anywhere as of mid-1995.
[e] One of the occurrences was historic.
[f] Two of the occurrences were historic.

Table 15. Globally imperiled (G2) or critically imperiled (G1) species and natural communities without state or federal protection documented occurring within the Upper Coosa watershed, Alabama, by the Alabama Natural Heritage Program[SM]. Imperilment status was indicated by Natural Heritage ranks. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150105) for all UCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Fish	*Percina lenticula*	freckled darter	G2	S2S3	1[c]	130
Insects	*Ceraclea alabamae*	caddisfly	G1	S1	2	80, 120
Insects	*Cheumatopsyche helma*	Helma's cheumatopsyche caddisfly	G1G3	S1	1	80
Insects	*Hydroptila micropotamis*	caddisfly	G1	S1	1	120
Natural Communities	*Bigelowia nuttallii - Coreopsis pulchra - Liatris microcephala*	sandstone glade	G2?	S2	4	110, 120
Vascular Plants	*Allium speculae*	Little River Canyon onion	G2	S2	14	110, 120
Vascular Plants	*Coreopsis pulchra*	woodland tickseed	G2	S2	14[d]	80, 110, 120, 140
Vascular Plants	*Cuscuta harperi*	Harper's dodder	G2	S2	16[e]	80, 110, 120, 140
Vascular Plants	*Fimbristylis brevivaginata*	glade fimbristylis	G2	S1	1	110
Vascular Plants	*Lobelia boykinii*	Boykin's lobelia	G2G3	S1S2	1	120
Vascular Plants	*Lysimachia graminea*	grass-leaf loosestrife	G1Q	S1	2[c]	200, 250
Vascular Plants	*Panicum lithophilum*	Swallen's panic-grass	G2G3Q	S1	1	110
Vascular Plants	*Rhynchospora thornei*	Thorne's beakrush	G1G2	S1	1	180
Vascular Plants	*Rudbeckia heliopsidis*	sun-facing coneflower	G2	S2	16[e]	80, 110, 120
Vascular Plants	*Sabatia capitata*	rose gentian	G2	S2	2	80, 110

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of September 2003.
[c] One occurrence was historic (last observed prior to 1980).
[d] Three occurrences were historic.
[e] Two occurrences were historic.

Table 16. State imperiled (S2) or critically imperiled (S1) species not globally imperiled and without state or federal protection documented occurring within the Upper Coosa watershed, Alabama, by the Alabama Natural Heritage Program[SM]. Imperilment status was indicated by Natural Heritage ranks. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150105) for all UCR subwatersheds.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	HUC
Amphibians	*Desmognathus aeneus*	seepage salamander	G3G4	S2	1[c]	220
Insects	*Agapetus spinosus*	caddisfly	GNR	S1	1	80
Insects	*Ceraclea alces*	caddisfly	GNR	S1	2	80, 120
Insects	*Chimarra augusta*	caddisfly	GNR	S1	1	220
Insects	*Hydropsyche simulans*	caddisfly	GNR	S1	1	220
Insects	*Neophylax acutus*	caddisfly	GNR	S1	1	220
Insects	*Theliopsyche melas*	caddisfly	GNR	S1	1	100
Insects	*Wormaldia shawnee*	caddisfly	GNR	S1	1	80
Mussels	*Elliptio arctata*	delicate spike	G3G4	S2	5	110, 120
Mussels	*Strophitus subvexus*	southern creekmussel	G3	S2	1	220
Non Vascular Plants	*Fontinalis welchiana*	difficult moss	GU	S1	1	120
Vascular Plants	*Amelanchier arborea*	downy serviceberry	G5	S1?	1	110
Vascular Plants	*Aster spectabilis*	showy aster	G5	S2	2[c]	110
Vascular Plants	*Aureolaria patula*	spreading false-foxglove	G3	S1	2	180
Vascular Plants	*Castilleja coccinea*	scarlet Indian paintbrush	G5	S1	1[c]	110
Vascular Plants	*Cyperus granitophilus*	granite-loving flatsedge	G3Q	S2	1[c]	110
Vascular Plants	*Dryopteris* x *australis*	southern woodfern	HYB	S1	1[c]	200
Vascular Plants	*Fothergilla major*	mountain witch-alder	G3	S2	2	110, 120
Vascular Plants	*Helianthus longifolius*	longleaf sunflower	G3	S1S2	2	110, 120
Vascular Plants	*Isotria verticillata*	large whorled pogonia	G5	S2	2[c]	110
Vascular Plants	*Juglans cinerea*	butternut	G3G4	S1	1	80
Vascular Plants	*Lathyrus venosus*	smooth veiny peavine	G5	S1	1	110
Vascular Plants	*Melanthium parviflorum*	small-flowered false hellebore	G4?	S1S2	2	80
Vascular Plants	*Nestronia umbellula*	nestronia	G4	S2	4[c]	110, 120
Vascular Plants	*Orobanche uniflora*	one-flowered broomrape	G5	S2	1	250
Vascular Plants	*Plantago cordata*	heart-leaved plantain	G4	S1	1	180
Vascular Plants	*Polygonella americana*	southern jointweed	G5	S1	2[c]	110
Vascular Plants	*Prenanthes barbata*	barbed rattlesnake-root	G3	S1S2	2	180
Vascular Plants	*Pycnanthemum virginianum*	Virginia mountain mint	G5	S1	3	180, 250
Vascular Plants	*Pyrularia pubera*	buffalo-nut	G5	S2	4[c]	80, 100, 110
Vascular Plants	*Ribes curvatum*	granite gooseberry	G4	S2	1[c]	80
Vascular Plants	*Ribes cynosbati*	prickly gooseberry	G5	S1S2	3[d]	110, 120
Vascular Plants	*Schoenolirion croceum*	yellow sunnybell	G4	S2	3	110
Vascular Plants	*Silene caroliniana* ssp *wherryi*	Wherry's catchfly	G5T2T4Q	S1S2	1[c]	110
Vascular Plants	*Stewartia ovata*	mountain camellia	G4	S2S3	1	110
Vascular Plants	*Talinum mengesii*	Menge's fame-flower	G3	S2S3	3	80, 110

[a] See Appendix B for an explanation of Global and State Ranks and Federal and State Protection Status.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of September 2003.
[c] One occurrence was historic (last observed prior to 1980).
[d] Three occurrences were historic.

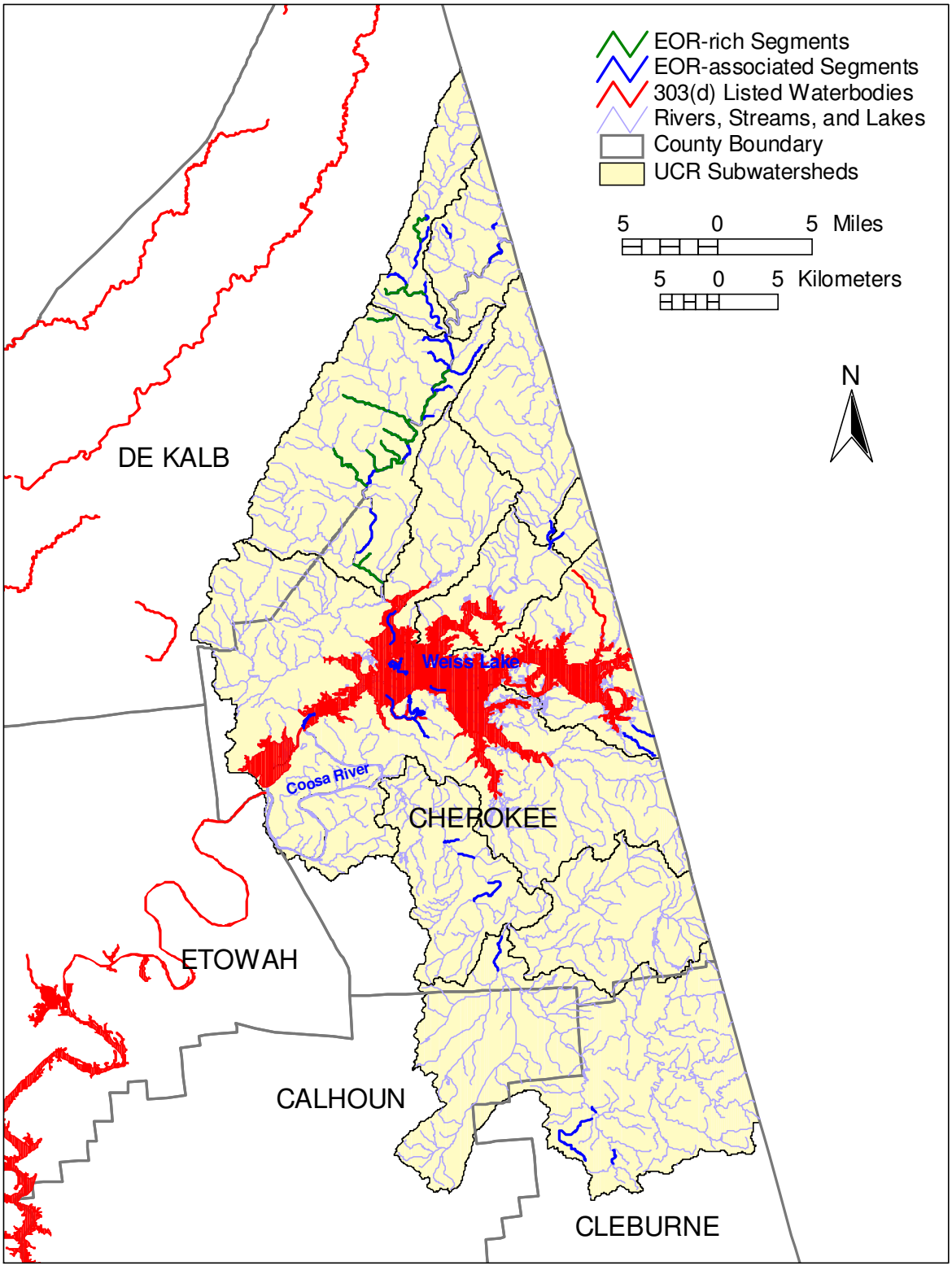

Figure 23. EOR-rich and EOR-associated stream segments within the Upper Coosa River watershed, Alabama. EOR-rich stream segments were those with ≥5 EORs within 100m of the stream. EOR-associated stream reaches were those with 1-4 EORs within 100m of the stream.

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Table 17. EOR-rich stream segments within the Upper Coosa River watershed, Alabama. EOR-rich stream segments were those with ≥5 EORs within 100m of the stream.

Waterbody	Description	County	# of EORs	Species <100 m from Waterbody	
				Scientific Name	Common Name
Bear Creek	Bear Creek from its confluence with Falls Branch downstream approximately 5,441 m to its confluence with Little River	DeKalb	10	*Aster spectabilis*, *Bigelowia nuttallii*, *Cheumatopsyche helma*, *Cuscuta harperi*, *Elliptio arctata*, *Ribes curvatum*, *Sarracenia oreophila* (3), *Talinum mengesii*	showy aster, Nuttall's rayless goldenrod, Helma's cheumatopsyche caddisfly, Harper's dodder, delicate spike, granite gooseberry, green pitcher plant (3), Menge's fame-flower
Brooks Branch	Brooks Branch from its headwater downstream to its confluence with Little River (approximately 2,487 m)	DeKalb	11	*Bigelowia nuttallii* (2), *Coreopsis pulchra*, *Lindernia monticola*, *Melanthium parviflorum*, *Ptilimnium nodosum* (2), *Sarracenia oreophila* (2), *Stewartia ovata*, *Talinum mengesii*	Nuttall's rayless goldenrod (2), woodland tickseed, Piedmont pimpernel, small-flowered false hellebore, harperella (2), green pitcher plant (2), mountain camellia, Menge's fame-flower
Little River (1)	within Little River Wildlife Management Area from unnamed tributary entering at Hartline Ford (Access Road 03 crossing) downstream approximately 2,487 m to Hurricane Creek	DeKalb, Cherokee	5	*Allium speculae*, *Bigelowia nuttallii*, *Ceraclea alces*, *Coreopsis pulchra*, *Sarracenia oreophila*	Little River Canyon onion, Nuttall's rayless goldenrod, caddisfly, woodland tickseed, green pitcher plant
Little River (2)	in Little River Wildlife Management Area from confluence with unnamed tributary (35:24:51N, 85:35:56W) downstream approximately 2,775 m to next confluence with unnamed tributary from the east	DeKalb, Cherokee	7	*Coreopsis pulchra* (2), *Cuscuta harperi*, *Elliptio arctata*, *Ribes cynosbati*, *Rudbeckia heliopsidis* (2)	woodland tickseed (2), Harper's dodder, delicate spike, prickly gooseberry, sun-facing coneflower (2)
Little River (3)	In Little River Canyon National Preserve Yellow Creek downstream approximately 2,698 m to confluence with Brooks Branch	DeKalb, Cherokee	10	*Allium speculae*, *Bigelowia nuttallii*, *Bigelowia nuttallii-Coreopsis pulchra-Liatris microcephala*, *Ceraclea alabamae*, *Coreopsis pulchra*, *Melanthium parviflorum*, *Ptilimnium nodosum*, *Pyrularia pubera*, *Rudbeckia heliopsidis*, *Sarracenia oreophila*	Little River Canyon onion, Nuttall's rayless goldenrod, sandstone glade, caddisfly, woodland tickseed, small-flowered false hellebore, harperella, buffalo-nut, sun-facing coneflower, green pitcher plant

Table 17. Continued.

Waterbody	Description	County	# of EORs	Species <100 m from Waterbody	
				Scientific Name	Common Name
Little River (4)	in Little River Canyon National Preserve – segment of little River between Brooks Branch and Bear Creek from confluence with an unnamed tributary (34:23:52N, 85:37:32) downstream approximately 3,208 m to Wolf Creek	DeKalb, Cherokee	12	*Allium speculae* (2), *Amelanchier arborea*, *Bigelowia nuttallii-Coreopsis pulchra-Liatris microcephala*, *Coreopsis pulchra*, *Cuscuta harperi* (2), *Fothergilla major*, *Nestronia umbellula*, *Rudbeckia heliopsidis* (2), *Sarracenia oreophila*	Little River Canyon onion (2), downy serviceberry, sandstone glade, woodland tickseed, Harper's dodder (2), mountain witch-alder, nestronia, sun-facing coneflower (2), green pitcher plant
Little River (5)	Little River from confluence with Johnnies Creek downstream approximately 3,018 m past Highway 273 crossing to confluence with unnamed tributary	Cherokee	10	*Allium speculae*, *Bigelowia nuttallii* (2), *Ceraclea alces*, *Coreopsis pulchra*, *Cuscuta harperi*, *Diamorpha smallii*, *Juglans cinerea*, *Lonicera flava*, *Wormaldia shawnee*	Little River Canyon onion, Nuttall's rayless goldenrod (2), caddisfly, woodland tickseed, Harper's dodder, elf orpine, butternut, yellow honeysuckle, caddisfly
Straight Creek	from headwaters downstream to confluence with an unnamed tributary approximately 300 m upstream of the confluence of Straight Creek and Yellow Creek	DeKalb	5	*Ceraclea alabamae*, *Coreopsis pulchra*, *Elliptio arctata*, *Lonicera flava*, *Sagittaria secundifolia*	caddisfly, woodland tickseed, delicate spike, yellow honeysuckle, little river arrow-head
Unnamed Tributary – Hurricane Creek	unnamed tributary from headwaters downstream to confluence with Hurricane Creek (HC) approximately 100 m northwest of DeSoto Parkway crossing HC	DeKalb	5	*Bigelowia nuttallii*, *Sarracenia oreophila* (3), *Schoenolirion croceum*	Nuttall's rayless goldenrod, green pitcher plant (3), yellow sunnybell
Unnamed Tributary – Little River	partially in Little River Canyon National Preserve – approximately 2, 764 m of unnamed tributary from (34:23:04N, 85:39:13W) to confluence with Little River	DeKalb	6	*Allium speculae*, *Amelanchier arborea*, *Cuscuta harperi*, *Helianthus longifolius*, *Nestronia umbellula*, *Sarracenia oreophila*	Little River Canyon onion, downy serviceberry, Harper's dodder, longleaf sunflower, nestronia, green pitcher plant
Unnamed Tributary – West Fork Little River	in DeSoto State Park – approximately 2,264 m of unnamed tributary from (34:29:55N, 85:38:06W) to confluence with West Fork Little River	DeKalb	5	*Bigelowia nuttallii*, *Cuscuta harperi*, *Ptilimnium nodosum*, *Sagittaria secundifolia*, *Sarracenia oreophila*	Nuttall's rayless goldenrod, Harper's dodder, harperella, Little River arrow-head, green pitcher plant
West Fork Little River (1)	from DeSoto Falls downstream approximately 3,222 m to confluence with an unnamed tributary north of Polecat Hollow	DeKalb	7	*Agapetus spinosus, Bigelowia nuttallii, Fontinalis welchiana, Hydroptila micropotamis, Polygonella americana, Talinum mengesii*	caddisfly, Nuttall's rayless goldenrod, difficult moss, caddisfly, southern jointweed, Menge's fame-flower

Table 17. Continued.

Waterbody	Description	County	# of EORs	Species <100 m from Waterbody	
				Scientific Name	Common Name
West Fork Little River (2)	partially in DeSoto State Park and Little River Wildlife Management Area – from confluence with Sharp Branch downstream approximately 2,625 m to confluence with unnamed tributary	DeKalb	15	*Allium speculae*, *Bigelowia nuttallii* (4), *Cuscuta harperi* (2), *Elliptio arctata* (2), *Lindernia monticola*, *Ptilimnium nodosum*, *Pyrularia pubera*, *Rudbeckia heliopsidis*, *Sagittaria secundifolia* (2)	Little River Canyon onion, Nuttall's rayless goldenrod (4), Harper's dodder (2), delicate spike (2), Piedmont pimpernel, harperella, buffalo-nut, sun-facing coneflower, Little River arrow-head (2)
Wolf Creek	Partially within the Little River National Preserve - from confluence of 2 unnamed tributaries (34:22:44N, 85:40:05W) downstream approximately 2,045 m to confluence with Little River (end point of Little River (4))	DeKalb	6	*Allium speculae*, *Cuscuta harperi*, *Pyrularia pubera*, *Rudbeckia heliopsidis* (2), *Sarracenia oreophila*	Little River Canyon onion, Harper's dodder, buffalo-nut, sun-facing coneflower (2), green pitcher plant
Yellow Creek[a]	from confluence with Straight Creek downstream approximately 1,990 m to confluence with Little River	DeKalb	9	*Allium speculae*, *Bigelowia nuttallii*, *Bigelowia nuttallii-Coreopsis pulchra-Liatris microcephala*, *Coreopsis pulchra*, *Melanthium parviflorum*, *Ptilimnium nodosum*, *Pyrularia pubera*, *Rudbeckia heliopsidis*, *Sarracenia oreophila*	Little River Canyon onion, Nuttall's rayless goldenrod, sandstone glade, woodland tickseed, small-flowered false hellebore, harperella, buffalo-nut, sun-facing coneflower, green pitcher plant

[a] – EORs associated with confluence of Yellow Creek and Little River

likely a reflection of the increased survey effort along the Little River relative to the remainder of the watershed.

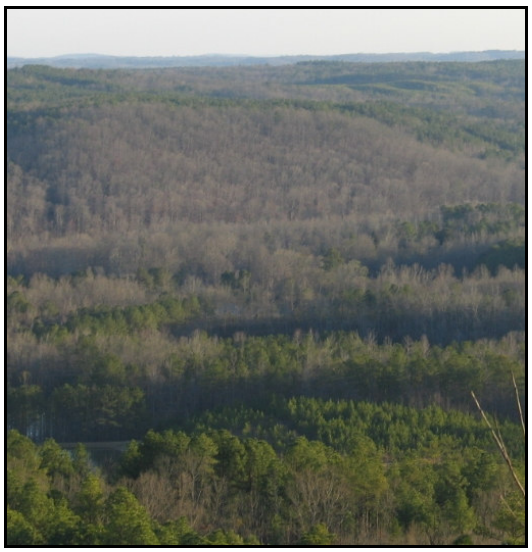
Forty-seven 1,000-ha rare species areas were identified in the UCR watershed: 37 critical, 8 imperiled, and 2 rare (Fig. 24, Appendix M). The number of EORs within the rare species areas ranged from 1 to 34. Although the majority of rare species areas contained >1 rare species occurrence documented, a large proportion (40.4%) contained only 1 rare species occurrence (Fig. 25). Although all the subwatersheds had portions covered by the rare species areas, the Coosa River (270), Hurricane Creek (240), Lower Chattooga River (060), and Mills Creek (050) subwatersheds only had small portions covered by areas with rare species outside the subwatersheds. Surveys of these subwatersheds are needed to verify the absence of areas important to rare species.

Eighty-nine 100-ha rare species areas were identified in the UCR watershed, with an additional 4 on the periphery in the MCR watershed: 60 critical, 23 imperiled, and 6 rare (Fig. 26, Appendix M). The number of EORs within these rare species areas ranged from 1 to 17. Nearly half of the areas (46.2%) contained only 1 rare species occurrence (Fig. 25). The Hurricane Creek (240) subwatershed was the only subwatershed with no area in the watershed covered by a 100-ha rare species area. A survey of this subwatershed is needed to verify the absence of areas important to rare species.

Conservation Targets

Seven conservation targets were chosen for the UCR watershed: riverine system, matrix forest communities (oak-hickory-pine forest), riparian vegetation, freshwater fish, mussels, and snails of critical conservation concern, imperiled salamanders, caddisflies, and plants of conservation concern.

I. Coarse Scale



Coarse scale conservation targets selected within the UCR watershed were the matrix forest community and the riverine system. The terrestrial system which was represented at the coarse scale in the MCR watershed was the southern Appalachian oak-hickory-pine forest community which forms the matrix terrestrial community of the region. The UCR and its tributaries, as part of the larger Mobile River system, represents the regional aquatic system. For a description of these targets, see the detailed description of the coarse scale conservation targets for the MCR watershed above.

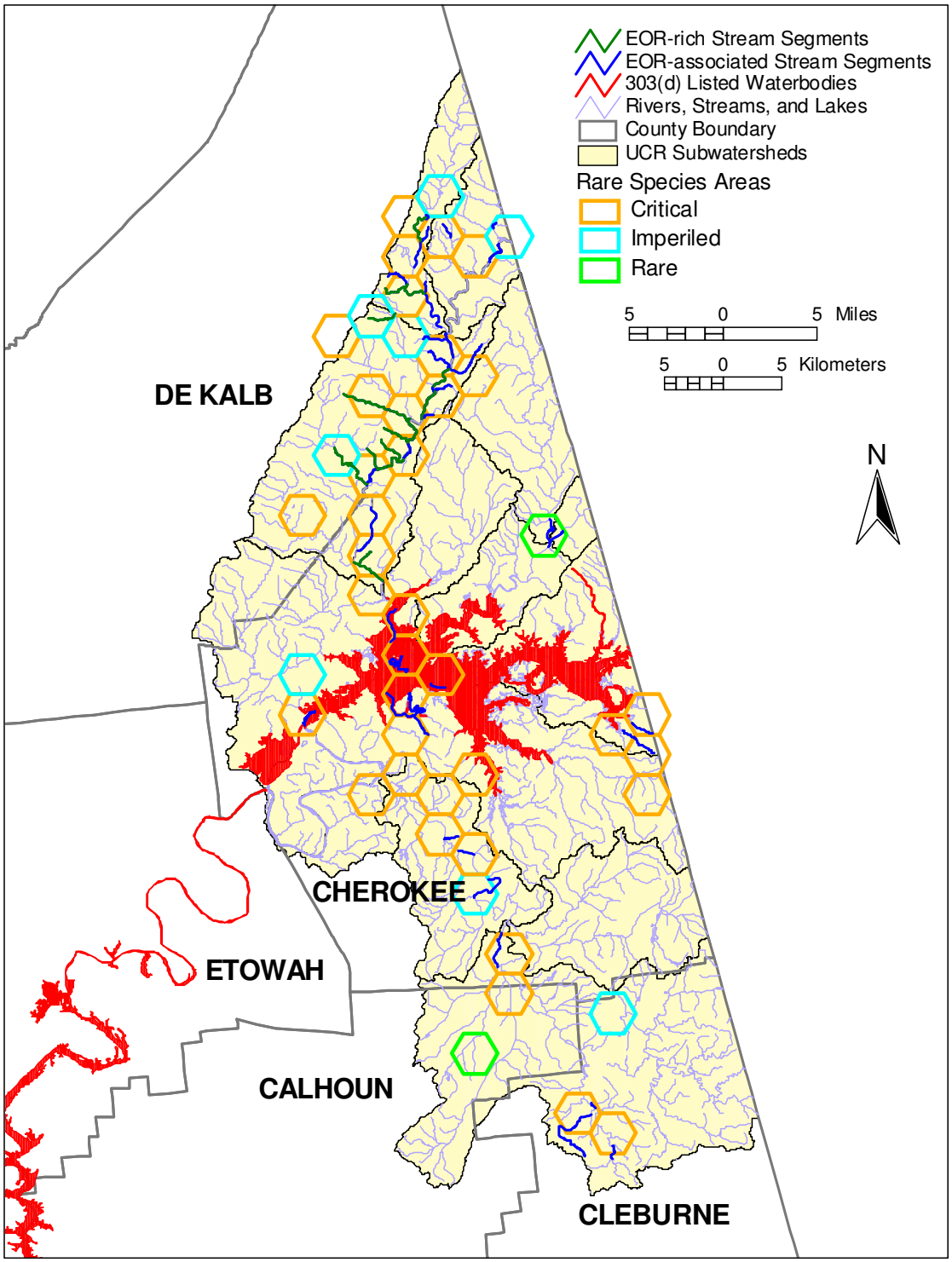


Figure 24. One thousand hectare rare species areas in the Upper Coosa River watershed, Alabama. Hexagon type was coded "critical", "imperiled", and "rare" based on the presence of federal or state protected species and heritage ranks. "Critical" hexagons were those containing federal or state protected species or species with a heritage rank of G1 or S1. "Imperiled" hexagons were those containing species with a heritage rank of G2 or S2 without federal or state protection. "Rare" hexagons were those containing species with a heritage rank of G3 – G5 without federal or state protection.

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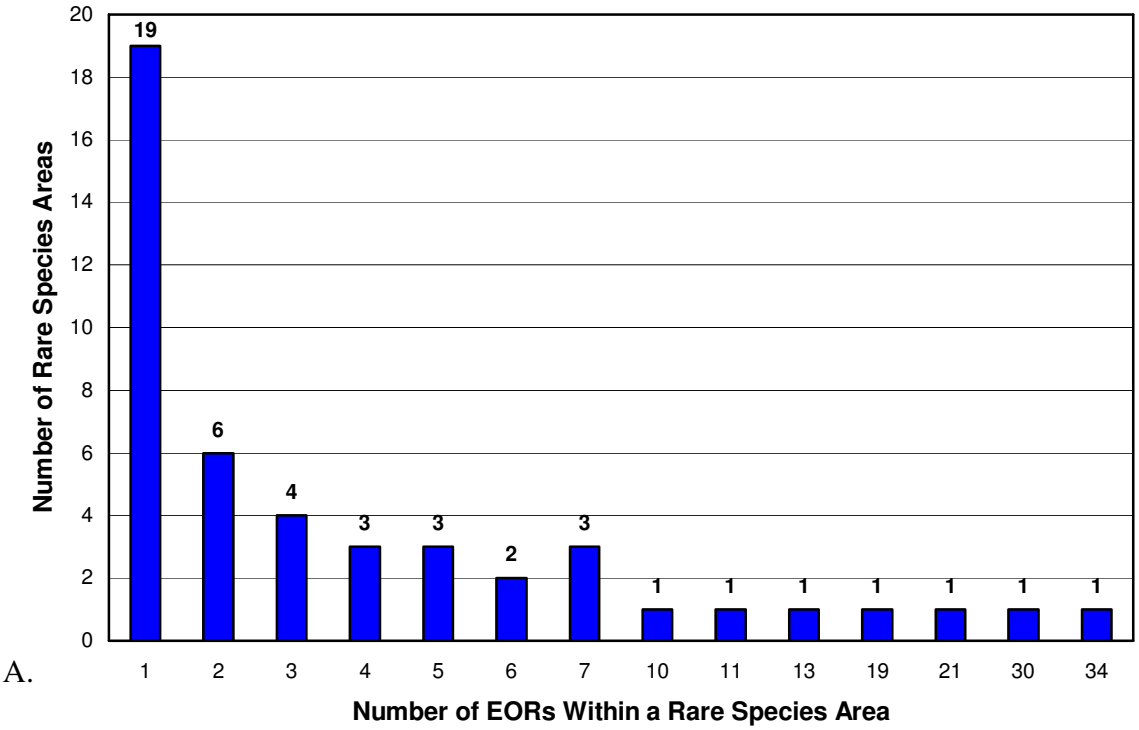
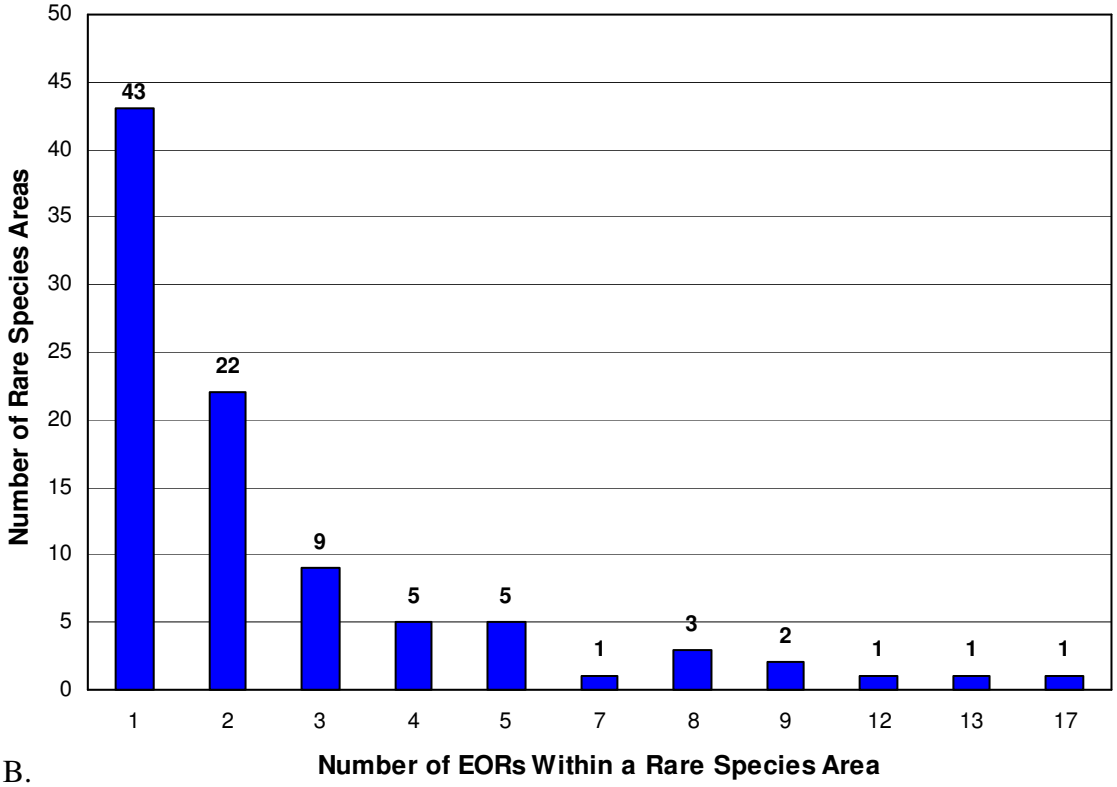


A.



B.

Figure 25. Number of 1,000 ha rare species areas (A) and 100 ha rare species areas (B) ranked by the number of Element Occurrence Records within the rare species area for the Upper Coosa River watershed, Alabama.

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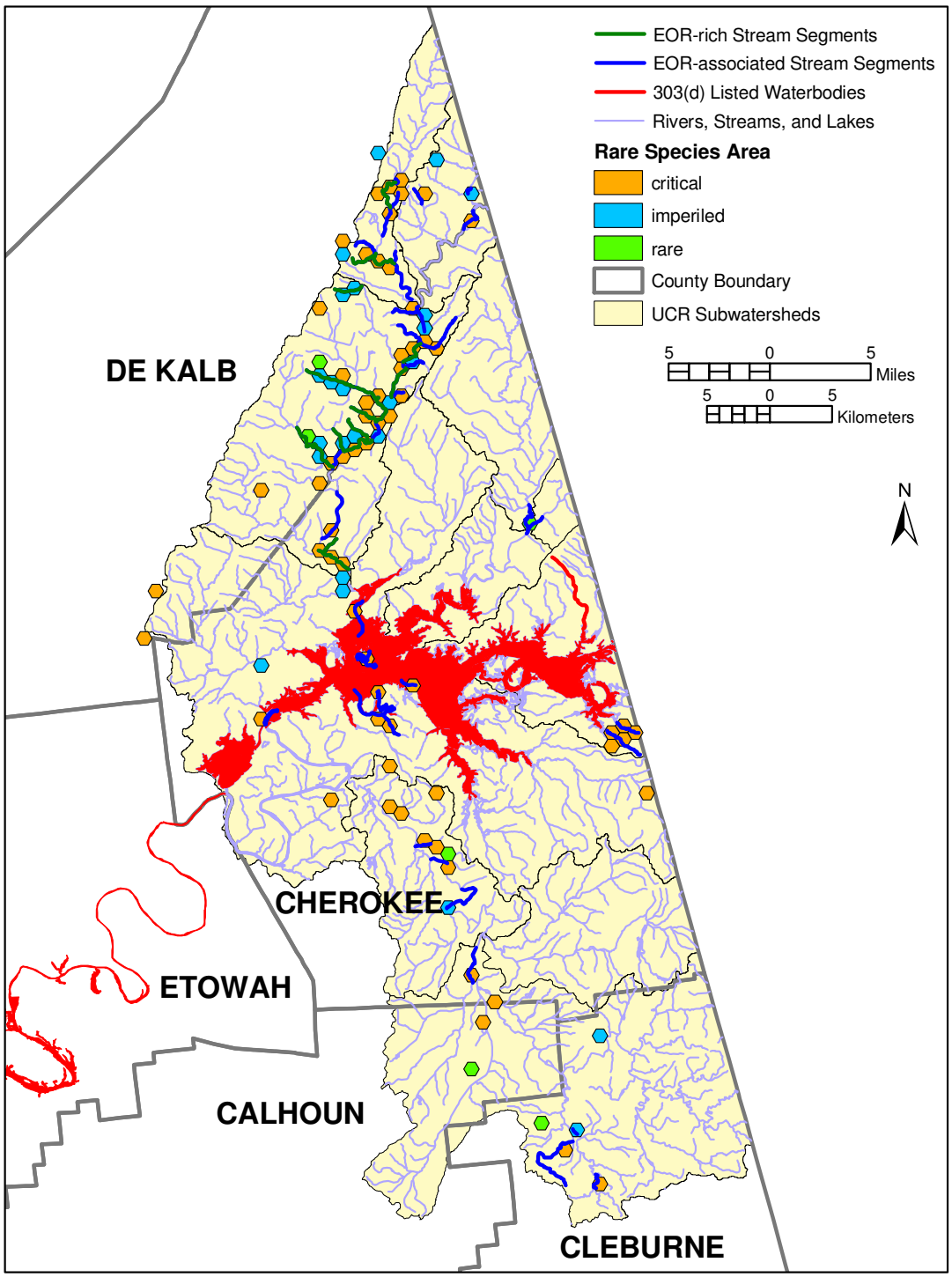

Figure 26. One hundred hectare rare species areas in the Upper Coosa River watershed, Alabama. Hexagon type was coded "critical", "imperiled", and "rare" based on the presence of federal or state protected species and heritage ranks. "Critical" hexagons were those containing federal or state protected species or species with a heritage rank of G1 or S1. "Imperiled" hexagons were those containing species with a heritage rank of G2 or S2 without federal or state protection. "Rare" hexagons were those containing species with a heritage rank of G3 – G5 without federal or state protection.

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II. Intermediate Scale

A. Riparian Vegetation

Riparian vegetation was chosen as a conservation target because of its importance in providing protection to aquatic communities and the increased biodiversity these communities add to a region. The riparian vegetation target encompasses the natural communities along the waterbodies of the UCR watershed. For a more detailed description of this conservation target and threats facing the target, see the discussion of the riparian vegetation target under the Intermediate Scale targets for the MCR watershed.

III. Local Scale

A. Freshwater Fish, Mussels, & Snails of Critical Conservation Concern

The freshwater fish, mussels and snails of critical conservation concern within the UCR watershed were selected as a conservation target because of the importance of these fauna in the watershed and the importance of the watershed to several species of the fauna. This target included those fish, mussels, and snails that are federal or state protected species or are considered globally imperiled (ranked G1 or G2). The species included in this target were blue shiner, delicate spike, upland combshell, coldwater darter, fine-lined pocketbook, Coosa moccasinshell, freckled darter (*Percina lenticula*), southern clubshell, southern pigtoe, ovate clubshell, triangular kidneyshell, and southern creekmussel (*Strophitus subvexus*). Many freshwater species historically present in the UCR watershed are now extinct, and much of the remaining freshwater fauna has exhibited declines from their historic distribution and abundance. These freshwater taxa, particularly mussels and snails, often are used as "indicator species" because they have certain physiological and ecological traits that justify their use as bioindicators of environmental health. A decline or loss of these species often indicates a water quality problem in their watershed. The greatest general threat facing these species is the isolation and small size and extent of many of their remaining populations, which makes the population extremely vulnerable to extinction. For a description of other general threats facing this target, see the discussion of this target under the local scale targets for the MCR watershed.

Blue Shiner

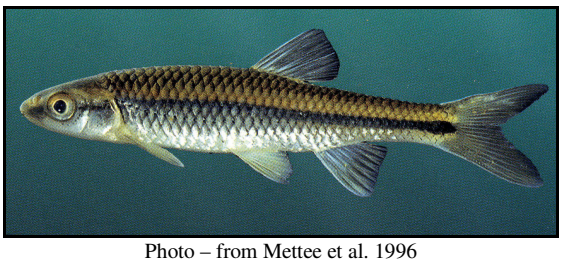

Photo – from Mettee et al. 1996

The blue shiner was listed as a federal threatened species by the USFWS 22 April 1992 (United States Fish and Wildlife Service 1992a), is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 (high conservation concern) species (Mirarchi 2004), and is considered to be imperiled globally (rank G2) and critically imperiled in Alabama (rank S1) by the NHN and TNC. Ramsey and Pierson (1986) considered this fish a species of special concern in Alabama. ALNHP had 2 occurrences documented in the UCR watershed in the Little River (120) and Spring Creek (130)

subwatersheds in Cherokee County. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Delicate Spike

Photo – Mike Gangloff

The delicate spike is considered to be rare globally (rank G3G4) and imperiled (rank S2) in Alabama by the NHN and TNC and is considered to be a Priority 1 species (highest conservation concern) by state experts (Mirarchi 2004). Williams et al. (1993) assigned the delicate spike a conservation status of special concern, and Gangloff (2003) suggested that it should be considered endangered because he found it to be much less common than other listed species in his surveys. ALNHP had 5 occurrences documented for this species in the UCR watershed. All 5 were in the Little River at the border between the Bear Creek (110) and Little River (120) subwatersheds. Gangloff (2003) did not find this species in the UCR watershed, but he had few sample points in the watershed with most restricted to Terrapin Creek and its tributaries. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Upland Combshell

Photo – Mike Gangloff

The USFWS listed the upland combshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) ranked historically occurring by the NHN and TNC. ALNHP had 1 historic occurrence documented in the UCR watershed: along Terrapin Creek in Cherokee County in the Lower Terrapin Creek (250) subwatershed last observed in 1968. This is the most recent record in the Coosa River watershed in Alabama despite additional survey efforts (Hurd 1974, Gangloff 2003). However, the most recent record in the Coosa watershed is the collection of a single individual from the Conasauga River in 1988 (United States Fish and Wildlife Service 1993). Mirarchi (2004) considered this species to be extirpated in Alabama and Gangloff (2003) suggested that the species is extinct. However, the USFWS has developed a recovery plan for this species (United States Fish and Wildlife Service 1997b), and has designated 8 units of critical habitat for this species (all currently unoccupied), including 1 unit in the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (a small part is in the MCR watershed). See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Coldwater Darter

Photo – from Mettee et al. 1996

The coldwater darter is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 (high conservation concern) species (Mirarchi 2004) and is considered a critically imperiled species (rank G1G2/S1) by the NHN and TNC. Ramsey (1986) consider this fish a species of special concern in Alabama. It is endemic to the Coosa River system. ALNHP had 2 occurrences documented in the Upper Terrapin Creek (220) subwatershed in Calhoun County, both last observed in 1986. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Fine-lined Pocketbook

Photo – Malcolm Pierson

The USFWS listed the fine-lined pocketbook as a federal threatened species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 (high conservation concern) species (Mirarchi 2004), and is considered to be imperiled (rank G2/S2) by the NHN and TNC. Williams et al. (1993) considered the species to be threatened. ALNHP had 1 historical occurrence documented in the Lower Terrapin Creek (250) subwatershed Cherokee County. The USFWS (2004b) has designated 12 critical habitat units (2 currently unoccupied) for this species, including 1 occupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Coosa Moccasinshell

Photo – from Parmalee and Bogan 1998

The USFWS listed the Coosa moccasinshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993) and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is a state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be extirpated in the

state by Mirarchi (2004), and is considered to be critically imperiled (rank G1) by the NHN and TNC. The species is currently known to occur only in the Conasauga River drainage, Georgia, and is apparently extirpated in Alabama as it has not been detected in any surveys conducted during the past 30 years (Hurd 1974, Gangloff 2003). ALNHP had no occurrences of this species documented in the UCR watershed. However, the USFWS (2004b) has designated 9 critical habitat units (only 1 of which is currently occupied) for this species, including 1 unoccupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Freckled Darter

Photo – from Mettee et al. 1996

The freckled darter was first described as a distinct species by Richards and Knapp (1964) from the Alabama River. Taxonomists consider this species, a member of the subgenus *Hadropterus*, to be one of the more primitive darters in the family Percidae (Mettee et al. 1996). It has a large maximum body size in comparison to other darters. This darter is a secretive, elusive species that is very difficult to collect using standard seining methods because of its preferred habitat; it is usually found in deep swift areas of flowing rivers and large streams (Mettee et al. 1996). Adults are most common in moderate-fast current of small to medium rivers, in deeper water (>0.8 m [2.6 ft]) in heavy cover such as log jams, undercut banks, boulders, or potholes. Juveniles occur in shallower water with a slower current, such as in vegetation in gently flowing riffles. Little is known about this darter's life history, however it presumably eats aquatic crustaceans and insects and spawns late March to early May (Mettee et al. 1996).

The freckled darter is considered to be an imperiled species (rank G2/S2) by the NHN and TNC and a Priority 3 (moderate conservation concern) species in Alabama by state experts (Mirarchi 2004). This species is a regional endemic restricted to the Mobile Bay, Pearl, and Pascagoula drainages of Alabama, Mississippi, Louisiana, and Georgia. This species experienced a major decline with construction of the Tennessee Tombigbee Waterway in Mississippi and Alabama. In Alabama, most records of the freckled darter are below the Fall Line, although scattered records exist above this line in the Cahaba and Coosa river systems. ALNHP had 1 historic occurrence documented in the UCR watershed: a record from the Little River in Cherokee County at the border between the Spring Creek (130) and Yellow Creek (140) subwatersheds. This record was prior to the construction of Weis Dam and the subsequent impoundment of this location from the formation of Weiss Lake. It is unlikely that this population is still extant unless it extended upstream to an area not impacted by the impoundment. Surveys are needed to determine if this species is still extant in the watershed.

Threats to this species include stream channelization, impoundments, excessive siltation, and pollution from mining discharges. The NHN identified the prevention of siltation or other pollution to known habitat, avoiding extensive clearcutting of the watersheds, and maintaining free-flowing stream habitat as the greatest protection needs for the freckled darter. They also recognized the need to monitor known populations.

Southern Clubshell

USGS/Florida Integrated Science Center photo

The USFWS listed the southern clubshell as a federal threatened species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 2 (high conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1G2/S1S2) by the NHN and TNC. ALNHP had 1 occurrence documented in the UCR watershed: a record from Cherokee County in the Coosa River above Weiss Lake along the border between Yellow Creek (140) and Spring Creek (200) subwatersheds. The USFWS (2004b) has designated 19 critical habitat units (6 currently unoccupied) for this species, including 1 occupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Southern Pigtoe

Photo – Mike Gangloff

The USFWS listed the southern pigtoe as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002), considered a Priority 1 (highest conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. ALNHP had no occurrences documented in the UCR watershed. However, the USFWS (2004b) has designated 9 critical habitat units (5 currently unoccupied) for this species, including 1 unoccupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties (mostly in the UCR watershed). See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Ovate Clubshell

Photo – Chuck Lydeard

The USFWS listed the ovate clubshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002), considered a Priority 1 (highest conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. ALNHP had no occurrences of this species documented in the UCR watershed. However, the USFWS (2004b) has designated 20 critical habitat units (only 6 currently occupied) for this species, including 1 unoccupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Triangular Kidneyshell

Photo – from Parmalee and Bogan 1998

The USFWS listed the triangular kidneyshell as a federal endangered species 17 March 1993 (United States Fish and Wildlife Service 1993), and designated critical habitat for the species, including portions of the Coosa River system, 1 July 2004 (United States Fish and Wildlife Service 2004b). It is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered to be a Priority 1 (highest conservation concern) species (Mirarchi 2004), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. ALNHP had no occurrences of this species documented in the UCR watershed, but small isolated populations are known from the Upper Coosa River system in Georgia. The USFWS (2004b) has designated 13 critical habitat units (6 currently unoccupied) for this species, including 1 unoccupied unit covering parts of the UCR watershed: unit 18 - Coosa River (Old River Channel) and Terrapin Creek in Cherokee, Calhoun, and Cleburne counties. See the details under this target in the MCR watershed for a more detailed discussion including the species' description, distribution, and threats facing the species.

Southern Creekmussel

The southern creekmussel is a moderately large mussel which commonly has a length <12.5 cm (4.9 in), but can reach lengths of 18.1 cm (7.1 in) (Deyrup and Franz 1994). The shell is thin to moderately thick, suboval to elliptical in outline, and moderately inflated. Each valve has a single low, stumpy pseudocardinal tooth, but lateral teeth are absent. Periostracum color varies

Photo – Trisha Menker

from greenish yellow to brown with green rays often present on the posterior slope (Deyrup and Franz 1994). This species typically inhabits small to large creeks with a substrate varying from sand to sandy mud in slow or no current, but it also has been found in small to large rivers. Adults are essentially sessile, so the greatest potential for mobility occurs during the glochidial stage on fish. The southern creekmussel can use a wide variety of fish species as a host for its glochidia. Gravid females have been observed from late February to mid-March (Haag and Warren 1997).

The southern creekmussel is considered globally rare (G3) and imperiled in Alabama (rank S2) by the NHN and TNC and a Priority 3 (moderate conservation concern) species by state experts (Mirarchi 2004). Historically, this species occurred in most Gulf Coast drainages from the Sabine River in Louisiana and Texas east to the Apalachicola, Chattahoochee, and Flint (ACF) basin and was found throughout Alabama south of the Tennessee River system. Little is known about the historical abundance of this species, but it appears to be extirpated from many historic localities (Brim Box and Williams 2000). ALNHP had 1 occurrence documented in the UCR watershed: a record from South Fork Terrapin Creek in the Talladega National Forest located in Cleburne County in the Upper Terrapin Creek (220) subwatershed. Gangloff (2003) also found this species in Terrapin Creek during his qualitative searches.

Potential threats to this species include impoundments, water withdrawals, urbanization and pollution from both point and non-point sources. This species appears to be most common in mid-channel river habitats that are most often impacted by excess sedimentation and overall channel modifications.

B. Imperiled Salamanders

This target included those salamanders that are state protected species or are considered imperiled in Alabama (ranked S1 or S2); there were no federally protected or globally imperiled salamanders documented in the UCR watershed. The species included in this target were the green salamander (*Aneides aeneus*) and seepage salamander (*Desmognathus aeneus*). The loss and degradation of habitats due to forest and wetland conversion to other land uses (agriculture, plantation forests, and urban areas) has negatively impacted many salamander populations in the southeastern United States (Bury et al. 1995). Amphibian declines often indicate a water quality or ecosystem health problem.

Green Salamander

The green salamander is a secretive, small- to medium-sized salamander averaging 10.2 cm (4 in) total length with a maximum length of approximately 14 cm (5.5 in) (Mount 1975, Georgia Department of Natural Resources 1999). Dorsal color is black to dark brown, with large light-green to metallic yellow-green mottling similar in coloration to rock-encrusting lichens, while ventral color is light and unmarked or lightly flecked with yellow (Ashton 1986). In addition to

Photo – Jim Godwin

its greenish color, identifying features of this species are a flattened body with a rounded tail slightly longer than the body, long legs, and expanded, squared toe tips that are adaptations for living in rock crevices (Petranka 1998). The green salamander has a high habitat specificity; populations are generally found in moist, but not dripping wet, rock outcroppings or cliffs with deep shaded crevices, in caves, and occasionally beneath loose bark on dead or fallen trees or under other ground litter (Mount 1975, Ashton 1986, Petranka 1998). Breeding can occur at almost any time during warmer months, but most occurs from May through September with peaks in May to June and September to October (Petranka 1998). The average clutch size is 17 eggs with eggs deposited on the upper surface of secluded, damp rock crevices. Eggs hatch 84-91 days after deposition, and females remain with and actively guard the eggs until they are hatched (Ashton 1986, Petranka 1998).

The green salamander is an Alabama state protected species (Alabama Department of Conservation and Natural Resources 2002) considered a Priority 2 species (high conservation concern) (Mirarchi 2003) and is considered to be globally rare/apparently secure (rank G3G4) and rare (rank S3) in Alabama by the NHN and TNC. Ashton (1986) considered it a species of concern because its status in Alabama was poorly known. This salamander occurs in hilly and mountainous areas from Northern Mississippi, Alabama, and Georgia to extreme southeastern Pennsylvania (Petranka 1998). It reaches its southernmost extent in Alabama, where its distribution is scattered in the Cumberlands Plateau Region (Appalachian Plateaus) with a few scattered localities in the Fall Line Hills region in northwestern Alabama (Mount 1975, Ashton 1986). The green salamander is generally uncommon and patchily distributed throughout most of its range because of its unusual habitat requirements (Petranka 1998), but the number of extant occurrences is unknown. Its status in Alabama is poorly known and in need of further investigation and monitoring. ALNHP had 1 historic occurrence documented in the UCR watershed: a record on Lookout Mountain from DeKalb County just north of the East Fork Little River and very near the DeKalb/Cherokee County border that has not been observed since 1939. This site needs to be re-visited and surveyed to determine if the population is still extant.

Green salamander populations have declined throughout their range due to habitat loss (land and watershed development and mining) and possibly over collecting and epidemic disease (Corser 2001). Severe drought conditions may exacerbate other threats or cause presumably temporary declines. Timber harvest in the immediate vicinity of rock outcrops could lead to local extirpations as a result of the drying of crevices used for foraging, so whenever feasible, a forested buffer of at least 100 m (328 ft) should be left around occupied rock outcrops (Petranka 1998). Human-induced chemical threats include acid precipitation, heavy metals, herbicides, and pesticides (Cline 2004).

Seepage Salamander

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The seepage salamander is a secretive, small, slender, round- and relatively short-tailed salamander that may reach a maximum total length of approximately 5.7 cm (2.2 in) (Mount 1975). It has a yellow to reddish brown dorsal stripe that can be either straight or wavy and is bordered laterally by a dark band (Petranka 1998). One of the most distinctive features of this species in Alabama is the presence of a conspicuous light oval spot on the top of the thigh (Mount 1976). Seepage salamanders are most frequently found in moist or wet leaf litter in and around seepages or in terrestrial habitats adjoining small streams, but are occasionally found beneath logs, moss mats, and other surface objects (Harrison 1967, Petranka 1998). Individuals apparently spend much of their time in thick leaf litter where they forage for tiny invertebrates (Petranka 1998). Eggs are laid in small depressions in protected places, with clutch sizes ranging from 5 to 17 eggs that are attended by the female (Mount 1975).

The seepage salamander is considered a Priority 2 species (high conservation concern) in Alabama by state experts (Mirarchi 2004) and is considered to be globally rare/apparently secure (rank G3G4) and imperiled in Alabama (rank S2) by the NHN and TNC. Mount (1976) considered it a species of special concern in Alabama. This species is spottily distributed in deciduous forests from extreme southeastern Tennessee and southwestern North Carolina to central Alabama (Petranka 1998). In Alabama, it is found in 2 disjunct areas: an eastern population in the Blue Ridge and adjacent Piedmont and a western population in a portion of the Fall Line Hills Region paralleling the Fall Line from northern Hale County to southern Marion County (Mount 1975). ALNHP had 1 historic occurrence documented in the UCR watershed: a record from the Upper Terrapin Creek (220) subwatershed in Cleburne County last observed in 1968. This site needs to be re-visited and additional surveys conducted to determine if the population is still extant.

This species is extremely vulnerable to local extirpations because it is extremely habitat-specific to a habitat that is easily eliminated or rendered unsuitable. The seepage salamander likely is vulnerable to activities such as stream channelization and intensive management practices, such as destructive forest practices, that eliminate leaf litter and shading (Mount 1976, Petranka 1998). Channelization of small streams within the species range should be avoided (Mount 1976). Whenever possible, forested buffers should be left around seepages and headwater streams in areas scheduled for timber operations because these are the major breeding site of this and many other salamander species (Petranka 1998). Road construction, urbanization, and overcollection also have been involved in the decline of some populations (Folkerts 2004)

C. Caddisflies

Caddisflies were selected as a conservation target because of the diversity of caddisflies in the watershed, and because caddisflies, confined to water for much of their lives, reflect the quality of their habitat by their numbers and diversity (Harris et al. 1991). Alabama has a rich caddisfly fauna, with more species than any other state in the nation. The Coosa River basin had the second highest number of species of the major river basins in the state (Harris et al. 1991). ALNHP had 10 rare species of caddisflies documented in the UCR watershed: *Agapetus spinosus*, *Ceraclea alabamae*, *Ceraclea alces*, *Cheumatopsyche helma* (Helma's cheumatopsyche caddisfly), *Chimarra augusta*, *Hydropsyche simulans*, *Hydroptila micropotamis*, *Neophylax acutus*, *Theliopsyche melas*, and *Wormaldia shawnee*. See the discussion of this MCR watershed target for more details on general caddisfly ecology. Caddisflies have long been utilized as indicators of water quality and health of water bodies because, in general, they are more numerous and diverse in clean, well-oxygenated waters (Harris and Lawrence 1978 as cited in Harris et al. 1991). Because of their general intolerance to perturbations, they also have been incorporated into the rapid bioassessment for streams protocol (Lenat 1988, Plafkin et. al 1989).

D. Plants of Conservation Concern

The plants of critical conservation concern within the UCR watershed were selected as a conservation target because of the importance of these flora in the watershed and the importance of the watershed to several of these floral species. This target included those plants that are federal or state protected species or are considered globally imperiled (ranked G1 or G2). The federally protected species included in this target were Alabama leather-flower, whorled sunflower (*Helianthus verticillatus*), Mohr's Barbara's button, harperella (*Ptilimnium nodosum*), Little River arrow-head (*Sagittaria secundifolia*), and green pitcher plant. The plants considered globally imperiled without federal protection included in this target were Little River Canyon onion (*Allium speculae*), woodland tickseed (*Coreopsis pulchra*), Harper's dodder, glade fimbristylis (*Fimbristylis brevivaginata*), grass-leaf loosestrife (*Lysimachia graminea*), Swallen's panic-grass (*Panicum lithophilum*), Thorne's beakrush (*Rhynchospora thornei*), sun-facing coneflower (*Rudbeckia heiopsidis*), and rose gentian. Plant rarity in the CSRV ecoregion is most often associated with specific niche habitat types such as seeps, cobble bars, sandstone outcrops, river prairies, and glades that often are very restricted environments (The Nature Conservancy 2003). Plants face perhaps the widest assortment of threats throughout the

ecoregion, with direct habitat destruction from conversion to other land uses believed to be the most pervasive threat (The Nature Conservancy 2003).

Alabama Leather-flower

The Alabama leather-flower was listed by the USFWS as a federal endangered species 26 September 1986 (United States Fish and Wildlife Service 1986), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. Listing was based on the limited number of populations (2) and colony sizes, the vulnerability of the populations and plants, and the lack of knowledge on the species biology and ecology (United States Fish and Wildlife Service 1986). Since its listing, additional populations have been discovered, but the species has not been observed at the site of initial discovery (Emanuel 1998). The species is a regional endemic restricted to 6 sites in Alabama (majority in the MCR watershed) and 1 site in Georgia. ALNHP had 2 occurrences documented in the UCR watershed, both in the Lower Terrapin Creek (250) subwatershed in Cherokee county. See the details under this target in the MCR watershed for a description of the plant and threats facing the species.

Whorled Sunflower

The whorled sunflower is a perennial, rhizomatous herb with slender, pale green stems 1-4 m (3.3-13.1 ft) high that change to a reddish or brown color with age (Matthews et al. 2002). The plant has long, narrow, linear leaves that are arranged in whorls of 3-4 leaves at the mid-stem, opposite below, and alternate in the inflorescence. It flowers September – October with deep yellow flowers at the top of the plant. It is distinguished from other sunflowers by its mostly whorled leaves, glabrous stems, narrow, entire leaf blades, and its narrowly linear-lanceolate involucre bracts (United States Fish and Wildlife Service 2002). This species appears to be a narrow habitat specialist occurring in natural wet meadows or prairies and calcareous barrens (United States Fish and Wildlife Service 2002). Such habitats are not very extensive, and they are often degraded or destroyed for a number of reasons, with many having been converted to pine monocultures. Most of the remaining wet prairies exist as remnants along roadside rights-of-way where mid-successional stages are artificially maintained.

The whorled sunflower was designated as a candidate species by the USFWS (United States Fish and Wildlife Service 1999), and is considered to be critically imperiled (rank G1Q/S1) by the NHN and TNC. The whorled sunflower's range is very restricted with only 5 known populations: 1 in Tennessee and 2 each in Alabama and Georgia (United States Fish and Wildlife Service 2002). The species was first described in 1898 based on a collection from Chester County, Tennessee in 1892 (Nordman 1998). It was not collected again for more than 100 years, when it was rediscovered in 1994 in Floyd County, Georgia. Both populations discovered in Alabama since are in the UCR watershed located in Cherokee County within the Coosa River (180) subwatershed. The first population in Alabama was discovered in 1996 in a remnant strip of prairie approximately 3.2 km (2 mi) from the Georgia site. This site also contains an occurrence of the federal threatened Mohr's Barbara's button, the critically imperiled Thorne's beakrush, and 2 other rare plants tracked by ALNHP: spreading false-foxglove (*Aureolaria patula* – rank G3/S1) and Virginia mountain mint (*Pycnanthemum virginianum* – rank G5/S1). The second population was discovered along a highway in 1999 approximately 1.8 km (1.1 mi) southwest from the first Alabama population. Both populations are relatively small and under threat

The biggest threat facing the whorled sunflower is habitat destruction and degradation from incompatible land uses such as agriculture, timber harvest, and development, with industrial forest practices appearing to pose the greatest threat (United States Fish and Wildlife Service 2002). While the species is not currently known to be a component of the commercial wildflower trade, it has horticultural potential and could be threatened by taking and vandalism if it becomes part of the trade because the sites are easily accessible and plants are highly visible when flowering (United States Fish and Wildlife Service 2002). In addition, fire suppression has played in role in habitat degradation, as occasional natural occurring fires are thought to have played a role in maintaining suitable habitat. The site in Georgia where the species was initially rediscovered was protected in 2002 when Temple-Inland donated a conservation easement in Georgia's Coosa Valley Prairie to TNC. However, the other populations remain vulnerable. The initial population discovered in Alabama was negatively impacted from a timber harvest operation nearby that disturbed the population and reduced the number of plants found at the site. The other Alabama population occurs along a highway, so herbicide application and/or vegetation removal pose a threat to the population. This species remains extremely vulnerable because the small number of sites and generally small population size leave the species susceptible to extinction from a single natural or unnatural disaster.

Mohr's Barbara's Button

Photo – from Johnson and Wehrle 2004

Mohr's Barbara's button was listed by the USFWS as a federal threatened species 7 September 1988 (United States Fish and Wildlife Service 1988a), and is considered to be rare (rank G3/S3) by the NHN and TNC. It was considered to be an endangered species in Alabama in the unofficial listings of both Thomas (1976) and Freeman et al. (1979). This species is a regional endemic found in the Appalachian plateau of northwestern Georgia (Lookout Mountain) and north Alabama, and is known from approximately 22 very

localized sites (United States Fish and Wildlife Service 1991c). Mohr's Barbara's button is rare over most of it limited range, and is declining due to habitat loss. ALNHP had 7 occurrences documented in the UCR watershed in the Coosa River (180), Spring Creek (200), Lower Terrapin Creek (250), and Sugar Creek (260) subwatersheds in Cherokee County. See the details under this target in the MCR watershed for a description of the plant and threats facing the species.

Harperella

Photo - USFWS

Harperella is a small annual herb that is a member of the carrot family (Apiaceae). It has slender, erect stems up to 1.2 m (3.9 ft) high, and hollow, quill-like leaves. Small clusters of small, white flowers bloom mostly in June and August. Harperella is generally found in 2 habitat types: (1) seasonally flooded rocky or gravel shoals and margins of swift-flowing, clear stream sections, and (2) the edges of coastal plain ponds or low, wet savannah meadows (United States Fish and Wildlife Service 1988b, 1990a). It is only known to occur in the second habitat type in South Carolina. This species is always found on saturated substrates. It is dependent on narrowly defined hydrologic conditions, and readily tolerates periodic, moderate flooding. Near rivers, fluctuating water levels often knock over the flowering stems, depositing the seeds in wet or moist soil near the site of the fallen flower.

Harperella was listed as a federal endangered species by the USFWS 28 September 1988 (United States Fish and Wildlife Service 1988b), and is considered to be globally imperiled (rank G2) and critically imperiled (rank S1) in Alabama by the NHN and TNC. It was considered to be a threatened species in Alabama in the unofficial listings of both Thomas (1976) and Freeman et al. (1979). Historically, this species was distributed across the southeast with populations in Maryland, West Virginia, North Carolina, South Carolina, Georgia, and Alabama. The plant is still found in these states, although in fewer numbers and populations, and a new population was recently found in Arkansas (United States Fish and Wildlife Service 1990a). Approximately half of the historic populations have been extirpated (United States Fish and Wildlife Service 1988b, 1990a), and harperella is currently believed to be extant in only about 15-20 populations. ALNHP had 10 occurrences documented in Alabama. However, 4 of them were historic occurrences that been observed for >50 years with several of the sites known to have been not been destroyed by impoundments or habitat degradation. Of the 6 occurrences observed more recently, 5 are in the UCR watershed in DeKalb and Cherokee counties scattered along the Little River in the Bear Creek (110) and Little River (120) subwatersheds. All occurrences are within the corridor of managed land along the Little River formed by DeSoto State Park, Little River Wildlife Management Area, and Little River Canyon National Preserve. The USFWS considers this to be one population with the individual occurrence locations being subpopulations (United States Fish and Wildlife Service 1990a). Maintaining these subpopulations is important for keeping harperella as a component of Alabama's floral species, because the only population known to still be extant in Alabama outside this area is a small population (<100 plants) on Town Creek in DeKalb County.

Harperella can be easily extirpated from an area, even by seemingly minor perturbations, because of its very specific habitat requirements. Over half of the remaining known populations are faced with continuing habitat degradation. Although stream populations may be large with regard to the number of individuals, destruction or degradation of their habitat would be equally effective at extirpating the population regardless of their number. Primary threats to the persistence of harperella populations involve manipulations of water flow and water quality, with the source of threats including development, agricultural activities, dam building and hydrological manipulation, logging, water diversion, sedimentation, water quality degradation, ditching, draining, and the appearance of alien (non-native) competitors (United States Fish and Wildlife Service 1990a). Small populations are particularly susceptible to loss during high water events. While certain critical sections of river corridors may need protection, the integrity of the upstream drainage systems also should be protected against watershed perturbations to minimize the impacts from intensive land use practices such as mining, impoundment, construction, agriculture, and hydrological flow alterations.

Little River Arrow-head

Photo – from Johnson and Wehrle 2004

Little River arrow-head is a submersed to emersed aquatic perennial arising from a stiff, elongated rhizome up to 10 cm (3.9 in) in length (United States Fish and Wildlife Service 1991e). It has 2 types of leaves where the shape of the leaves depends on the water velocity and depth in which the plant occurs. In swift shallows, the leaves are linear, rigid, sickle-shaped, and 5-8 cm (2-3 in) in length; quiet, deep waters, the leaves are more quill-like, linear and tapering, and longer, up to 10-30 cm (3.9-11.8 in) (United States Fish and Wildlife Service 1990b). Flowering stems are erect, emergent, and bear separate male and female flowers near the apex on stalks 10-50 cm (4-20 in) long. The species blooms infrequently from May into the fall, and only the white petaled male flowers are conspicuous (United States Fish and Wildlife Service 1991e). The fruit consists of a cluster of achenes approximately 2 mm (0.08 in) in length.

Little River arrow-head occurs in undammed riverine reaches on frequently exposed shoals or rooted among loose boulders in sands, gravels, and silts in pools up to 1 m (3.2 ft) deep (United States Fish and Wildlife Service 1990b). The stream bottoms are typically narrow and bounded by steep slopes. Where suitable habitat exists, the plants grow in nearly pure stands, although several endangered or candidate plants occur in associated habitat at several sites.

The Little River arrow-head was listed by the USFWS as a federal threatened species 13 April 1990 (United States Fish and Wildlife Service 1990c), and is considered to be critically imperiled (rank G1/S1) by the NHN and TNC. This species is a regional endemic with a very

narrow range. When listed by the USFWS, it was only known from the Little River drainage system on Lookout Mountain in northeast Alabama and northwest Georgia and a historical, extirpated population from Town Creek in the Sand Mountain area in DeKalb County, Alabama (United States Fish and Wildlife Service 1990b). Since its listing, an additional small population was discovered in the Sipsey Fork Bluffs area in Winston County, Alabama. However, this is the only non-historic occurrence in Alabama documented outside the UCR watershed. ALNHP had 5 occurrences documented in the UCR watershed along Little River in DeKalb and Cherokee counties in the Bear Creek (110), Little River (120), and West Fork of the Little River (080) subwatersheds.

A major threat to this species is the elimination or adverse modification of its already limited habitat. The major threat facing the species is increased turbidity and sedimentation and water quality degradation from intensive land-use practices in the adjacent watershed such as silvicultural activities, residential-recreational development, surface mining, or agricultural activities (United States Fish and Wildlife Service 1991e). These types of impacts are likely what caused the extirpation of the Town Creek population. The Little River populations also may be adversely affected by eutrophication from garbage dumping and leaking sewage systems (United States Fish and Wildlife Service 1991e).

Green Pitcher Plant

The green pitcher plant was listed by the USFWS as a federal endangered species 21 September 1979 (United States Fish and Wildlife Service 1979), and is considered to be imperiled (rank G2/S2) by the NHN and TNC. It was considered to be an endangered species in Alabama in the unofficial listings of both Thomas (1976) and Freeman et al. (1979). Historically this species was found throughout the Coastal Plain and Piedmont of Alabama, Georgia, southwestern North Carolina, and Tennessee (United States Fish and Wildlife Service 1994a). The plant was once very common throughout its range, but is now restricted to 35 sites in northeastern Alabama, north Georgia, and southwestern North Carolina due to habitat loss from land conversion to residential, agricultural, silvicultural, or industrial uses (Emanuel 2002). Thirty-three of the extant sites are in Alabama. ALNHP had 28 occurrences documented in the UCR watershed in the West Fork of the Little River (080), Bear Creek (110), Little River (120), and Spring Creek (200) subwatersheds in Cherokee and DeKalb counties. See the details under this target in the MCR watershed for a description of the plant and threats facing the species.

Human Context Information

Managed Areas

There were 7 managed areas identified within the UCR watershed: Talladega National Forest (TNF), Choccolocco Wildlife Management Area (CWMA), Little River Wildlife Management Area (LRWMA), Little River Canyon National Preserve (LRCNP), DeSoto State Park (DSP), DeSoto Woods Preserve (DWP), and Coosa River Bog Preserve (CRBP) (Fig. 27). The managed areas were clustered in 2 concentrations in the watershed with CRBP, LRWMA, DSP, LRCNP, and DWP along the Little River in the northern section of the watershed and TNF and CWMA along the southern edge of the watershed. Slightly more than half (53.3%) of the rare occurrences documented in the UCR watershed were on managed areas. However, less than half (48.2%) of the federal threatened or endangered species occurrences were documented in these managed areas. Therefore, maintaining habitat for rare, threatened, and endangered species will require not only appropriate management of public lands, but also outreach to landowners and potential public-private partnerships for private land management.

I. Talladega National Forest

The Talladega National Forest was created out of the Talladega and Oakmulgee Purchase Units 17 July 1936 by proclamation from President Franklin D. Roosevelt. The Talladega Division of the Talladega National Forest (TDTNF) is a 92,511-ha (228,600-ac) division administered by 2 ranger districts, Shoal Creek Ranger District (SCRD) and Talladega Ranger District (TDR), located in east-central Alabama in Calhoun, Cherokee, Clay, Cleburne, and Talladega counties (a map of the Talladega and Shoal Creek Ranger Districts is available online at <http://www.r8web.com/alabama/talladega/tal-directions.htm>). Only the SCRD extends into the UCR watershed with approximately 25% of the total acreage covered by the TDTNF occurring in the UCR watershed, encompassing land within the Upper Terrapin Creek (220) and Hurricane Creek (240) subwatersheds (Fig. 27). The Talladega Division is managed for multiple resource values including wildlife, water, recreation, and wood products. It surrounds the southernmost extension of the Appalachian mountain chain that includes Cheaha Mountain, Alabama's highest point at 734 meters (2,407 feet).

There were 7 species with 1 occurrence each documented in TDTNF (Table 18) in the UCR watershed, none of which have federal or state protection. The most recent observation for any of these species is >10 years. A thorough survey of Shoal Creek Ranger District is needed to determine if these species are still extant in the area or other species are present.

Dugger Mountain Wilderness Area is the only special designated area in the TDTNF located in the UCR watershed. Although TDTNF contains 4 National Forest Inventoried Roadless Areas,

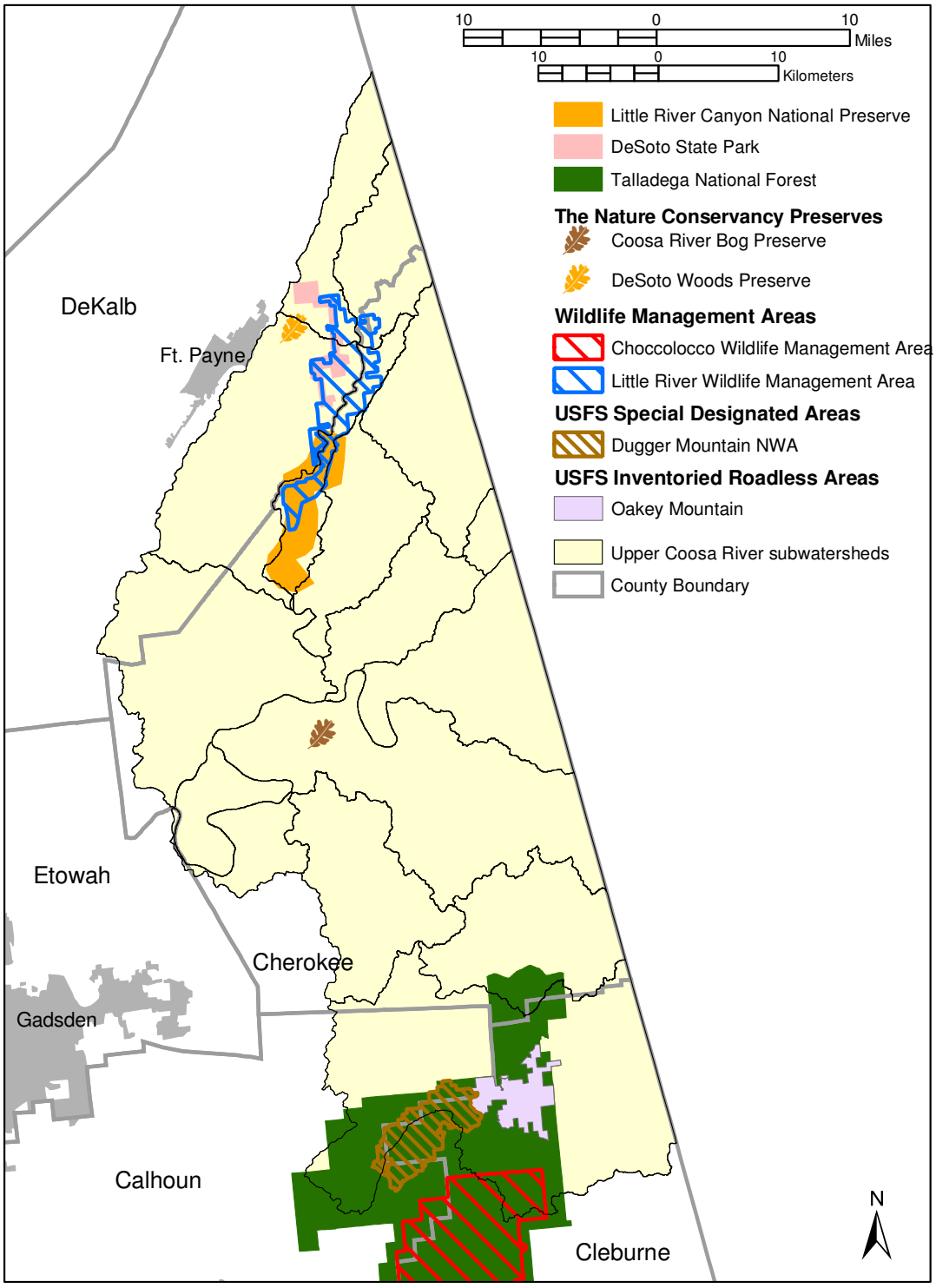

Figure 27. Managed areas within the Upper Coosa River watershed; Calhoun, Cherokee, Cleburne, De Kalb, and Etowah counties, Alabama. The Nature Conservancy preserves are approximate locations and do not represent precise boundaries. The Talladega National Forest boundary is the proclamation boundary and does not reflect federal ownership because there are private inholdings within the proclamation boundary.

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Table 18. Rare, threatened, and endangered species documented by the Alabama Natural Heritage Program[SM] occurring in the Shoal Creek Ranger District of the Talladega Division of the Talladega National Forest, Alabama in the Upper Coosa River watershed. None of the species are federal or state protected species.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	Last Observed
Amphibians	*Desmognathus aeneus*	seepage salamander	G3G4	S2	1	1968-04-23
Insects	*Chimarra augusta*	caddisfly	GNR	S1	1	
Insects	*Neophylax acutus*	caddisfly	GNR	S1	1	
Mussels	*Strophitus subvexus*	southern creekmussel	G3	S2	1	1992-06-30
Snails	*Elimia gerhardti*	coldwater elimia	G5	S3S4	1	1992-06-30
Vascular Plants	*Jamesianthus alabamensis*	jamesianthus	G3	S3	1	1993-09-09
Vascular Plants	*Gentiana saponaria*	soapwort gentian	G5	S3	1	1981-10-01

[a] See Appendix B for an explanation of Global and State Ranks.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of December 2003.

only Oakey Mountain Roadless Area occurs in the UCR watershed. In addition to these designated areas, Marshall and Wills (2003) identified 2 additional wild areas within the TDTNF in the UCR watershed they recommended be protected from further road construction, industrial timber harvests, and other intensive management activities by designated the area as a scenic area (Maxwell Gap) or wilderness (Oakey Mountain).

A. Dugger Mountain Wilderness Area

Dugger Mountain Wilderness (DMW) encompasses approximately 3,723 ha (9,200 ac) on the SCRD in Cleburne and Calhoun counties (Fig. 27). DMW is on the southern edge of the UCR watershed in the Upper Terrapin Creek (220) subwatershed, with approximately half of its area outside the UCR watershed. Dugger Mountain was managed as a wilderness study area beginning in 1986, and was designated by Congress as a wilderness area November 1999. Dugger Mountain is the second highest peak in Alabama with an elevation of 652 m (2,140 ft). ALNHP had no rare species documented in DMW. However, the Alabama Environmental Council has reported the federal threatened blue shiner (*Cyprinella caerulea*) occurs there. A survey of this area is needed to verify if rare species are present.

B. Oakey Mountain Roadless Area

Oakey Mountain Roadless Area (OMRA) consists of approximately 2,460 ha (6,080 ac) on the north end of the Shoal Creek Ranger District in the Talladega National Forest located mostly in Cleburne County with a small portion in Calhoun County (Upper Terrapin Creek subwatershed - HUC 220) and adjacent to Dugger Mountain Wilderness Area (Fig. 27). Most of the area consists of mountainous type topography typical of the foothills of the Appalachian Mountain chain with moderately steep terrain over the majority of the area and very steep terrain on Oakey Mountain and its immediate vicinity (United States Forest Service 2003). Elevations range from 232 m (760 ft) to 591 m (1,938 ft) on Oakey Mountain. The forest type is predominately oak-hickory-pine, with smaller areas of predominately pine forest. This area was not recommended for wilderness designation in the USFS Draft Management Plan for TNF because of the irregular pattern of its boundaries (United States Forest Service 2003).

ALNHP had no rare species documented within OMRA. However, there were 3 occurrences just outside the boundaries and the USFS (2003) reported OMRA includes potential habitat for at least 22 terrestrial vertebrate species of viability concern. USFS (2003) also reported that rare communities and habitat associations of the OMRA include mountain longleaf, mixed shortleaf/longleaf, open pine hardwood, riparian zones, loblolly flats, cliff faces, mesic hardwood, xeric oak/pine ridgetops, and talus slopes; and possibly include springs, seeps, glades, rocky barrens chert/limestone formations, and mesic basic forests. Many of these rare community types require active forest management practices, particularly the use of prescribed fire. A survey of this area is needed to verify which, if any, of the potential rare species occur there.

II. Little River Canyon National Preserve

Little River Canyon National Preserve is a 5,666 ha (14,000 ac) national preserve managed by the National Park Service in conjunction with its partners located in Cherokee and DeKalb

counties (Fig. 27). The Preserve consists of 4,184 ha (10,338 ac) under federal ownership and 1,482 ha (3,662 ac) in nonfederal ownership (United States National Park Service 2003), and encompasses land within the West Fork of the Little River (080), East Fork of the Little River (100), Bear Creek (110), Little River (120), and Spring Creek (130) subwatersheds.


Little River Falls

LRCNP was established and made a unit of the National Park System by Public Law 102-427 on 21 October 1992 to protect and preserve the natural, scenic, recreational and cultural resources of the area and to provide for public enjoyment of those resources (United States National Park Service 2003). The Preserve includes DeSoto State Park and Little River Wildlife Management Area. Prior to the establishment of LRCNP, the Alabama Legislature designated the Little River south of the Alabama State Highway 35 bridge to the mouth of the canyon as a State Wild and Scenic River in 19969.


Little River Canyon

Little River is a high gradient river that flows along the top of Lookout Mountain, and is unique in that it forms and flows on the top of the mountain almost all of its entire length before emptying into Weiss Lake (National Park Service 1991). Little River Falls, a 14 m (45 ft) waterfall at AL Highway 35, separates the plateau section and canyon section of the river. Below the falls, Little River has cut a deep sandstone gorge to form Little River Canyon, which is one of the deepest and longest gorges east of the Rocky Mountains. Little River flows out of the canyon as it leaves Lookout Mountain at Canyon Mouth Park, which is owned by Cherokee County. The river is among the cleanest and wildest waterways in the south because it is free-flowing with relatively few man-made developments to pollute its water.

There were 146 occurrences of 43 rare species and natural communities documented by ALNHP in LRCNP (Table 19), including occurrences in DeSoto State Park and Little River Wildlife

Table 19. Rare, threatened, and endangered species documented by the Alabama Natural Heritage Program[SM] occurring in the Little River Canyon National Preserve, Alabama (including DeSoto State Park and Little River Wildlife Management Area) in the Upper Coosa River watershed.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	Last Observed
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	1	1994
Insects	*Agapetus spinosus*	caddisfly	GNR	S1	1 [c]	
Insects	*Ceraclea alabamae*	caddisfly	G1	S1	2 [c]	
Insects	*Ceraclea alces*	caddisfly	GNR	S1	2 [c]	
Insects	*Cheumatopsyche helma*	Helma's cheumatopsyche caddisfly	G1G3	S1	1 [c]	
Insects	*Hydroptila micropotamis*	caddisfly	G1	S1	1	
Insects	*Theliopsyche melas*	caddisfly	GNR	S1	1	
Insects	*Wormaldia shawnee*	caddisfly	GNR	S1	1 [c]	
Mussels	*Elliptio arctata*	delicate spike	G3G4	S2	5	1998-10-01
Natural Communities	*Bigelowia nuttallii - Coreopsis pulchra -Liatris microcephala*	sandstone glade	G2?	S2	4 [d]	1997-10-05
Non Vascular Plants	*Fontinalis welchiana*	difficult moss	GU	S1	1 [d]	1989
Reptiles	*Pituophis melanoleucus melanoleucus*	northern pine snake	G4T4	S3	1 [d]	1997-04-03
Vascular Plants	*Allium speculae*	Little River Canyon onion	G2	S2	14 [e]	1997-06-08
Vascular Plants	*Amelanchier arborea*	downy serviceberry	G5	S1?	1	1994-09-09
Vascular Plants	*Aster spectabilis*	showy aster	G5	S2	1 [d]	1980-08-29
Vascular Plants	*Bigelowia nuttallii*	Nuttall's rayless goldenrod	G3G4	S3	15 [cf]	2000-07-27
Vascular Plants	*Coreopsis pulchra*	woodland tickseed	G2	S2	8 [gh]	2000-07-27
Vascular Plants	*Cuscuta harperi*	Harper's dodder	G2	S2	10 [f]	1998-06-09
Vascular Plants	*Cypripedium acaule*	pink lady's-slipper	G5	S3	1 [c]	1993-09-10
Vascular Plants	*Diamorpha smallii*	elf orpine	G4	S3	1 [d]	1987-05-20
Vascular Plants	*Fimbristylis brevivaginata*	glade fimbristylis	G2	S1	1	1994-06-08
Vascular Plants	*Fothergilla major*	mountain witch-alder	G3	S2	2	2000-04-08
Vascular Plants	*Helianthus longifolius*	longleaf sunflower	G3	S1S2	1	1994-09-07
Vascular Plants	*Isotria verticillata*	large whorled pogonia	G5	S2	2 [d]	2001-05-10
Vascular Plants	*Lathyrus venosus*	smooth veiny peavine	G5	S1	1	2002-10-17
Vascular Plants	*Lindernia monticola*	Piedmont pimpernel	G4	S3	2 [d]	1994-06-09
Vascular Plants	*Lobelia boykinii*	Boykin's lobelia	G2G3	S1S2	1	1981-08-27
Vascular Plants	*Lonicera flava*	yellow honeysuckle	G5?	S3	3	1967-04-15
Vascular Plants	*Melanthium parviflorum*	small-flowered false hellebore	G4?	S1S2	3 [cd]	2003-10-22
Vascular Plants	*Nestronia umbellula*	nestronia	G4	S2	3 [h]	2001-05-19
Vascular Plants	*Panicum lithophilum*	Swallen's panic-grass	G2G3Q	S1	1	1994-06-08
Vascular Plants	*Polygonella americana*	southern jointweed	G5	S1	2	2002-10-18

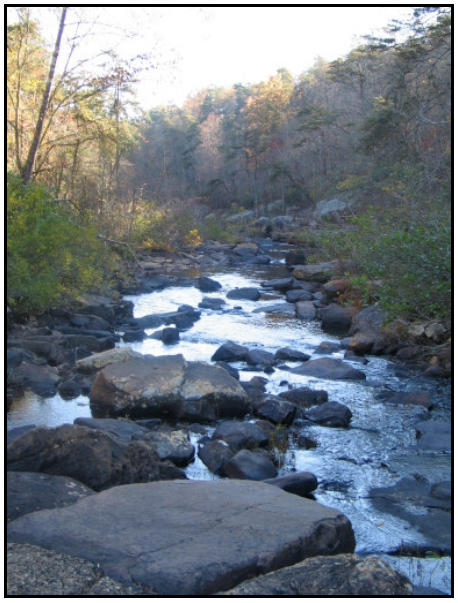
Table 19. Continued.

Major Group	Scientific name	Common Name	Global Rank[a]	State Rank[a]	Number of Occurrences[b]	Last Observed
Vascular Plants	*Ptilimnium nodosum*	harperella	G2	S1	4 [h]	1994-07-15
Vascular Plants	*Pyrularia pubera*	buffalo-nut	G5	S2	2 [cd]	2000-06-07
Vascular Plants	*Ribes curvatum*	granite gooseberry	G4	S2	1 [c]	1959-05-09
Vascular Plants	*Ribes cycynosbati*	prickly gooseberry	G5	S1S2	3	1966-10-15
Vascular Plants	*Rudbeckia heliopsidis*	sun-facing coneflower	G2	S2	13 [ci]	1994-09-09
Vascular Plants	*Sabatia capitata*	rose gentian	G2	S2	1	1992-07-21
Vascular Plants	*Sagittaria secundifolia*	Little River arrow-head	G1	S1	3 [f]	1994-07-15
Vascular Plants	*Sarracenia oreophila*	green pitcher plant	G2	S2	20 [cj]	2003
Vascular Plants	*Schoenolirion croceum*	yellow sunnybell	G4	S2	2 [d]	1994-06-08
Vascular Plants	*Silene caroliniana* ssp *wherryi*	Wherry's catchfly	G5T2T4Q	S1S2	1	1969-04-12
Vascular Plants	*Talinum mengesii*	Menge's fame-flower	G3	S2S3	2 [c]	1993-09-09

[a] See Appendix B for an explanation of Global and State Ranks.
[b] Number of Element Occurrence Records in ALNHP's Biological Conservation Database as of December 2003.
[c] 1 occurrence in DeSoto State Park.
[d] 1 occurrence in Little River Wildlife Management Area
[e] 6 occurrences in Little River Wildlife Management Area
[f] 2 occurrences in Little River Wildlife Management Area
[g] 2 occurrences in DeSoto State Park.
[h] 3 occurrences in Little River Wildlife Management Area
[i] 6 occurrences in Little River Wildlife Management Area
[j] 17 occurrences in Little River Wildlife Management Area

Management Area. This includes 28 occurrences of 4 federal protected species: 1 occurrence of the federal threatened blue shiner, 3 occurrences of the federal threatened Little River arrow-head, 4 occurrences of the federal endangered harperella, and 20 occurrences of the federal endangered green pitcher plant.

III. DeSoto State Park



Little River in DeSoto State Park

DeSoto State Park (DSP) is a 1,214 ha (3,000 ac) state park atop Lookout Mountain located 13 km (8 mi) northeast of Fort Payne in DeKalb County (Fig. 27). DSP encompasses land within the West Fork of the Little River (080) and Bear Creek (110) subwatersheds. DSP lies within the preserve boundary of LRCNP, and along with the Preserve and LRWMA forms a continuous corridor of public land along a small section of the West Fork Little River and most of Little River. DSP was developed in the mid 1930's by members of he Civilian Conservation Corps. The park includes DeSoto Falls and Lake, a 32 m (104 ft) waterfall with an historic dam creating a lake above the falls, and numerous other smaller waterfalls. Of the 146 occurrences of rare species documented in the LRCNP area, 15 occurrences of 14 species were documented in DSP (Table 19).

IV. Little River Wildlife Management Area

Littler River Wildlife Management Area (LRWMA) is a 6,173 ha (15,255 ac) wildlife management area managed by ADCNR located in Cherokee and DeKalb counties near Centre (Fig. 27) (a map of the management area is available online at <http://www.dcnr.state.al.us/agfd/littleriver_wma.jpg>). LRWMA is located in the northern portion of the UCR watershed and encompasses land within the West Fork of the Little River (080), East Fork of the Little River (100), Bear Creek (110), and Little River (120) subwatersheds. LRWMA was established in 1967 and is managed as a public hunting area through cooperative agreements between ADCNR and the landowners. The major landowners are Alabama Power Company, Inland-Rome, Inc., and Alabama State Parks. Of the 146 occurrences of rare species documented in the LRCNP area, 54 occurrences of 20 species or natural communities were documented in LRWMA (Table 19).

V. Choccolocco Wildlife Management Area

Choccolocco Wildlife Management Area (CWMA) is a 18,838 ha (46,550 ac) wildlife management area managed by the Alabama Department of Conservation and Natural Resources located in Calhoun and Cleburne counties, Alabama (Fig. 27) (a map of the management area is available online at <http://www.dcnr.state.al.us/agfd/chocco_wma.jpg >). CWMA is located within the Shoal Creek Ranger District of the Talladega National Forest, U.S. Forest Service. The majority of CWMA is outside the UCR watershed boundaries with only a very small section on the southern edge of the UCR watershed in the Upper Terrapin Creek (220) subwatershed. ALNHP had 1 rare species occurrence (a caddisfly, *Chimarra augusta* – rank GNR/S1) documented within the CWMA boundaries in the UCR watershed in the Upper Terrapin Creek (220) subwatershed.

VI. The Nature Conservancy Preserves

TNC's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. They operate the largest system of private nature sanctuaries in the world with 1,600 preserves worldwide. TNC has 2 preserves within the UCR watershed: Coosa River Bog Preserve (CRBP) and DeSoto Woods Preserve (DWP).

A. Coosa River Bog Preserve

CRBP is a 1.3 ha (3.3 ac) private preserve located in a residential area of Cherokee County in the Spring Creek (200) subwatershed (Fig. 27). CRBP was the first Alabama acquisition for TNC after opening the state chapter in 1989, and was acquired to protect the federal endangered green pitcher plant. It contains a well developed and increasingly rare seepage bog community. This bog is especially unique because it supports one of the largest remaining green pitcher plant populations, a colony of approximately 1,000 individuals. Grass-leaf loosestrife (rank G1Q/S1) has also been documented at this site.

green pitcher plants at Coosa Bog
©Keith Tassin

B. DeSoto Woods Preserve

DWP is a 22 ha (54 ac) private preserve located within the city limits of Fort Payne in the Bear Creek (110) subwatershed (Fig. 27). DWP was acquired to protect a rare natural community

Photo – TNC

type and protects a small stand (approximately 12 ha [30 ac]) of old growth upland oak climax forest. The forest is a rare example of a southern hardwood stand over 100 years old. Such forest on top of the Cumberland Plateau is rare because extensive logging and agricultural use has greatly depleted most forests this age. The forest is dominated by oaks, but ash, gum, maple (*Acer* sp.), and tulip poplar are also present. A cool moist environment is created by two small streams flowing through the middle of the woods and heavy shading from the canopy, resulting in an understory consisting of a rich mat of ferns, lichens, algae, mosses, and many other herbaceous species. Rare species documented occurring on DWP were 3 occurrences of Nuttall's rayless goldenrod, 2 occurrences of woodland tickseed, and 1 occurrence each of Harper's dodder and Menge's fame-flower (*Talinum mengesii* – rank G3/S2S3). The main threat to this site is negative impacts from residential development in the surrounding area.

Land Cover

Land cover within the watershed was predominately forest (Fig. 28) mixed with rowcrop and pasture and, to a lesser extent, water (Tables 20 & 21). Although the majority of the overall watershed was forested, individual subwatersheds ranged from 25 to 98% forested from ASWCC estimates and 36.4 to 95.4% forested from NLCD calculations (Tables 20 & 21). A significant proportion of the watershed is under agricultural use (rowcrop or pasture), but the proportion of agricultural land varies widely by subwatersheds with rowcrop generally more prevalent than pasture. The majority (60%) of subwatersheds contained $\geq$10% rowcrop, with approximately a quarter of the subwatersheds estimated to be >25% rowcrop by the ASWCC (Table 21). Rowcrop was particularly prevalent in the Coosa River subwatershed (270), which was 53% rowcrop. There was little urban land in the watershed, and ASWCC (1998) estimated that 8 of the 15 subwatersheds had no urban land.

Overall, land cover percentages were similar between the ASWCC estimates and estimates obtained from NLCD calculations (Tables 20 & 21). The percentage of the watershed classified as urban was much lower for the NLCD estimate (0.5%) than for the ASWCC estimates (3%). This is likely a reflection of errors within the data set, and the fact that the images used to estimate land cover for the NLCD are somewhat dated (early 1990s) and do not depict the increased urbanization that has occurred in the watershed since. The accuracy of the classification is strongly related to the homogeneity of the land use (Zhu et al. 2000). Classification accuracy tends to decrease with increased heterogeneity in the landscape, particularly if the different land use parcels are small. Much of the landscape in the UCR watershed outside the large public land blocks exhibits this heterogeneous nature, which can lead to difficulties with the classification. Although the NLCD data is widely used, it is recognized to have errors within the data, with widely varying accuracy for the various classes. Overall accuracy of the classification for Region 4 was estimated to be 62 to 81% depending on the accuracy assessment technique used (United States Geological Survey 2004). In general, water,

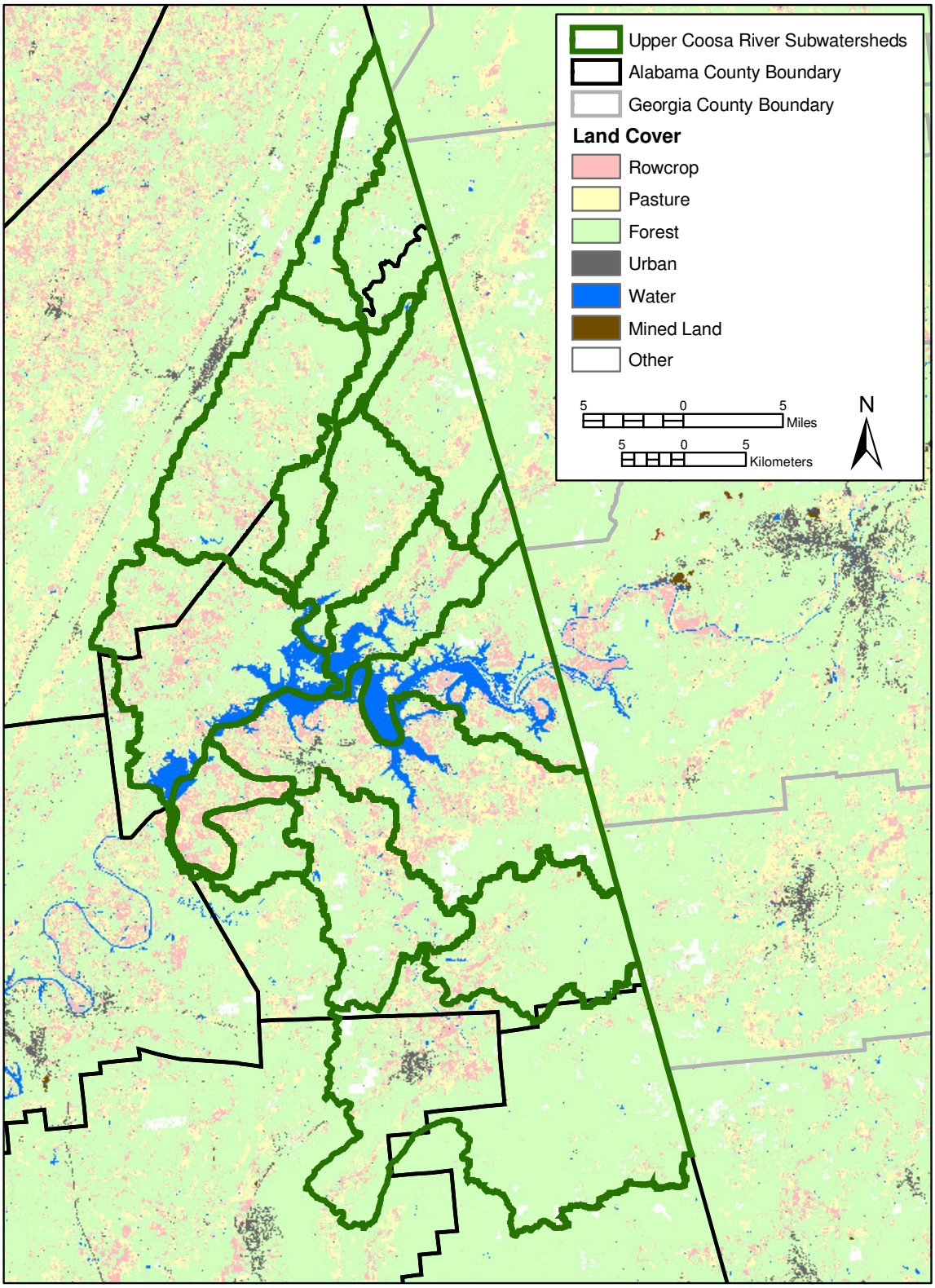


Figure 28. Land cover within the Upper Coosa River subwatershed as indicated from a reclassification of the USGS National Land Cover Data.

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Table 20. Area (ha) and land use (%) for Upper Coosa River subwatersheds as estimated by the Alabama Soil and Water Conservation Committee (1998) and local soil and water conservation districts. Data was not available for the Coosa river subwatershed (030) in Cherokee County. The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds.

Subwatershed				Land Use						
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other
Mills Creek	050	Cherokee	11,982	10	16	70	0	1	0	3
Lower Chattooga River	060	Cherokee	8,796	33	7	43	6	8	0	3
West Fork of the Little River	080	DeKalb	7,508	2	12	79	2	1	1	4
East Fork of the Little River	100	Cherokee, DeKalb	7,567	3	10	82	0	1	<1	3
Bear Creek	110	Cherokee, DeKalb	18,687	7	26	65	0	<1	1	1
Little River	120	Cherokee	5,788	2	1	96	0	1	0	1
Spring Creek	130	Cherokee	10,605	12	12	57	1	6	0	12
Yellow Creek	140	Cherokee, DeKalb	22,314	11	18	42	8	16	1	3
Coosa River	180	Cherokee	15,507	26	7	25	5	29	0	8
Spring Creek	200	Cherokee	27,831	25	7	44	7	14	<1	4
Upper Terrapin Creek	220	Calhoun, Cherokee, Cleburne	42,787	2	11	77	8	1	<1	1
Hurricane Creek	240	Cherokee, Cleburne	14,067	1	1	98	0	<1	0	<1
Lower Terrapin Creek	250	Cherokee	14,004	19	7	72	0	1	0	2
Sugar Creek	260	Cherokee, Etowah	4,274	17	2	76	0	0	0	3
Coosa River	270	Cherokee	4,709	53	4	39	0	1	0	3
UCR Watershed			534,801	13	11	62	3	7	<1	3

Table 21. Area (ha), land use (%), and road density (m/ha) for Upper Coosa River subwatersheds calculated from National Landcover Data (NLCD). The hydrologic unit code (HUC) is the 3 digit subwatershed code which is the last 3 digits of the 11-digit HUC; the first 8 digits are the same (03150106) for all MCR subwatersheds. Area estimates and road densities are from calculations in ArcView.

Subwatershed				Land Use							
Name	HUC	Counties	Total Area	Rowcrop	Pasture	Forest	Urban	Water	Mined Land	Other	Road Density
Upper Chattooga River	030	Cherokee	1,697	9.4	5.1	81.8	<0.1	0	0	3.6	14.4
Mills Creek	050	Cherokee	11,940	6.5	11.8	79.2	0.1	0.1	0	2.3	14.5
Lower Chattooga River	060	Cherokee	8,615	8.7	6.8	67.1	1	16.1	0	0.4	18.1
West Fork of the Little River	080	DeKalb	7,585	2.1	5.1	88.2	0.4	0.7	0	3.5	19.0
East Fork of the Little River	100	Cherokee, DeKalb	7,611	2.3	3.2	91.9	0.2	0.5	0	2	15.7
Bear Creek	110	Cherokee, DeKalb	20,607	9.2	12.9	76.7	0.2	0.6	0	0.4	19.5
Little River	120	Cherokee	5,755	1.9	1.9	95.4	0.4	0.6	0	0.1	14.1
Spring Creek	130	Cherokee	10,665	4.6	6.8	84.7	0.1	3	0	0.7	18.2
Yellow Creek	140	Cherokee, DeKalb	22,206	12.9	11.3	61.5	0.3	13.3	0	0.7	19.7
Coosa River	180	Cherokee	15,474	12.8	7.6	52.1	0.3	23.6	0	3.6	16.2
Spring Creek	200	Cherokee	27,776	15.2	17.1	54.5	1.3	8.8	0	3.1	19.3
Upper Terrapin Creek	220	Calhoun, Cherokee, Cleburne	43,010	5.1	6.3	84.5	1	0.2	<0.1	2.8	12.9
Hurricane Creek	240	Cherokee, Cleburne	14,206	5.1	7.8	86.2	0.1	0.3	0.1	0.4	12.1
Lower Terrapin Creek	250	Cherokee	13,946	9.8	12.7	72.8	0.4	0.9	0	3.5	13.4
Sugar Creek	260	Cherokee, Etowah	43,95	11.9	15.7	70.3	0.1	1.6	0	0.3	12.2
Coosa River	270	Cherokee	4,751	31.2	24.1	36.4	0.4	7.7	0	0.2	14.4
UCR Watershed			220,239	9.0	10.0	73.1	0.5	5.3	<0.1	2.0	16.1

urban, and forest are well mapped with the NLCD, whereas forested wetlands, hay/pasture, and crops are more confused (Zhu et al. 2000, Yang et al. 2001).

One important land cover class not included in the ASWCC estimates was wetlands. Although the UCR watershed does not have the large emergent wetlands or extensive bottomland floodplains found elsewhere in the state, wetlands are an important component of the landscape. The values and functions of wetlands are well recognized, and wetlands are considered beneficial natural resources which need protection and/or preservation because of their pivotal role in the landscape (Reddy and Gale 1994). Wetlands provide many ecosystem functions that protect both aquatic and terrestrial systems: sedimentation and filtration of runoff, providing environments for nutrient assimilation, diverting and dissipating floodwater volume and energy reducing erosion, filtering toxic heavy metals and other pollutants from water, providing important fish and wildlife habitat, and providing food chain support (Reddy and Gale 1994, Patrick 1994). The NLCD contains 2 wetland classifications: emergent wetlands and woody wetlands. Emergent wetlands were grouped within the other class and woody wetlands were grouped in forest in the reclassified NLCD to give the percentages reported in the summary tables. The amount of wetlands in the subwatersheds ranged from 0 to 5.5%, with only half of the subwatersheds (050, 080, 100, 110, 120, 130, 220, and 240) containing >1% of the land cover as wetlands. Many of the wetland types, such as seepage springs and bogs, found in the UCR watershed would be incorrectly classified in the NLCD data because they are too small for the course resolution of the classification. Although these wetland areas cover a small percentage of the landscape, they support many rare species. Maintaining existing wetlands in the watershed is important to maintaining and improving water quality as well as maintaining the biodiversity of the watershed.

Road densities within the subwatersheds ranged from 12.1 to 19.7 m/ha with an overall road density in the UCR watershed of 16.1 m/ha (Table 21). The subwatersheds with the highest road densities were those on the northwestern edge of the watershed around Fort Payne and those in the middle of the watershed around Weiss Lake, with higher road densities south of the Lake (Fig. 29). The lowest road densities tended to be in the southern subwatersheds.

Population & Demographics

There were 129 populated place locations in the UCR watershed as identified from EPA's BASINS dataset (Appendix M). One urban cluster (Piedmont – population 5,120) identified from the Census 2000 TIGER/Line Data (U.S. Census Bureau 2000a) occurred completely within the boundaries of the UCR watershed (Fig. 30). One additional urban cluster (Fort Payne – population 12,938) intersects the UCR watershed boundaries, but the majority is outside the watershed (Fig. 30). An urban cluster consisted of densely settled territory that has at least 2,500 people but fewer than 50,000 people (United States Census Bureau 2001). Only 1 rare species occurrence was within the area delineated for the urban clusters in the UCR watershed: an historical occurrence of the northern pine snake (*Pituophis melanoleucus melanoleucus* – rank G4T4/S3) in Piedmont which may no longer be extant at that site. An additional 33 occurrences, including 11 state or federal protected species, were within 1 km of these urban clusters or populated places within the watershed (Appendix M). Twenty-one of these occurrences were historical occurrences that need to be revisited to determine if the population is still extant.

Total population within the 2000 Census block groups encompassed by the UCR watershed was 49,897 (Environmental Systems Research Institute 2000), but the population within the watershed is somewhat smaller because the area covered by the block groups includes area outside the watershed. Calhoun County experienced a population decline between 1990 and 2000, but the other 3 counties in the watershed experienced population growth between 1990 and 2000 greater than the state average of a 10.1% increase (United States Census Bureau 2000b). Cherokee County was among the fastest growing county in the state, with a population increase of 22.7%. These trends are expected to continue, which will continue to place pressure on rare and sensitive species in the watershed.

Land within the UCR watershed is mostly rural. Although there are no large metropolitan areas in the watershed, there are several small urbanized areas in the watershed and several moderate-sized urban areas surrounding the watershed that affect land use within the watershed. With the increasing population in the watershed, urbanization and development pressures are increasing and could cause extirpations for some species. Population densities are relatively low throughout the watershed, with the highest population densities seen around the two urban clusters (Fort Payne and Piedmont) and portions of Weiss Lake (Fig 31). Most of the watershed has a population density below 0.3 people/ha. Only 21 (55%) of the 38 census block groups contained a rare species occurrence, and most of the rare species occurrences were in the lower density areas in the watershed. Only 3 block groups containing a rare species occurrence had a population density above 0.5 people/ha.

Potential Pollution Sources

ADEM (2002b) estimated the nonpoint source impairment potential in the UCR watershed was low for 7 subwatersheds, moderate for 5 subwatersheds, high for 2 subwatersheds, and not determined for 2 subwatershed.

Agricultural and Animal Production

Agricultural activities (animal production, pasture, and row crops) are among the primary NPS concerns within the UCR watershed. Agricultural production is an important component of the economy within the UCR watershed, particularly in DeKalb county, and has the potential to be a large contributor to NPS pollution in the watershed. Agriculture is a significant component of the land use in many of the subwatersheds and dominates in several (Tables 20 & 21). The amount and type of animal production varies greatly within the subwatersheds (Table 22). Cattle production is the only animal production activity that occurs in every subwatershed, but poultry production, and to a lesser extent swine production, is a substantial contributor to animal production activities in many subwatersheds (Table 22). Poultry production tends to be the single largest animal production activity in those watersheds in which it occurs.

Permitted Sites

There were 8 active and 3 inactive NPDES permitted discharge sites (Fig. 32), 18 IFD sites (Fig. 33), 25 HSW sites (Fig. 32), 5 TRI sites (Fig. 33), and 253 mines (Fig 34) identified in the watershed within the BASINS dataset (Appendix O). The majority of the mines were unnamed iron mines that may not have been developed (Appendix O). There were no Superfund National Priority List sites identified in the watershed from the BASINS data.

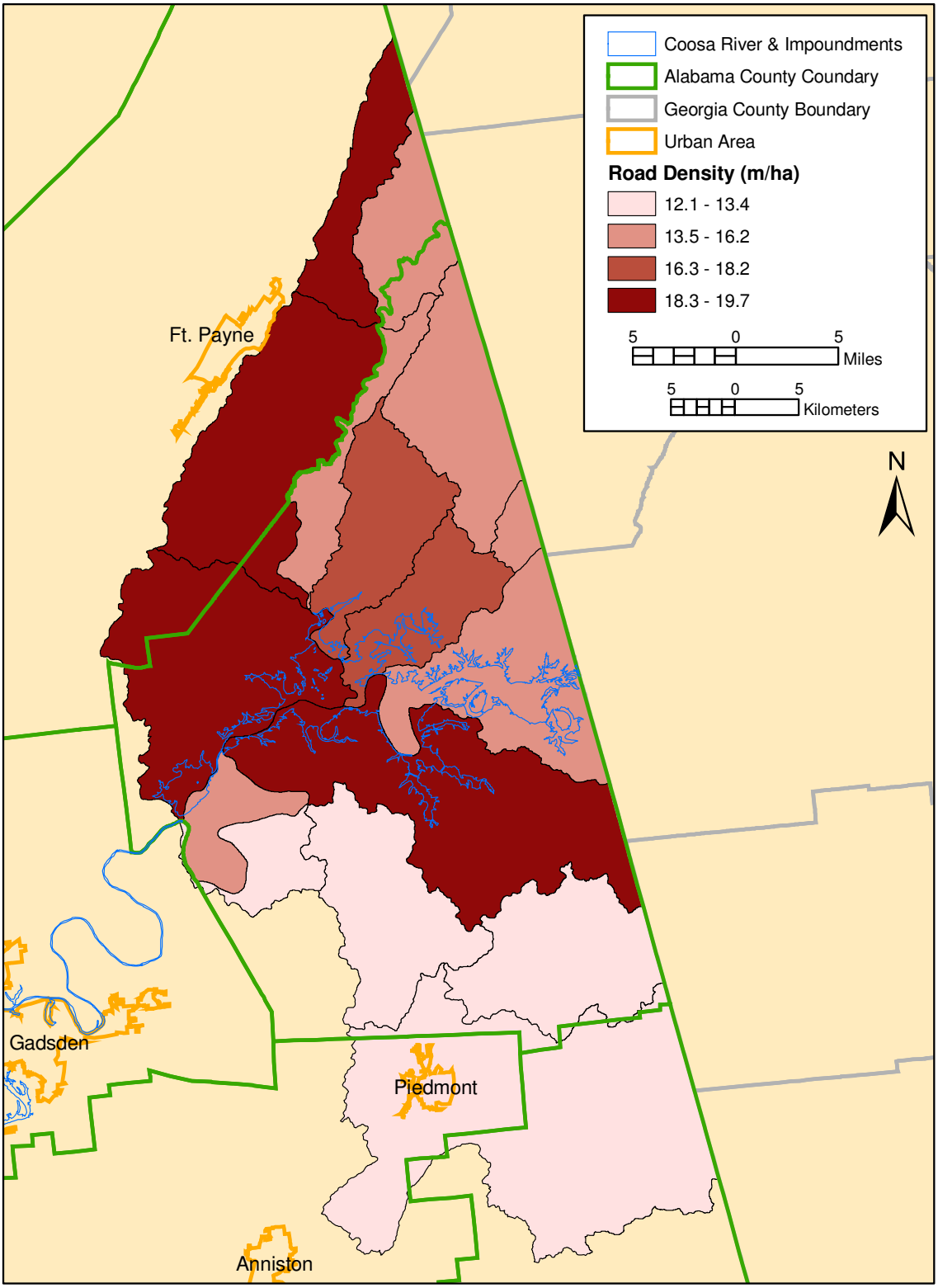

Figure 29. Road density (m/ha) for subwatersheds within the Upper Coosa River watershed. Road density was classified using natural breaks.

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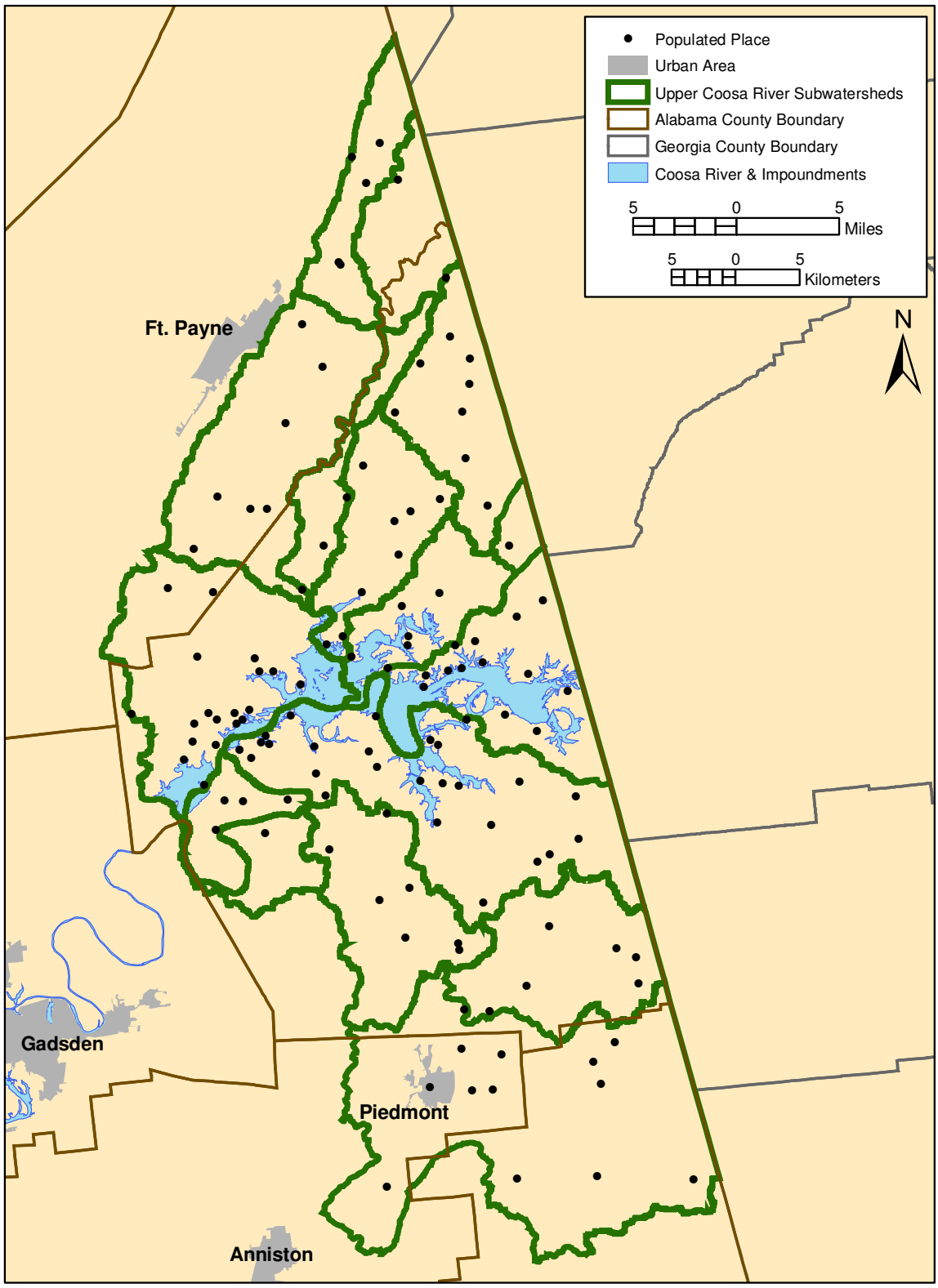

Figure 30. Urban clusters and populated place locations within the Upper Coosa River watershed, Alabama, as identified from the EPA BASINS and Census 2000 TIGER/line files.

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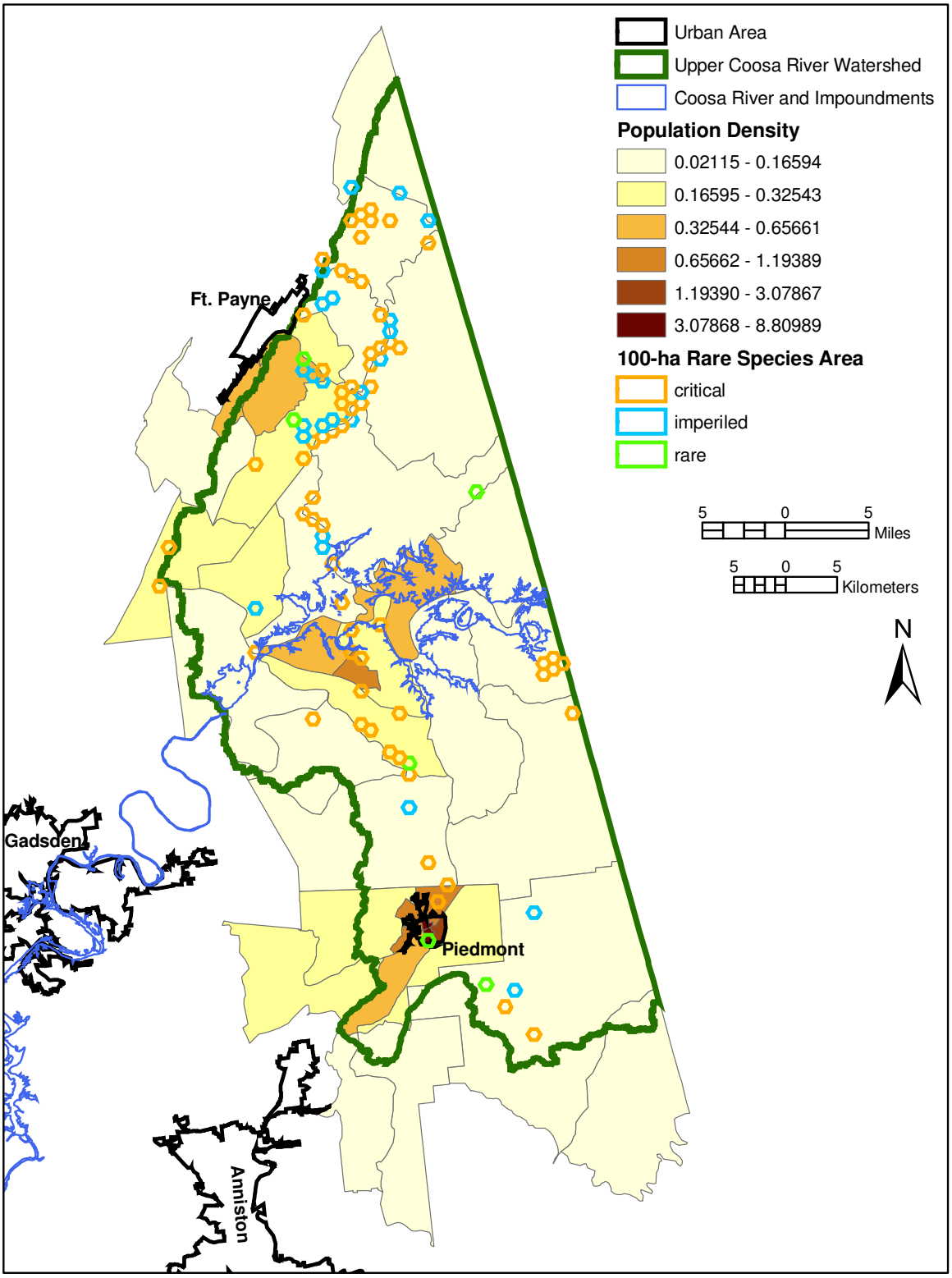

Figure 31. Population density (persons/ha) by 2000 census block groups for the Upper Coosa River watershed, Alabama. Population density was classified using natural breaks.

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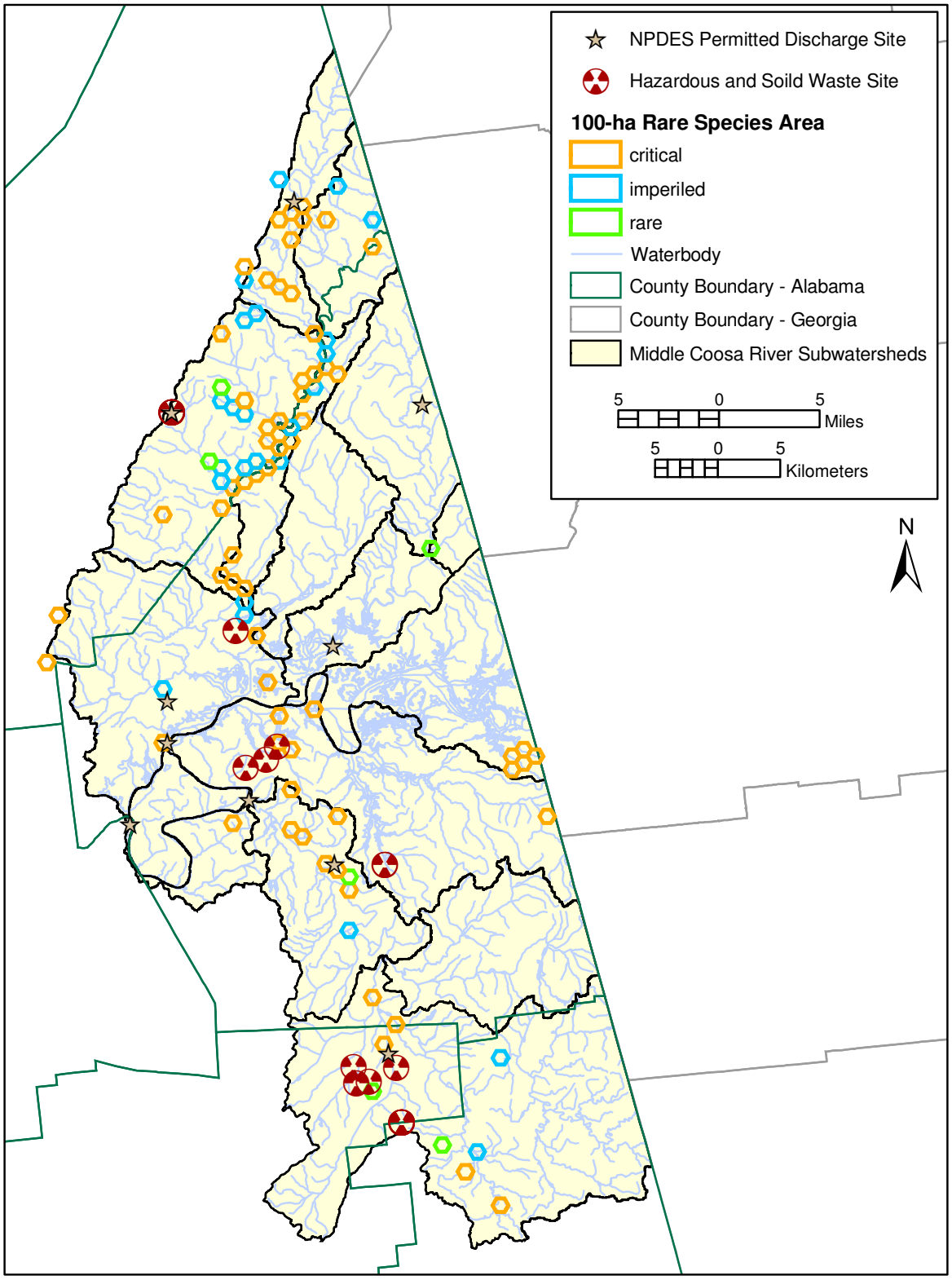

Figure 32. National Pollutant Discharge Elimination System (NPDES) permitted discharge sites and Hazardous and Solid Waste sites identified from BASINS data (United States Environmental Protection Agency (2001b) in the Upper Coosa River watershed, Alabama.

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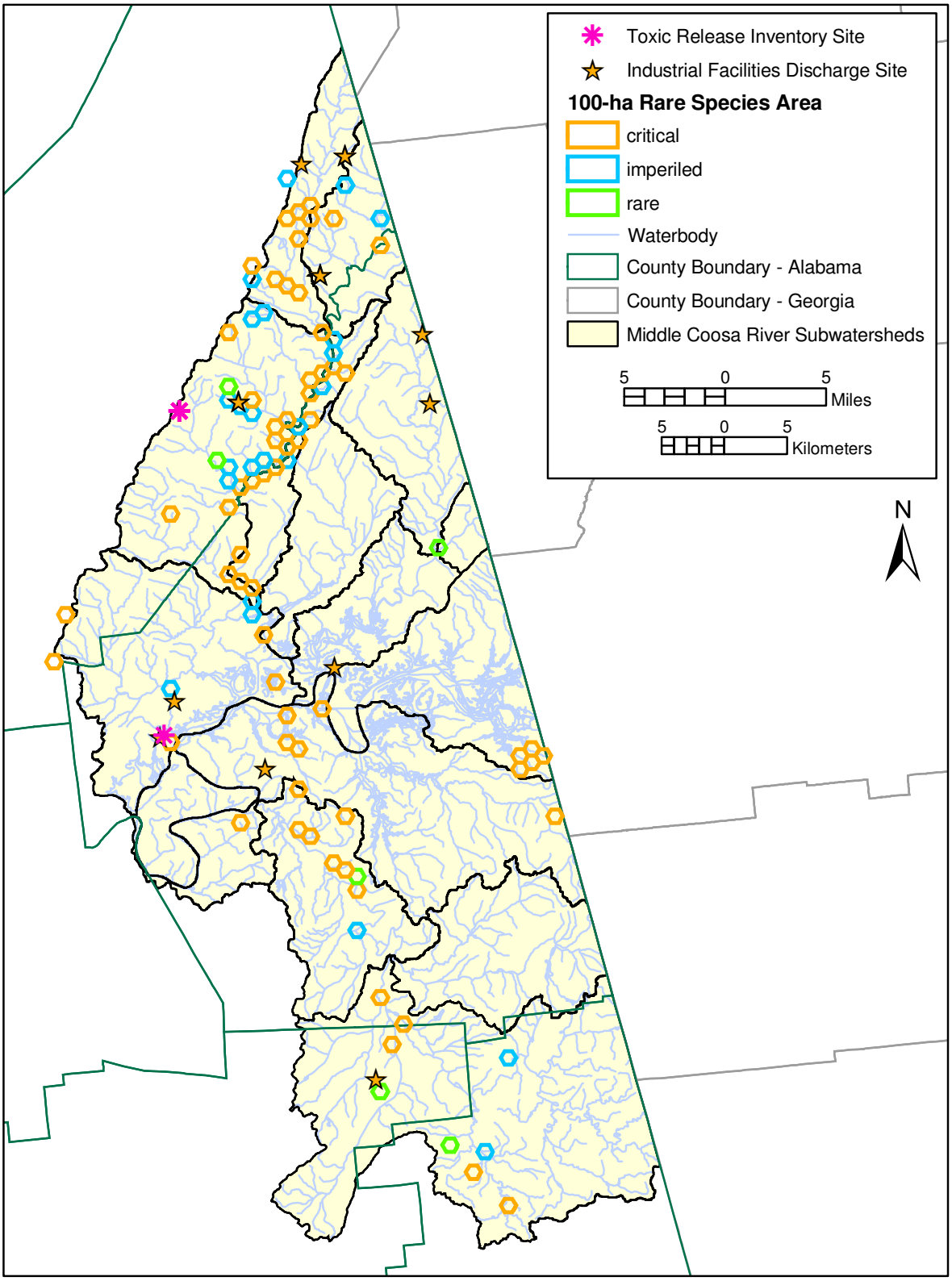

Figure 33. Toxic Release Inventory sites and Industrial Facilities Discharge sites identified from BASINS data (United States Environmental Protection Agency (2001b) in the Upper Coosa River watershed, Alabama.

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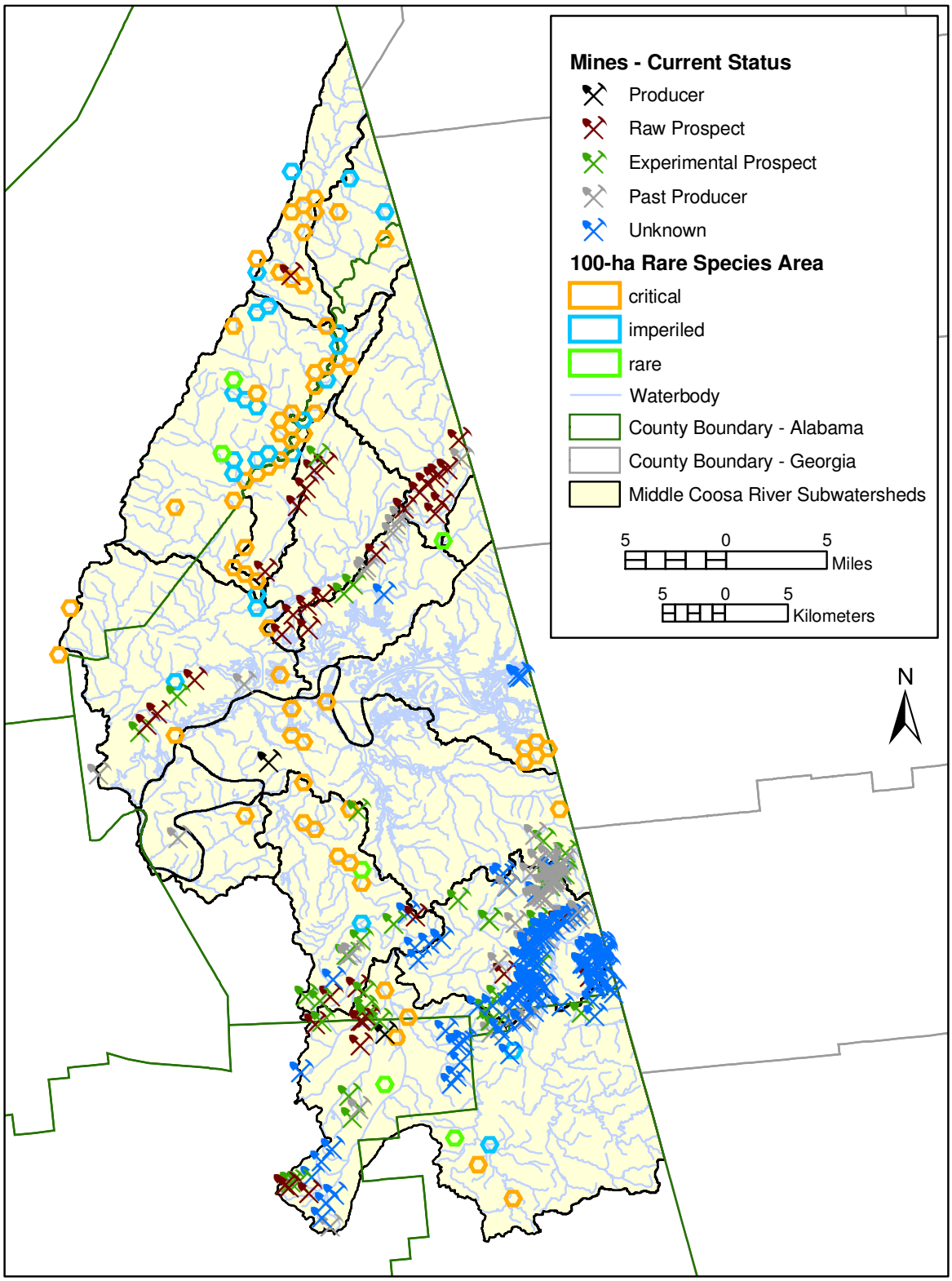

Figure 34. Mines identified from BASINS data (Environmental Protection Agency (2001b) in the Upper Coosa River watershed, Alabama.

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Table 22. Number of animals and animal units for cattle, dairy, swine, poultry, and catfish production in the Upper Coosa River watershed, Alabama. Estimates are from the Alabama Soil and Water Conservation Committee (1998). Estimates were not available for the Upper Chattooga River (030) subwatershed. The hydrologic unit code (HUC) is the 3-digit subwatershed code of the 11-digit HUC; the first 8 digits are the same (03150105) for all UCR subwatersheds.

Subwatershed Name	HUC	Total Area	# of Cattle in Watershed	Cattle AU	Number of Dairies	Dairy AU	Number of swine	Swine AU	Number of Broilers	Broiler – Poultry AU	Number of Layers	Layer-Poultry AU	# of Catfish Acres
Mills Creek	050	11,982	2,240	2,240	0	0	0	0	0	0	0	0	5
Lower Chattooga River	060	8,796	700	700	0	0	0	0	0	0	0	0	0
West Fork Little River	080	7,508	1,088	1,088	0	0	0	0	220,000	1,760	10,000	80	0
East Fork Little River	100	7,567	855	855	0	0	0	0	40,000	320	0	0	0
Bear Creek	110	18,687	5,910	5,910	150	210	1,100	440	400,000	3,200	75,000	600	0
Little River	120	5,788	70	70	0	0	0	0	0	0	0	0	0
Spring Creek	130	10,605	1,400	1,400	0	0	0	0	0	0	0	0	0
Yellow Creek	140	22,314	4,758	4,758	180	252	650	260	200,000	1,600	18,000	144	0
Coosa River	180	15,507	1,260	1,260	0	0	200	80	0	0	0	0	0
Spring Creek	200	27,831	2,380	2,380	100	140	0	0	540,000	4,320	0	0	0
Upper Terrapin Creek	220	42,787	3019	3019	0	0	0	0	0	0	0	0	0
Hurricane Creek	240	14,067	140	140	0	0	0	0	132,000	1,056	0	0	0
Lower Terrapin Creek	250	14,004	1,120	1,120	0	0	0	0	480,000	3,840	0	0	0
Sugar Creek	260	4,274	140	140	0	0	0	0	0	0	0	0	3
Coosa River	270	4,709	280	280	0	0	200	80	0	0	0	0	5
UCR watershed		412,074	47,780	47,780	860	1,204	4,300	1,720	2,800,000	32,192	206,000	1,648	21

There were 43 rare species occurrences documented within 1 km of these sites (Appendix O). Fifteen rare species occurrences were documented within 1 km of NPDES sites, including 2 occurrences each of the federal endangered green pitcher plant and the federal threatened Mohr's Barbara's button and one occurrence each of the federal endangered Alabama leather-flower, the federal endangered southern clubshell, and the state protected coldwater darter (Appendix O). Nine rare species occurrences were documented within 1 km of IFD sites, eight of which were closest to a single site (Brown Brothers Coal – Pit #1). None of these occurrences were federal or state protected species. Two rare species occurrences (one occurrence each of grass-leaf loosestrife and the federal endangered green pitcher plant) were documented within 1 km of a HSW site (Burkhalter Pontiac Buick GMC Inc.). Both occurrences were on the Coosa River Bog TNC Preserve in Cherokee County. Twenty rare species occurrences were within 1 km of a mine, including 1 occurrence each of the federal endangered green pitcher plant, federal endangered Alabama leather-flower, and the state protected coldwater darter. There was no rare species occurrence documented within 1 km of any TRI site. Only 2 occurrences were within 1 km of multiple site types: one occurrence of Harper's dodder within 1 km of a NPDES, IFD, and mine site and one occurrence of the state protected coldwater darter within 1 km of a mine and NPDES site. Only 6 100-ha rare species areas contained potential source sites: 2 contained NPDES sites (Fig. 32), 1 contained an IFD site (Fig. 33), 1 contained a HSW site (Fig. 32), and 2 contained mines (Fig. 34).

Septic Systems

Much of the soil in the UCR watershed is not suitable for septic systems and failed systems are a primary NPS concern within the UCR watershed. The estimated number of septic systems and failing septic systems varied widely among the subwatersheds, with most having moderate to low numbers of failing systems (Table 23). However, several of the subwatersheds had relatively high estimates for the number of failing septic systems, and most of the subwatersheds had an estimated failure rate between 20 and 30% of the number of septic systems in the subwatershed. ADEM (2002b) estimated NPS impairment potential from non-rural sources, including septic systems, as low in 11 subwatersheds and moderate in 5 subwatersheds (Table 23). Four of the moderately rated subwatersheds were those clustered around Weiss Lake.

Other Sources

The Consortium of Alabama Environmental Groups (2003) identified 23 potential point and nonpoint source pollution sources in the UCR watershed (Fig. 35) using low-flying aircraft and documenting the sites with photographs (Appendix P). Only 2 of the potential sources identified were not around Weiss Lake. The main potential problem identified was nutrient/bacteria runoff, with the majority of the sites identified being residential concentrations. Only 3 potential sources (CHER02, CHER27, and DEKA16) were within a 100-ha rare species area. CHER02 was a construction site with sediment control problems and the other 2 were hog Confined Animal Feeding Operations (CAFO). CHER27 and DEKA16 were within the same rare species area, a "critical" area containing 7 species: Little River Canyon onion (G2/S2), Nuttall's rayless goldenrod (G3G4/S3), Harper's dodder (G2/S2), nestronia (*Nestronia umbellula* – G4/S2), and 3 species of caddisfly (*Ceraclea alabamae* (G1/S1), *Ceraclea alces* (GNR/S1), and *Hydroptila micropotamis* (G1/S1)). CHER02 was within a "critical" rare species area containing 2 fish species: the federal threatened blue shiner (G2/S1) and freckled darter (G2/S2S3). One additional site in Cherokee County was within 1 km of a rare species occurrence: a campground

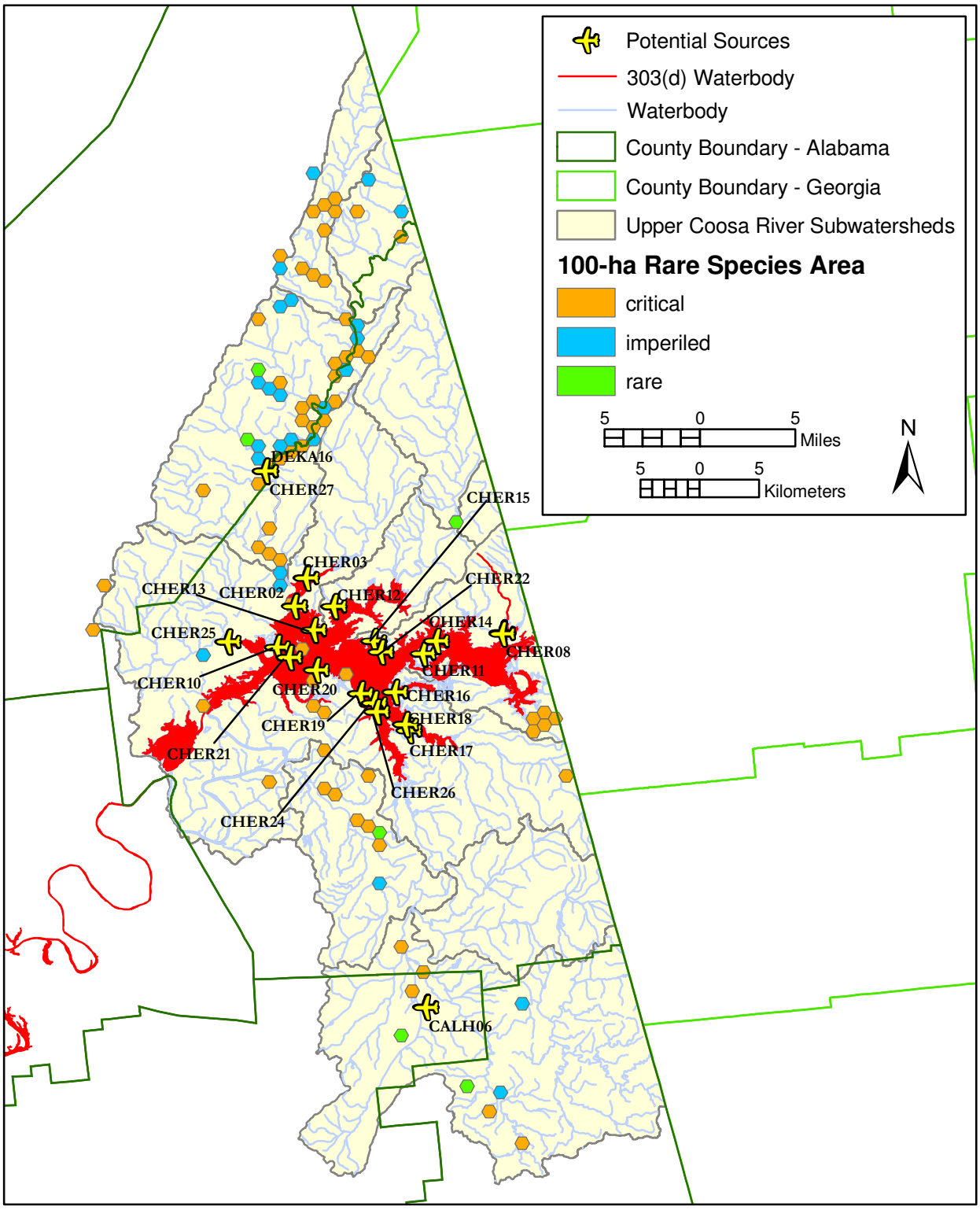

Figure 35. Potential point and nonpoint pollution sources in the Upper Coosa River watershed, Alabama, identified by the Consortium of Alabama Environmental Groups (2003) using low-flying aircraft.

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Table 23. Estimated number of septic systems and failing septic systems within the subwatersheds of the Middle Coosa River watershed, Alabama, as published by the Alabama Soil and Water Conservation Committee (1998). Estimates were not available for the Upper Chattooga River (030) subwatershed. The potential impairment rating is the non-rural potential estimated by the Alabama Department of Environmental Management (2002b) that included septic tank failure rates. The hydrologic unit code (HUC) is the 3-digit subwatershed code of the 11-digit HUC; the first 8 digits are the same (03150105) for all UCR subwatersheds.

HUC	Subwatershed Name	Area (ha)	Estimated Number of Septic Systems	Estimated Number of Septic Systems Failing	Potential Impairment Rating
050	Mills Creek	11,982	670	201	low
060	Lower Chattooga River	8,796	490	122.5	moderate
080	West Fork Little River	7,508	748	149.6	low
100	East Fork Little River	7,567	361	60.1	low
110	Bear Creek	18,687	406	81.2	low
120	Little River	5,788	100	30	low
130	Spring Creek	10,605	600	180	low
140	Yellow Creek	22,314	1325	361	moderate
180	Coosa River	15,507	870	261	moderate
200	Spring Creek	27,831	1550	465	moderate
220	Upper Terrapin Creek	42,787	190	57	moderate
240	Hurricane Creek	14,067	750	225	low
250	Lower Terrapin Creek	14,004	750	262.5	low
260	Sugar Creek	4,274	220	66	low
270	Coosa River	4,709	200	60	low
03150105	Upper Coosa River watershed	216,426	9230	2581.9	

concentration (CHER21) along Weiss Lake slightly <1 km from a bald eagle (*Haliaeetus leucocephalus*) nest.

303(d) Listed Waters

Alabama's 2000 Final 303(d) list of impaired waters (Alabama Department of Environmental Management 2000) included 1 stream reach in the UCR watershed that did not support its water use classifications (Fig. 36): an unnamed tributary to Weiss Lake in Cherokee County (Table 24). Weiss Lake, which covers the entire main stem Coosa River in the UCR watershed, also was listed (Table 24).

No rare species were documented within 1 km of the 2 listed stream reaches. However, eleven rare species occurrences were documented within 1 km of Weiss Lake (Fig. 37), including the 2 federal endangered species (southern clubshell and green pitcher plant) and 2 federal threatened species (bald eagle and blue shiner [historical]) (Table 25).

THREATS

A detailed threat assessment analysis was not conducted due to time constraints. Instead, generalized threats to biodiversity in the watershed were identified based on threats to the conservation targets, known problems in the watershed, and threats to conservation targets identified in TNC's Cumberlands and Southern Ridge and Valley Ecoregion Conservation Plan (The Nature Conservancy 2003). Under TNC planning methodology (The Nature Conservancy 2000), threat analysis involves identifying both the "stresses" and "sources of stress" that affect conservation targets. Most stresses are caused directly by incompatible human uses of land, water, and natural resources; sometimes, incompatible human uses indirectly cause stress by exacerbating natural phenomena. Most stresses can be generalized to what Noss and Peters (1995) listed as the greatest threat to biodiversity at both the species and ecosystem levels: habitat loss, alteration, or degradation. Populations inevitably decline when vital habitat is lost or substantially altered, and these changes are major contributors to declines in wildlife populations and biodiversity worldwide. However, there are many different sources for this stress. Overall, 6 major sources of stress were identified in the watershed: agriculture (crop and livestock production practices), forestry, development (including roads), invasive/alien species, waste disposal (trash and septic systems), and altered disturbance regimes (i.e., fire suppression).

These threats are compounded by habitat fragmentation and the isolation and small population sizes of many of the rare species that occur in the watersheds. Habitat fragmentation negatively impacts native biodiversity by reducing habitat total area and patch size, particularly for habitat types such as forest interior; isolating existing populations; and modifying microclimates (Noss and Csuti 1994). The loss of corridors connecting habitat patches further isolates the remaining population as the remaining habitat is embedded in a landscape that usually inhibits movements. The restriction of movements by individuals drastically reduces genetic flow among populations, potentially leading to increased inbreeding and increased probabilities of local extirpations.

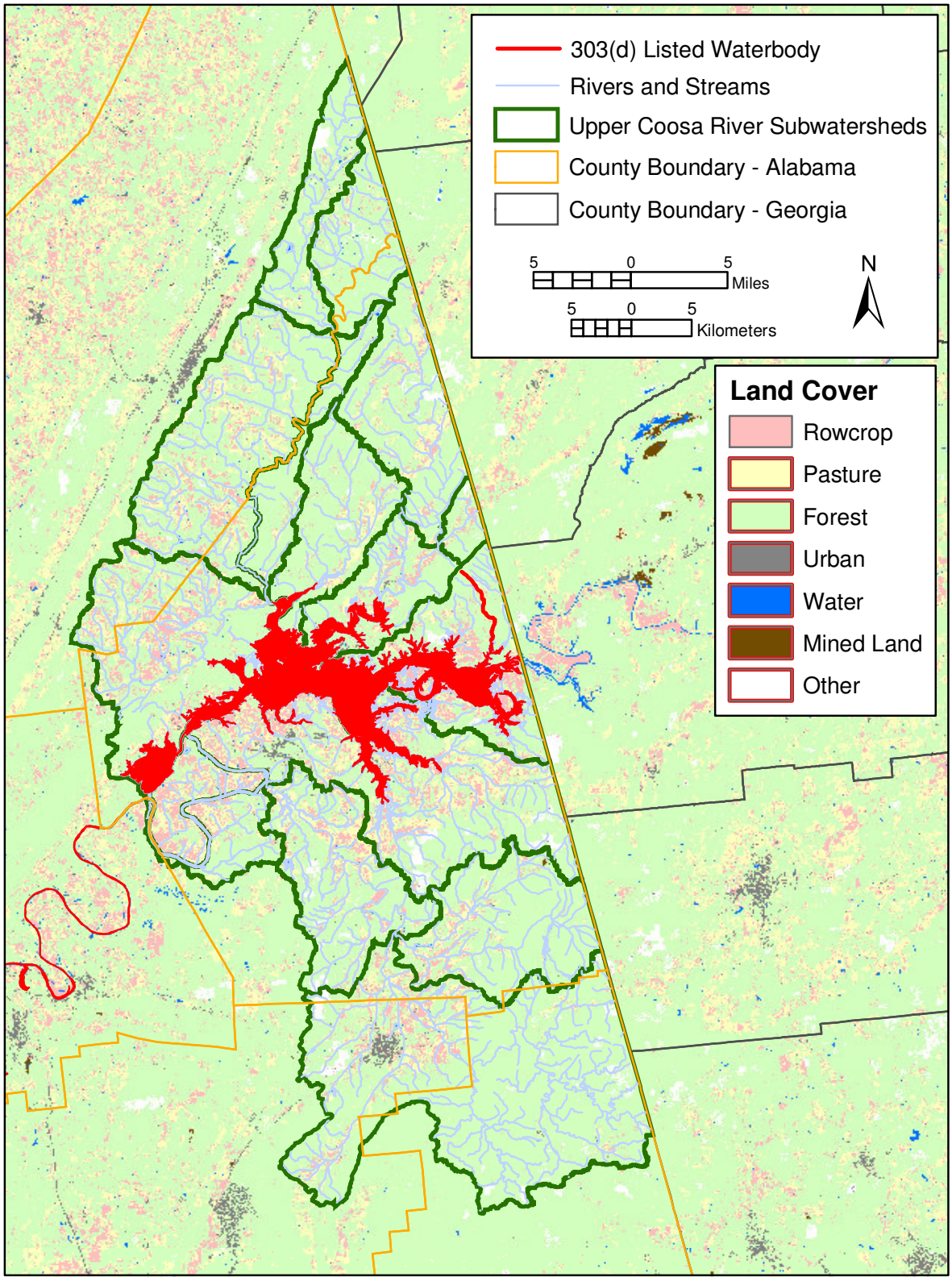

Figure 36. Waters in the Upper Coosa River watershed on Alabama's final 303(d) list of impaired waters.

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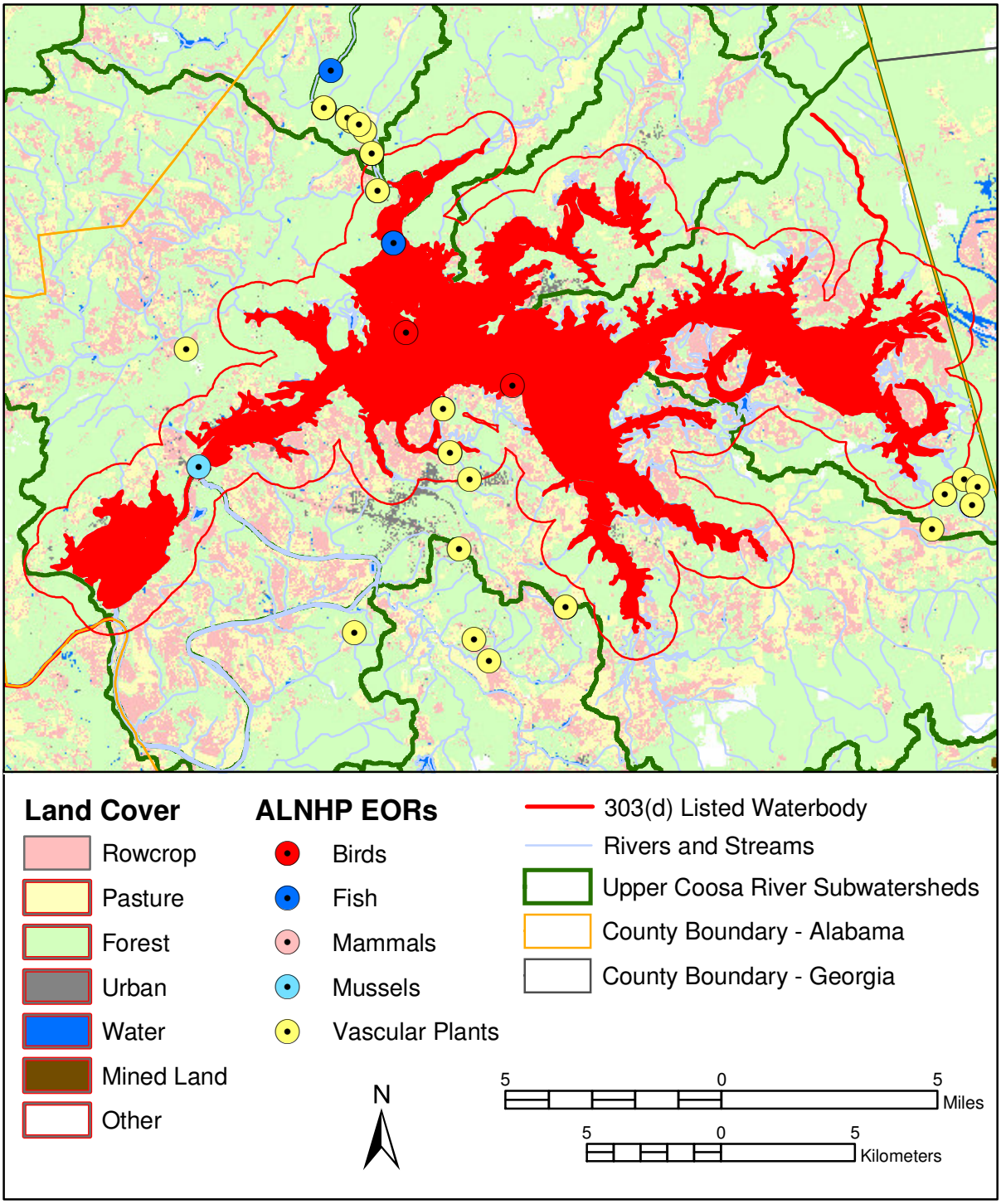

Figure 37. Rare, threatened and endangered species associated with Weiss Lake, listed on Alabama's final 2000 303(d) list of impaired waters. A 1-km buffer around the lake is indicated by the red line circling the lake.

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Table 24. Waters in the Upper Coosa River watershed listed on Alabama's 2002 final 303(d) list of impaired waters.

Waterbody ID	Waterbody Name	County	Support Status	Uses	Causes	Sources	Date of Data	Size	Downstream/ Upstream Location
AL/03150105 -180_01	Unnamed Tributary to Weiss Lake	Cherokee	non	fish & wildlife	ammonia nutrients OE/DO pathogens	agriculture	1986	4.4 mi	Ballplay Creek/ its source
AL/Weiss Res_01	Weiss Lake	Cherokee	partial	public water supply swimming fish & wildlife	priority organics nutrients pH	sources outside state flow regulation/modification	1992-94	30,200 acres	Weiss Dam/ AL-GA State Line

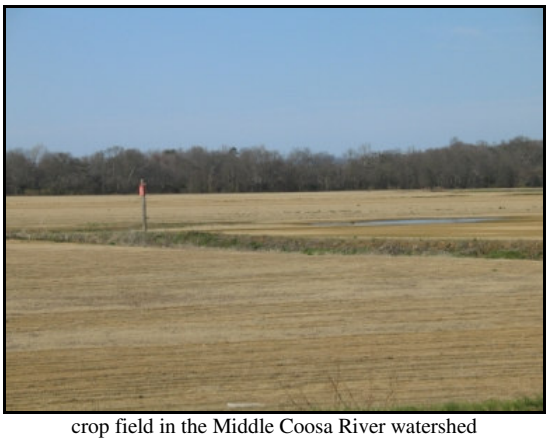
Table 25. Rare, threatened, and endangered species within 1 km of Weiss Lake listed on Alabama's 2000 303 (d) listed streams within the Middle Coosa River watershed, Alabama.

Major Group	Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Distance to Stream (m)
Birds	*Haliaeetus leucocephalus*	bald eagle	G4	S3B	PS [a]	SP	348
Birds	*Haliaeetus leucocephalus*	bald eagle	G4	S3B	PS [a]	SP	221
Fish	*Cyprinella caerulea*	blue shiner	G2	S1	LT	SP	164
Fish	*Percina lenticula*	freckled darter	G2	S2S3			164
Mammals	*Sciurus niger*	eastern fox squirrel	G5	S3S4			295
Mussels	*Pleurobema decisum*	southern clubshell	G1G2	S1S2	LE	SP	46
Vascular Plants	*Coreopsis pulchra*	woodland tickseed	G2	S2			499
Vascular Plants	*Cuscuta harperi*	Harper's dodder	G2	S2			499
Vascular Plants	*Lysimachia graminea*	grass-leaf loosestrife	G1Q	S1			43
Vascular Plants	*Sarracenia oreophila*	green pitcher plant	G2	S2	LE		43
Vascular Plants	*Sarracenia oreophila*	green pitcher plant	G2	S2	LE		295

[a] – LT throughout range; proposed for delisting 6 July 1999. Federal status is categorized by state/region, rather than by subspecies. Listed as Threatened in the coterminous U.S.

Agriculture

The source Agriculture was defined as runoff from agricultural areas, both crop and livestock, resulting in fertilizers, pesticides, herbicides, organic materials, pathogens, and sediment entering into waterways as well as any agriculture-related practices that result in erosion, collapsed streambanks, and channelization of waterways, thereby altering the natural flow regime of water.


crop field in the Middle Coosa River watershed

Agricultural practices have long been considered the most widespread and significant source of NPS pollution in the United States, and are known to have major impacts on water quality. In a 2000 Report to Congress, the EPA identified agriculture as the leading source of impairment to rivers and streams, with the most common agricultural types causing impairment being nonirrigated crop production, animal feeding operations, and irrigated crop production (United States Environmental Protection Agency 2002a). In Alabama, ADEM estimated that 40% of NPS problems originate from agriculture. Additionally, ADEM receives more water quality complaints associated with animal waste than any other agricultural activities (Beck 1995). Agriculture was one of the top three threats identified for conservation targets across the Cumberlands and Southern Ridge and Valley Ecoregion in TNC's ecoregion plan (2003), and agricultural development generally ranks first among activities responsible for habitat destruction (Noss and Peters 1995).

The types of impairment from agricultural sources include sedimentation of streambeds due to accelerated soil erosion, nutrient loading (primarily nitrogen and phosphorus), pesticide and herbicide (and other toxins) contamination of surface- and ground-water, contamination by animal waste, and pathogen contamination (Ribaudo 1989, Tim and Jolly 1994, Basnyat et al. 1999). Sedimentation resulting from agriculture generally is the single greatest pollutant by volume in U.S. waters (Basnyat 1998). Excessive sedimentation alters aquatic habitat, suffocates bottom-dwelling organisms and fish eggs, and can interfere with the recreational use of a river or stream (United States Environmental Protection Agency 2002a). Although excessive sedimentation is generally the largest NPS pollutant from agriculture, the highest contribution by agriculture to NPS pollution in some U.S. watersheds may be nutrients, primarily nitrogen and phosphorous, due to the intensive use of fertilizers and pesticides or from animal manure (Puckett 1994, Basnyat 1998). In addition, more lake acres in the U.S. are affected by nutrients than any other pollutant or stressor (United States Environmental Protection Agency 2002a). The major environmental effect of excessive nutrients is eutrophication of surface waters (Puckett 1994).

The negative impacts of agriculture on wildlife are indisputable and often diminish the ability of agricultural ecosystems to sustain viable populations. In addition to the direct habitat loss caused by the initial land use conversion to agriculture, the effects of agriculture include increased habitat fragmentation and isolation, decreased habitat diversity, and decreased water quality (Allen 1995). Species present in agricultural systems often suffer from reduced reproductive

success and increased predation compared to more natural systems. The high impact of sustained anthropogenic disturbance (i.e., sustained agriculture) profoundly alters biotic communities, and may result in long-term modifications such as lowering diversity and changing species composition that may still be evident long after land use has reverted to a more natural state (Harding et al. 1998).

cattle grazing along Yellow Creek in the Upper Coosa River watershed

The USFWS concluded that livestock grazing is the fourth major cause of species endangerment nationwide and the second major cause of plant endangerment (Flather et al. 1994). The primary effects of livestock grazing include the removal and trampling of vegetation, compaction of underlying soils, and dispersal of exotic plant species and pathogens (National Research Council 2002). Grazing can also alter both hydrologic and fire disturbance regimes, accelerate erosion, and reduce plant or animal reproductive success and/or establishment of plants. Long-term cumulative effects of domestic livestock grazing involve changes in the structure, composition, and productivity of plants and animals at community, ecosystem, and landscape scales. Livestock have a disproportionate effect on riparian areas because they tend to congregate in these areas, which are rich in forage and water (National Research Council 2002). Cattle access points are site specific, but cause several impacts to water quality. Where livestock have access to streams, riparian vegetation is generally lacking and cattle entering and leaving the stream adds to the instability of the stream bank. This can lead to increased erosion and sedimentation and fecal contamination of the stream. The majority of livestock in both watersheds likely are not excluded from streams running through pastures, which has the potential to cause major problems for aquatic species. Excluding livestock from riparian areas is the most effective tool for restoring and maintaining water quality and ecological function of riparian areas impacted by livestock. However, it can be expensive and will require livestock management changes such as supplying alternative water and forage sources. Still, livestock exclusion from streams should be encouraged in both watersheds where feasible. Where it is not feasible to exclude cattle from streams, the impacts can be reduced by changing the season of use, reducing the stocking rate or grazing period, resting the area from livestock use for several seasons, and/or implementing a different grazing system (National Research Council 2002).

The negative impacts from agriculture can be minimized somewhat through implementation of Best Management Practices (BMP) designed to minimize agricultural contributions to NPS pollution, and many state agencies have BMPs designed to abate the impact of agriculture on adjacent aquatic systems. These practices include livestock management to limit access to

streams and the use of vegetated stream buffers. The presence of a naturally-vegetated buffer around streams can greatly reduce the amount of sediment and nutrients reaching the stream by reducing bank erosion and trapping sediments and nutrients flowing off agricultural areas before reaching the stream (Anderson and Ohmart 1985, Basnyat et al. 1999, Schultz and Cruse 1992, Osbourne and Kovacic 1993, Weller et al. 1996). Implementation of the strategies outlined in the Watershed Management Plan (Alabama Clean Water Partnership 2003) to reduce agricultural pollution and TNC's Cumberland and Southern Ridge and Valley Ecoregion Plan (The Nature Conservancy 2003) for abating threats from agricultural practices will help with conservation of aquatic species in the watershed. Conservation in agricultural areas can be further increased by continuing to implement conservation practices in agricultural areas through programs such as the USFWS Landowner Incentive Program and the various Farm Bill conservation programs. Increasing the implementation of agricultural BMPs, especially the use of riparian buffers, should be a goal in both watersheds.

Development

The source Development was defined as stress from activities associated with rural development, urbanization, and commercial and industrial development, including roads and construction activities, which contribute to runoff, sedimentation, and other NPS pollution. This included contributions from sources such as sedimentation as a result of new construction; maintenance of roads; mining; and contaminants such as engine oil, antifreeze, rubber, and metal deposits from tire wear resulting from vehicular use of roads. Urban development is a leading cause of habitat destruction for many species (Noss and Peters 1995), and was identified as the greatest threat for endangered and threatened plants in a review of recovery plans (Schemske et al. 1994). Residential development also was one of the top three threats identified for conservation targets across the Cumberlands and Southern Ridge and Valley Ecoregion in TNC's ecoregion plan (2003).

road construction for new development near Pell City

Urban runoff has been identified as a major contributor to NPS pollution due to the highly polluted runoff from urbanized areas and the potential for urban areas to generate large amounts of NPS pollutants from storm-water discharge. Nationwide, the EPA and state agencies estimated urban runoff was responsible for approximately 12% of the water quality impairment in rivers and streams (United States Environmental Protection Agency 2002a). Constituents in urban runoff include sediment and other suspended solids, toxins such as automotive fluids, pesticides from lawn and garden activities, bacteria and other pathogens, heavy metals, oxygen-demanding substances, and nutrients from fertilizers used in lawn and garden activities (Olivera et al. 1996). Increased sedimentation has been recognized as one of the primary results of urban runoff, and

construction, both buildings and roads, is one of the most significant contributors of suspended solids to urban runoff. Sediment loads from inadequately controlled construction sites typically are 10 to 20 times greater per unit of land than those from agricultural land and 1,000 to 2,000 times those from forests (Weiss 1995). Many state agencies have BMPs designed to reduce nutrient and sediment loads from urban runoff to abate the impact of urban development on aquatic systems (Reddy and Gale 1994). However, if these BMPs are not properly implemented and maintained, they contribute little to abating the impact of urban runoff.


clearing land for development near Pell City

Extensive urbanization across the South as human population has grown has accelerated the rate at which open land was converted to urban since the 1970's (Macie and Hermansen 2002). Urbanization alters the species composition of an area and generally negatively impacts an area's biodiversity. Tabit and Johnson (2002) reported that anthropogenic impacts associated with population growth were a significant threat to the biodiversity and structure of fish communities in the Coosa River drainage because they depress the fish fauna and reduce species richness compared to less impacted streams. In general, the number of amphibian, reptile, mammal, and bird species decreases as you move from rural to urban landscapes (Macie and Hermansen 2002). The number of native species decreases as the habitat specialists are lost, while the number of exotic species increases and the generalist species remaining may reach very high densities that can cause problems for the remaining biota as well as causing conflicts with humans (Macie and Hermansen 2002). Forest communities in urban and urbanizing landscapes often have been altered and have modified soils, low native biodiversity, an absence of large predator species, simple food webs, and a high frequency of human disturbances making them more susceptible to nonnative species invasions than intact communities (Lodge 1993, McDonnell et al. 1997, Williams and Meffe 1998).

In addition to contributing to habitat loss, development creates new edge habitat and alters habitat shape from irregular to highly regular and linear (Godron and Forman 1983, Zipperer 1993). Much of the alterations associated with development is driven by road construction. In addition to increasing the probability of future development, fragmenting habitat, and increased edge effects roads have numerous other ecological effects such as increased habitat loss; direct mortality on roads; increased access by people possibly leading to increased harassment of wildlife, increased mortality from hunting, increased woodcutting and trampling, increased disturbance, and increased dumping; increased spread of nonnative species; increased pollution including increased light, noise, dust, and fumes; accelerated erosion; changes in natural disturbance regimes; and providing increased access to poachers (Macie and Hermansen 2002). To address urbanization's effects on ecosystem health, an integrative and interdisciplinary

approach is necessary, and must include terrestrial and aquatic systems and account for ecological processes operating at different spatial and temporal scales and the complexity of interactions among the social, ecological, and physical components of an ecosystem (Macie and Hermansen 2002).

strip development outside Anniston

In recent years, urban sprawl has emerged as one of the dominant forces of change in land cover and has been predicted to be a major cause of native forest loss in the future (Wear and Greis 2002). Urbanization changes the structure, function, and composition of natural ecosystems, as well as the benefits derived from them and can severely degrade aquatic and terrestrial ecosystems (Wang et al. 2001, Macie and Hermansen 2002). Major changes in biota can occur with relatively small amounts of urban land use in a watershed, and there appear to be urbanization threshold values which lead to rapid and dramatic degradation of biotic communities when exceeded (May et al. 1997, Wang et al. 2000). The most direct effect of land use changed resulting from development is the loss and fragmentation of the natural land cover. Of all the attributes of natural land in the South, wildlife habitat may be the most endangered by human growth pressures, and future population growth in the watersheds is projected to exert moderate to heavy pressures on wildlife habitat (Macie and Mermansen 2002). Urbanization's indirect effects on natural systems include modifying hydrology, altering nutrient cycling, modifying disturbance regimes, introducing nonnative species, and changing atmospheric conditions (Macie and Hermansen 2002). These changes significantly affect ecosystem health and modify the goods and services provided by ecosystems.

Increased housing, roads, and the associated construction activities puts pressure on the waterways, especially by the forced assimilation of additional stormwater runoff due to expanded impervious surfaces. Runoff that moves across natural terrain reaches receiving waters gradually because the surface is porous allowing water to percolate into the soil. However, urban areas have a much higher proportion of impervious surfaces, which increases the flow of runoff because these surfaces force the water to accumulate on the surface and storm sewer systems are designed to quickly channel this runoff from roads and other impervious surfaces to the receiving water. Once runoff enters the sewer system, it empties into streams with enough volume and speed to erode streambanks, strip streamside vegetation, alter the streambed, and widen stream channels resulting in fluctuating water levels, increased sediment loading, and higher water temperatures (United States Environmental Protection Agency 2002b).

The percentage of land covered by impervious surfaces increases as development increases and alters the natural landscape such that imperviousness has become synonymous with human presence. Although impervious land cover has long been characteristic of urban areas, it has

only recently emerged as an environmental indicator and been recognized as a very useful indicator with which to measure the impacts of land development on aquatic systems (Arnold and Gibbons 1996). Increased impervious surface cover can be a prime indicator of NPS pollution and water quality degradation because impervious surfaces not only indicate urbanization, but also are major contributors to the environmental impacts of urbanization. Research consistently shows a strong negative correlation between the imperviousness of a drainage basin and the health of its receiving stream so that percent of impervious surface within a watershed is a viable indicator of watershed health and ecosystem quality (Klein 1979, Griffin 1980, Schueler 1994a, Arnold and Gibbons 1996). Degradation first begins to become noticeable at 10% impervious surface and becomes so severe as to be almost unavoidable at 25-30%. Arnold and Gibbons (1996) defined 3 broad categories of stream health in relation to impervious surface: "protected" (<10 %), "impacted" (10-30%), and "degraded" (>30%). Although there is not always agreement for the demarcation between impacted and degraded, the threshold of initial degradation is remarkably consistent at 10% impervious surface with studies evaluating stream health using many different criteria including habitat quality, aquatic species diversity and abundance, and pollutant loads (Schueler 1994a, Hicks 1995, Arnold and Gibbons 1996). Impervious coverage, then, is both a reliable and integrative indicator of the impact of development on water resources.

hotel parking lot draining directly to Coosa River in Gadsden

Urbanization and the accompanying increase in impervious surface profoundly modify watershed hydrology and vegetation. As vegetation is replaced by impervious surfaces, infiltration, groundwater recharge, groundwater contributions to streams, and stream base flows all decrease, while overland flow volumes and peak runoff rates increase (National Research Council 2002). Stream channels respond by increasing their cross-sectional area to accommodate the higher flows, which triggers a cycle of streambank erosion and habitat degradation and typically ends in degraded water resources. Sediment loadings may increase by one to two orders of magnitude compared to pre-development conditions, such that streambeds are covered with shifting deposits of sand and mud. Storm runoff from roads and parking lots often flows directly into streams without treatment, carrying all the sediment and pollutants picked up directly into the stream (Macie and Hermansen 2002). The impacts of these changes include habitat loss and degradation for aquatic species, and can lead to decreases in macroinvertebrate communities and shellfish beds and deleterious impacts on aquatic systems, with macroinvertebrates disappearing from urban streams in areas with $\geq$25% impervious surface cover.

The accurate mapping of impervious surfaces plays an important role in water quality management and is essential to our ability to monitor urban-related NPS pollution because

increased impervious surface coverage can be a prime indicator of NPS problems and water quality degradation. The amount of impervious surface in watersheds is often estimated using a generalized estimate based on land use/ land cover data. These types of estimates tend to be too generalized and typically do not depict an areas true spatial pattern of impervious surfaces (Civco and Hurd 1997). A more detailed analysis of impervious surface using methods that map impervious surface at a finer scale (such as Ridd 1995, Civco and Hurd 1997, Flanagan and Civco 2001) should be conducted for both watersheds. The results of an impervious surface analysis can be used to help guide planning emphasis within each local basin area.

Imperviousness works well as a surrogate for water quality in planning and land use decisions because it is integrative (so it can help cut through much of the complexity of some issues) and measurable (and so appropriate for a wide range of planning and regulatory applications). Also, the basic tenets of reducing imperviousness--retaining the natural landscape, minimizing pavement, promoting infiltration to the soil--are simple concepts that can be understood by a community and its residents (Arnold and Gibbons 1996). However, planners should remember that using heavy equipment during construction and heavy use of roads and parking lots, even if created using one of the various pervious surface options available, can create an impervious surface through soil compaction. This increase in imperviousness, even potentially when using a pervious surface, should be factored into any analysis for future imperviousness in a watershed. Roads usually account for the majority of a communities impervious coverage and tend to produce the most pollutant-laden runoff, so decreasing road widths is one of the best design-related opportunities for reducing imperviousness. Another design-related opportunity to reduce imperviousness is the use of cluster development, which can reduce site imperviousness by 10-50% depending on the road network and lot size (Schueler 1994b). Cluster development and other development alternatives intended to reduce imperviousness and promote the retention of undeveloped buffers along streams have less impact than traditional types of development on the biotic integrity of streams (Wang et al. 2001). In commercial and industrial areas, reducing imperviousness through design-related reductions can best be achieved by targeting parking through smaller lot sizes and emphasizing the use of infiltration and nonstructural solutions, such as placing vegetated landscaped areas in parking lots below the level of the parking surface that serve as infiltration and treatment areas for runoff (Bitter and Bowers 1994). Reducing imperviousness through planning and design reduces the deleterious impacts of imperviousness, but also can save money for the community or region doing the planning. Arnolds and Gibbons (1996) recommend that "for areas in the lower impervious zone, emphasis should be placed on preventive measures that retain existing natural systems, using techniques like open space planning and stream buffers. For areas that are in, or will be in, the "impacted" (10-30%) zone, preventive planning should be accompanied by a focus on site design considerations that reduce runoff and imperviousness. Finally, for area at (or climbing into) the "degraded" (over 30%) zone, the focus shifts to remediation through pollutant mitigation and resource restoration."

Forestry

The source Forestry was defined as silvicultural activities resulting in NPS pollution as a result of negative silvicultural practices including inadequate Best Management Practices (BMP); lack of a streamside management zone (SMZ); timber road construction and use; timber harvesting; site preparation; and any other silvicultural activity resulting in disruption of surface hydrology, sedimentation, elevated water temperatures, and degradation of aquatic habitat. Incompatible

forestry practices was one of the top three threats identified for conservation targets across the Cumberlands and Southern Ridge and Valley Ecoregion in TNC's ecoregion plan (The Nature Conservancy 2003).


clearcut in Cherokee County

Timber harvest is a long-standing and vital component to the economic welfare of all southern states (Wear and Greis 2002). Approximately 202,343,100 ha (499,998,700 ac)of land is managed for timber production in the United States. Although only a small fraction of this is harvested yearly, forestry activities can cause major water quality problems if not managed properly. Nationwide, the EPA and state agencies estimated forestry practices were responsible for approximately 10% of the water quality impairment in rivers and streams (United States Environmental Protection Agency 2002a). Inadequate BMPs, SMZs, and road maintenance can be a significant source of sedimentation. Forestry road construction and use are a primary source of NPS pollution from silvicultural activities, contributing up to 90% of the sediment produced in forestry practices. Properly implementing forestry BMPs during road construction and maintenance is very important because surface erosion rates on roads often equal or exceed erosion rates reported on severely eroding agricultural lands. Additionally, intense silvicultural practices such as clearcutting, mechanical site preparation and heavy herbicide use could also significantly impact the watershed. Potential hydrologic effects from timber harvest include increased annual water yields, increased sediment production, and altered stream chemistry (National Research Council 2002). The potential impacts of silvicultural practices on aquatic systems include increased riffle sediment, length of open stream, water temperature, snag volume, and algal cover; decreased riffle macroinvertebrates; compositional changes in forest avian communities; and chemical contamination from fuels and lubricants (Beck 1995, Wenger 1999, Haag and Dickinson 2000, Jackson et al. 2001). These responses do not always occur and typically depend on terrain conditions, the amount of timber removed, the type of logging system, post-harvest rainfall patterns, soil type, and other factors.

Many of these impacts can be minimized through proper implementation of BMPs. The current role and effectiveness of forestry BMPs for reducing sediment and nutrients reaching a waterbody in the south is generally well accepted; numerous studies have shown properly implemented BMPs limit the impacts of forestry practices on water quality and base flow (Arthur et al. 1998, Wear and Greis 2002, Aust and Blinn 2004). However, Mortimer and Visser (2004) suggest that recent litigation concerning land management activities (i.e., timber harvesting) causing flooding through increased surface flow and sedimentation necessitates a review of BMP design and implementation because forestry BMPs have not specifically been designed for

preventing peak flow water from reaching a stream, and may warrant consideration of a water quantity BMP.

The use of streamside buffers and SMZs on forest lands are critical to the protection of water resources. Cutting without a riparian buffer results in immediate channel changes (Jackson et al. 2001) and can have a profoundly negative impact on stream biota that may alter the long-term composition and character of the area. Timber harvest in riparian areas also can adversely impact the adjacent waterbody if SMZs are not used or are improperly used through shade removal resulting in increased the water temperature, destabilized soil leading to increased sedimentation, and decreased dissolved oxygen. It is critical that all silvicultural activities be strongly encouraged to properly implement the use of streamside buffers.

Invasive/Alien Species

For the purpose of this project, the source Invasive/Alien Species was defined as any non-native species which can cause environmental harm. Invasive species are species that are non-native (or alien) to the ecosystem under consideration that are likely to cause economic or environmental harm to the area in which they have been introduced (Executive Order 13112). Invasive non-native organisms are one of the greatest threats to the natural species and ecosystems of the U.S. (Stein and Flack 1996). They are the second greatest threat to imperiled species and the integrity of ecosystems in the U.S. after habitat destruction/degradation (Noss and Peters 1995, Stein et al. 2000), and impact nearly half of the species currently listed as "Threatened" or "Endangered" under the U.S. Federal Endangered Species Act (Flather et al. 1994). TNC's Cumberlands and Southern Ridge and Valley Ecoregion Plan (The Nature Conservancy 2003) identified invasive species as a major threat to conservation in the ecoregion and provided strategies for abating threats from invasive species.. The most common concern about invasive organisms is their displacement of native species and the subsequent alteration of ecosystem properties (National Research Council 2002).

This threat often works in tandem with habitat destruction because exotic species more readily invade disturbed habitat. Numerous species that have become invasive problems were intentionally introduced to "create" a desired landscape, but many others were unintentional introductions. Invasive species are especially problematic in areas that have been disturbed by human activities such as road building, residential development, forest clearing, logging operations, grazing, mining, ditching of marshes for mosquito control, mowing, erosion control, and fire prevention and control activities. These unwelcome plants, insects, and other organisms disrupt the ecology of natural ecosystems, displace native plant and animal species, and degrade our nation's unique and diverse biological resources. Some of the known ecological impacts of invasive species are a reduction in the amount of light, water, nutrients and space available to native species; alteration of hydrological patterns, soil chemistry, moisture-holding capacity, erodibility, fire regimes, and natural ecological processes such as plant community succession; hybridization with native species; harboring of pathogens; loss of food sources for wildlife; loss of and encroachment upon endangered and threatened species and their habitat; and disruption of insect-plant associations necessary for seed dispersal of native plants (Randall and Marinelli 1996, Stein and Flack 1996, Plant Conservation Alliance 2000). Invasive species also reduce an ecosystem's ability to provide basic ecological services, such as flood control and crop pollination, on which humans depend (Stein and Flack 1996). In addition, invasive species

negatively impact domesticated species, damaging agricultural crops and rangelands and spreading diseases that affect domestic animals and humans, causing economic losses and expenditures measured in billions of dollars each year for agriculture, forestry, commercial fisheries, range lands, tourism, and roadways management (Li 1995, Westbrooks 1998).

Asian clam (*Corbicula fluminea*)
Photo – from Florida Integrated Science Center - Gainesville

Because of their life cycle, small population sizes, and limited habitat availability, the federally listed mussel and snail species in both watersheds are highly susceptible to competitive or predaceous nonnative species (United States Fish and Wildlife Service 2004b). The most abundant aquatic invasive faunal species of concern in both watersheds is the Asian clam (*Corbicula fluminea*). The Asian clam has invaded all major drainages in the Mobile River Basin. This nonnative species has been coexisting with the native mussel fauna for several decades, but little is known about the effects of competitive interaction between native species and Asian clams (United States Fish and Wildlife Service 2004b). The Asian clam is a known biofouler in power plant and industrial water systems and has also caused problems in irrigation canals and pipes. Ecologically, this species can alter benthic substrates and compete with native mussel species for food and space (Florida Caribbean Science Center 2001). In addition, Asian clams appear to be capable of tolerating polluted environments better than many native bivalves. The source of first introduction to North America is unknown, but it is suspected that this species was brought from China by immigrants as a food source and subsequently released. This species is found in fresh waters throughout the United States including all five Gulf states and northern Mexico. Estuarine populations have been reported for the San Francisco Bay, California, and Chesapeake Bay, Virginia, but none have been reported for the Gulf of Mexico ecosystem (Florida Caribbean Science Center 2001).


black carp – photo USGS

Another potential aquatic invasive that could pose a threat in both watersheds is the black carp (*Mylopharyngodon piceus*), a mollusk-eating Asian fish used to control snails in commercial fish farms (United States Fish and Wildlife Service 2004b). Other Asian carp species that have become established in the United States spread quickly after introduction, became very abundant, and hurt native fishes either by damaging habitats or by consuming vast amounts of food. If this species becomes established in the watersheds, it is likely to have a considerable negative impact on native freshwater mussels and snails. Therefore, all efforts should be made to prevent this species from becoming established. Other nonnative aquatic species of concern to the USFWS (2004b) for possible spread or introduction into the watersheds include the zebra mussel (*Dreissena polymorpha*) and quagga mussel (*D. bugensis*). The zebra mussel was one of the "dirty dozen" species identified by Stein and Flack (1996) that exemplify the worst of invasive species to illustrate the breadth of problems presented by invasive species.

There are numerous invasive plant species in both watersheds, including kudzu (*Pueraria montana* var. *lobata*), Japanese stilt grass (*Microstegium vimineum*), and privet (*Ligustrum* spp.). Chinese tallow (*Sapium sebiferum*), one of Stein and Flack's (1996) "dirty dozen", is a pernicious invader of wetlands but is not yet abundant in either watershed. Efforts should be made to prevent this species from becoming established in the watershed, including educating plant consumers and nursery owners about its negative impacts and the need to use native species in landscaping because this species is still in demand from nurseries where it is stocked as an ornamental despite it being a serious and growing threat to the native plants and habitats of the southeast.

kudzu patch in Calhoun County near Talladega National Forest

Kudzu was introduced into the U.S. in 1876 and was actively promoted as a forage crop, ornamental plant, and cover crop to prevent erosion through the mid 1950s. The U.S. Department of Agriculture recognized kudzu as a pest species in 1963 and removed it from its list of permissible cover plants. Kudzu was included by the Invasive Species Specialist Group as one their list of 100 of the world's worst invasive alien species. Kudzu is an aggressive climbing, semi-woody, leguminous, perennial vine actively growing from early summer (May) until the first frost (Bergmann and Swearingen 1999). Kudzu grows well under a wide range of conditions and in most soil types. Preferred habitats are forest edges, abandoned fields, roadsides, and disturbed areas, where sunlight is abundant. Kudzu is common throughout the southeastern U.S., covering an estimated 2.83 million ha (7 million ac) (Southeast Exotic Pest Plant Council 2003a), and has extended its range throughout most of the eastern and central US. However, it grows best where winters are mild, summer temperatures are >27° C (80° F), and annual rainfall is > 102 cm (40 in) (Bergmann and Swearingen 1999). Kudzu roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weighing as much as 400 pounds. As many as thirty vines may grow from a single root crown. Once established, kudzu grows rapidly, extending as much as 18 m (60 ft) per season at a rate of about 0.3 m (1 ft) or more per day, forming a continuous blanket of foliage that often chokes out competing native vegetation that provides food and habitat for native animals resulting in a large scale alteration of biotic communities (Southeast Exotic Pest Plant Council 2003a). Kudzu kills or degrades other plants by smothering them under a solid blanket of leaves, by girdling woody stems and tree trunks, and by breaking branches or uprooting entire trees and shrubs through the sheer force of its weight (Bergmann and Swearingen 1999). Kudzu is well established in many populations throughout both watersheds, and is a problem on both public and private land.

While complete eradication of this species in either watershed is unlikely, the goal should be to prevent further spread of the species and eradication of the plant from as many areas as possible. For effective control, the extensive root system must be destroyed.


Japanese stilt grass (*Microstegium vimineum*)
Photo - TNC

Introduced about 1919 in Tennessee, Japanese stilt grass may have accidentally escaped as a result of its use as a packing material for porcelain. Japanese stilt grass is an annual grass that may grow to 1 m (3 ft) in height and forms dense, sprawling mats with its long, thin, alternating leaves (Swearingen 1999). It occurs in a wide variety of disturbed habitat types and opportunistically in areas of open soil that are generally not already occupied by other species (Swearingen 1999). Japanese stilt grass is adapted to low light conditions and threatens native understory vegetation in open to shady locations. It spreads opportunistically following disturbance to form dense patches, displacing native wetland and forest vegetation as the patch expands. Japanese stilt grass is capable of invading wildland areas and swiftly replacing natural communities with nearly monospecific stands. It is generally slow to invade undisturbed areas, but rapidly fills disturbed areas such as flood-scoured stream sides and areas subject to mowing, tilling and other soil disturbing activities (Tu 2000). Japanese stilt grass is a problem at numerous sites in both watersheds, including areas around several of the pitcher plant bogs. Once established, the removal of *M. vimineum* requires major eradication and restoration efforts. Whenever possible, Japanese stilt grass should be prevented from invading natural plant communities adjacent to existing stilt grass populations by avoiding disturbance to vegetation and soil in those areas (Swearingen 1999). The likelihood of its establishment also can be greatly reduced through early control of new infestations. Japanese stilt grass may be pulled by hand because it is shallow-rooted. However disturbance to the soil may allow for germination of stored stilt grass seed if plants are pulled early in the summer, and treatment will need to be repeated and continued for many seasons. A more effective mechanical method might be to wait until late summer when the plants are in peak bloom but before seed is produced, and simply cut them back. Being an annual plant, Japanese stilt grass cut late in the season will die back for the winter and not produce additional vegetative shoots (Swearingen 1999). For extensive infestations, where mechanical methods are not feasible, a systemic herbicide like glyphosate (e.g., Roundup), an herbicidal soap that kills the plants back (e.g., Scythe) and herbicides specific to annual grasses may be a more effective choice.

Privet is a perennial, shade tolerant shrub that readily grows from seed or from root and stump sprouts and spreads widely by abundant bird- and other animal-dispersed seeds (Southeast Exotic Pest Plant Council 2003b). Privet was included by the Invasive Species Specialist Group as one their list of 100 of the world's worst invasive alien species and was identified as one of the worst invaders in the southeast by TNC's Invasive Species Initiative. Various species of privet have been introduced to the United States as garden plants and are widely used as a common hedge in

Chinese privet (*Ligustrum sinense*) – Photo - TNC

landscaping. It escapes cultivation by movement of seed, which is eaten and subsequently transported by wildlife, particularly birds. Four species of privet are known to occur in Alabama: Japanese privet (*Ligustrum japonicum*), glossy privet (*L. lucidum*), Chinese privet (*L. sinense*), and European or common privet (*L. vulgare*) (Batcher 2000). Privet is an aggressive and troublesome invasive, and often forms dense thickets that outcompete many kinds of native vegetation, particularly in bottom-land forests and along fencerows, thus gaining access to forests, fields, and right-of-ways (Miller 2003). It may displace shrubs in regenerating communities and remain persistent in these areas. Privet is often seen along roadsides and other areas of disturbed soil at elevations less than 915 m (3000 ft), and also becomes established in old fields and landscapes that have abundant sunlight (Southeast Exotic Pest Plant Council 2003b). Control of privet is difficult because the plant resprouts following fires and has no known effective biological control agents. However, efforts should be made to eradicate privet from both watersheds. Eradication is possible at specific sites using mechanical removal, herbicidal applications, or a mix of the two. However, follow-up at the site is absolutely necessary because plant fragments left on the site have the potential to resprout or new plants could sprout from seeds in the soil.

Waste Disposal

For the purpose of this project, the source Waste Disposal was defined as stress from disposal of human waste products not handled by a sewage treatment facility including trash dumping and faulty septic systems.

Septic systems are the most common on-site domestic waste disposal system in use in the U.S. The number of active septic systems in Alabama has been estimated at 670,000 with an unknown number of older, abandoned systems. If properly installed, used, and maintained, septic systems pose no threat to water quality, but if the system is improperly installed or fails, disease-causing pathogens, nitrates, or other pollutants may enter the water table and/or nearby streams. The Alabama Department of Public Health has estimated that 50% of all conventional, onsite septic systems in the state are failing or will fail in the future.

In many rural areas, dead end roads, sinkholes, and streams commonly become disposal sites for garbage and other waste materials. These places are eyesores and pose a threat to ground and surface water quality as well as being a public health hazard. They can quickly contaminate surface and ground water with toxins and pathogens. When the disposal site is a sinkhole or cave, dumping can also cause disturbance to the habitat.

Altered Disturbance Regimes

Ecosystems are dynamic and change through time as ecological, physical, and social components change and because of natural and human disturbances (Macie and Hermansen 2002). Disturbances alter the composition, structure, and spatial arrangement of ecosystems on the landscape, and suppressing disturbances alters landscape heterogeneity. The habitat structure of an ecosystem can changed dramatically when their natural processes, such as their disturbance regime, are disrupted or altered (Turner et al. 1998).

In the South, one of the single most disruptive changes in the natural disturbance regime has been fire suppression. TNC's Cumberlands and Southern Ridge and Valley Ecoregion Plan (The Nature Conservancy 2003) identified fire suppression as a major threat to conservation in the ecoregion, and Noss and Peters (1995) identified fire suppression as one of the most deleterious threats to ecosystems. Many southern ecosystems, such as longleaf pine forests, are dependent on fire for maintaining ecological processes. Fire suppression policies have endangered the existence of fire-dependent communities and species, enabled xeric communities to become more mesic in species composition, increased the size and severity of forest fires, and reduced landscape heterogeneity (Stuart 1998). Fire suppression also alters the frequency and severity of other disturbances, such as those caused by insects and pathogens. Fire suppression has led to dramatic changes in vegetation structure and declines of many plant and animals species associated with fire-maintained communities. One of the communities that has suffered the most from fire suppression is the longleaf pine forest because every stage of the longleaf pine life cycle relates to fire (Myers 1990). Fires consumes aboveground litter, mineralizing phosphorous and other nutrients and making them available to plants. Fire suppression in longleaf pine forests causes invasion by hardwood trees and a major change in the species composition of the forest, because the fire-adapted longleaf pine are outcompeted by fire-sensitive hardwoods when fires are suppressed (Noss and Peters 1995). Vegetation density usually increases and the fire-dependent species are choked out. Restoring these fire-dependent communities will require the ability of managers to use prescribed fire. However, the ability of managers to use prescribed fire is limited by weather and by public opinion. The main impediment is often public opinion, which is often negative towards the use of prescribed fire, and liability issues, particularly in areas containing any type of development.

CONSERVATION MEASURES

Information on the occurrence of rare and sensitive species is often incomplete and heavily influenced by where surveys have been conducted in the past and the taxonomic expertise of the searchers. Many areas of both the MCR & UCR watersheds have not been surveyed or have been surveyed only for specific taxonomic groups. A comprehensive survey is needed throughout both watersheds. In focus groups conducted by the Forest Service for their wildland-urban interface assessment (Monroe et al. 2003), many of the participants suggested natural resource inventories would help provide data to support and aid in the decision-making process.

One of the greatest general threats to the survival of many rare species populations in both watersheds is the isolation and small size and extent of the populations that remain which magnifies the negative impacts of anthropogenic stresses. Cumulative effects of physical habitat

modifications have caused widespread fragmentation and isolation of many populations of rare species, presenting difficult challenges for those trying to reverse their decline and restore these species. These small isolated populations remain vulnerable to extinction or extirpation due to demographic stochasticity, catastrophic events, or habitat loss and degradation caused by the many potential stresses in the watersheds. For several species, especially the freshwater mussels and snails, maintaining the species as part of the biota in the watershed will require not only protection of existing populations, but also reintroductions into currently unoccupied portions of their historic range. The USFWS (2003b) noted the need to reintroduce mussel species into historical portions of their range now unoccupied if the federally listed species were to be recovered. When possible, efforts need to be made to reintroduce mussels into their designated critical habitat currently unoccupied. Existing and future reintroduction efforts should be supported. In addition, the efforts underway to improve conditions in the Weiss Bypass Channel for mussels and snails by altering the water release policy at Weiss Dam similar to what was accomplished at Jordan Dam should be promoted.

Conservation actions should initially concentrate on the rare species areas and their buffers and USFWS designated critical habitat for mussels. An action which is likely to have a great impact on aquatic systems and should be a priority in both watersheds is the protection and restoration of riparian vegetation along the waterbodies in the watershed, particularly the lower order streams. Numerous studies have shown the benefits of maintaining native vegetation in riparian zones adjacent to more intensive land uses for reducing pollutant loads to the waterbody and maintaining biotic integrity (Anderson and Ohmart 1985, Castelle et al. 1994, Gilliam 1994, Basnyat et al. 1999, National Research Council 2002). Because riparian areas perform a disproportionate number of biological and physical functions on a unit area basis, their protection and restoration can have a major influence on achieving the goals of the Clean Water Act, the Endangered Species Act, and flood damage control programs, and thus, provide an important management strategy for controlling stream water quality in multiuse landscapes (Weller et al. 1996, National Research Council 2002). Riparian areas also provide some of society's best opportunities for restoring habitat connectivity across the landscape. Protection should be the goal for the riparian areas in the watersheds in the best ecological condition, while riparian areas that are degraded should have restoration as their goal. Measures to protect intact areas are often relatively easy to implement, have a high likelihood of being successful, and are less expensive than the restoration of degraded systems (National Research Council 2002). NRC (2002) recommended that "management of riparian areas should give first priority to protecting those areas in natural or nearly natural condition from future alterations. The restoration of altered or degraded areas could then be prioritized in terms of their relative potential value for providing environmental services and/or the cost effectiveness and likelihood that restoration efforts would succeed." In many cases, relatively easy things can be done to improve the condition of degraded riparian areas, such as planting vegetation, discontinuing those land- or water-use practices that caused degradation, removing small flood-control structures, or reducing or removing a stressor such as grazing or forestry. For a variety of reasons, however, eliminating practices causing harm can be a major challenge.

Buffer zones, both within and upslope from riparian areas, can offset some of the negative effects of anthropogenic land uses (Steedman 1988, May et al. 1997), and are currently being promoted as management measures for water quality protection throughout the world,

Example of forested riparian buffer. Photo – USDA NRCS

particularly in the United States and Europe (National Research Council 2002). Establishment and maintenance of well-vegetated buffer strips along streams has become one of the most visible and widely accepted applications of watershed management, and has become a major focus in the restoration and management of landscapes (Knopf et al. 1988, Wang et al. 2001). Vegetative buffers are effective in trapping sediment, pathogens, toxins, and contaminants from runoff by intercepting NPS pollution in surface and shallow subsurface flow as well as reducing channel erosion. They are a valuable conservation practice with many important water-quality functions including moderation of stormwater runoff, moderation of water temperature, maintenance of habitat diversity, protection for wildlife species distribution and diversity, and reduction of human impacts (Lowrance et al. 1984, Cooper et al. 1987, Cheschier et al. 1991, Castelle et al. 1994, Gilliam 1994, National Research Council 2002). In urban areas, vegetated riparian zones, often called “greenbelts” or “greenways”, managed for conservation, recreation, and nonmotorized transportation provide numerous social benefits and are a focus of many community enhancement programs (Fisher and Fischenich 2000).

Buffer zones are included in many BMPs including those for silvicultural and agricultural activities. However, to be effective, buffers must extend along all streams, including intermittent and ephemeral channels, because riparian buffers along headwater streams (i.e., those adjacent to first-, second-, and third-order streams) have much larger impacts on overall water quality within a watershed than those along higher-order streams (Fischer et al. 2000). In addition, buffers must be augmented with enforceable on-site sediment controls and a limited amount of impervious surfaces. Buffers are most effective at pollutant removal when surface and shallow subsurface flow is distributed uniformly as sheet flow. However, agricultural and urban areas tend to concentrate flow into channelized flow before it reaches the buffer. Furthermore, it is crucial that these riparian corridors contain native vegetation, and should be maintained or, where necessary, restored. An adequate buffer size to protect aquatic resources will depend on the specific function it needs to provide under site-specific conditions. Economic, legal and political considerations often take precedence over ecological factors when recommending size and design of buffer strips (Fischer and Fischenich 2000). Recommended designs are highly variable, but most recommended widths are for a minimum width of 15-30 m width under most circumstances. However, site-specific conditions may indicate the need for substantially larger buffers particularly for ecological concerns such as wildlife habitat needs which typically require much wider buffers than that needed for water quality concerns (Fischer and Fischenich 2000, Fischer et al. 2000). Riparian buffer zones should be used as part of a larger conservation management system that improves management of upland areas to reduce pollutant loads at the source, and should not be relied upon as the sole BMP for water-quality improvement. Instead, they should be viewed as a secondary practice that assists in in-field and upland conservation practices and "polishes" the hillslope runoff from an upland area (National Research Council

2002). Even when riparian buffer zones are marginally effective for pollutant removal, they are still valuable because of the numerous habitat, flood control, groundwater recharge, and other environmental services they provide. An intact naturally functioning riverine system, with riparian vegetation, in which native plant and animal communities can exist is a critical, measurable strategy to preserve water quality and abate NPS pollution.

Land use practices in adjacent uplands must be considered and addressed in riparian area management because upslope management practices can influence the ability of riparian areas to function by altering the magnitude and timing of overland flow, the production of sediment, and quality of water arriving at a downslope riparian area (National Research Council 2002). In other words, riparian area management should be approached on a watershed scale, and watershed management plans should incorporate riparian area management whenever possible because it is a component of good watershed management. Riparian area management should be based on the same principles that characterize watershed management: partnerships, geographic focus, and science-based management (National Research Council 2002). The future success of at least five national policy objectives - protection of water quality, protection of wetlands, protection of threatened and endangered species, reduction of flood damage, and beneficial management of public lands - depends on the restoration of riparian areas (National Research Council 2002). Because many of the options for improving riparian areas across watersheds encompass a wide range of individual and societal values, there is a great need to engage various stakeholders in broad-scale and collaborative restoration efforts. Most riparian lands are in private ownership, and these owners typically have only limited motivation to use these areas in a manner protective of their ecological functions because their value is most often measured in terms of their economic benefit rather than their ecological functions (National Research Council 2002). However, an increasing number of public programs, such as the various Farm Bill conservation program and the USFWS Private Stewardship Grants program, are offering some form of payment in return for such protection. Educational outreach for these programs should highlight the benefits these programs provide to landowners. Educational efforts on the importance of riparian areas needs to reach broad and diverse audiences, and should include traditional educational institutions and reach out directly to policy makers, natural resource personnel, government officials, developers, landowners, and the public at large. To be successful, riparian education must also foster a sense of community and responsible stewardship (Orr 1990).

Population growth is the most significant social change affecting natural resources, and it will continue to affect the area as both the MCR and UCR watersheds are projected to have 13-28% population growth in interval 2000-2020 (Macie and Hermansen 2002). Managing growth in the watersheds will be vital to maintaining the biodiversity of the watersheds. As populations and urban growth expand, natural environments are increasingly affected by human activities; rapid development leads to the fragmentation and loss of natural resources, as well as the continued degradation of environmental resources (Macie and Hermansen 2002). In the wildland-urban interface, that area where homes or other structures are adjacent to or within forests and other rural settings, natural resource managers face critical challenges, such as wildfire prevention, control, and mitigation; watershed conservation and management; biodiversity management; and forest-resource management and conservation (Monroe et al. 2003). Protecting wildlife habitat, improving water and air quality, and preserving the rural character of communities top the list of

issues many managers and planners must deal with as developed areas expand. The pace of urban sprawl is bringing to the rural landscape the noise, pollution, and conflicts many people thought they were escaping by moving and many fear the beauty and rural character they cherish will be lost if appropriate measures are not taken to protect key features (Monroe et al. 2003). In focus groups conducted by the Forest Service for their wildland-urban interface assessment (Monroe et al. 2003), participants in every discussion group mentioned changes in air quality, wildlife habitat, water quality, water quantity, species composition, soil quality, and pollution levels as issues of concern. Most groups also mentioned increasingly hazardous fuel loads and the threat of wildfire. The need for smart-growth initiatives and planned communities that protect habitat and stream corridors while providing housing for people was raised in every group. However, Macie and Hermansen (2002) suggested a need to move beyond smart growth models and start to predict the impacts of land use changes on landscape heterogeneity as well as ecosystem composition, structure, and function. They also suggested expanding Wear et al.'s (1998) modeling approach to land use changes in an urban and urbanizing context to landscapes throughout the region, and applying the results to land use decisions. Every focus group also complained that a lack of vision, leadership, planning, and regional coordination for comprehensive growth management are major factors that create interface problems. An issue raised in the Alabama groups was the lack of home rule which prohibits local governments from regulating growth. In addition, local governments receive most of their funding from property and sales taxes, which creates an incentive to promote economic development at the local level, usually to the detriment of the natural resources in the area (Macie and Hermansen 2002). Key issues in Alabama included political issues, a lack of vision and leadership to guide development and planning (a common concern in all states), the need for sustainable development, a lack of comprehensive land use planning, water quality and quantity, and education (Monroe et al. 2003).

The health and condition of natural resources are also related to the manner in which land is developed. It often appears that that land use decisions are made without regard to the sensitivity of the landscape or its suitability for development so that land development too often inhibits natural ecosystem functions (Macie and Hermansen 2002). Land use planners must reconcile economic development with environmental protection. Traditionally, effects on soils, vegetation, species composition, and hydrology have been analyzed only on a fine scale. To understand the ecological effects of urbanization, we need to look at entire landscapes (broad scale) as well as affected sites (fine scale) (Macie and Hermansen 2002). Therefore, planning and management should include broad scale considerations that cover the needs of entire ecosystems, not just the pieces. Because aquatic habitats are intrinsically connected to their watersheds, aquatic species conservation is a complex task, and may best be served by a watershed management approach. A watershed approach provides a framework to design the optimal mix of land covers, minimize the effects on water resources, and coordinate management priorities across land ownerships (Macie and Hermansen 2002). However, managing ecosystems at a watershed scale presents many challenges: most management strategies are not on a scale commensurate with issues at the watershed scale; local control or management for system components often takes precedence over system wide needs; data generally are not collected and analyzed on watershed scales; and small parcels, multiple owners, and conflicting objectives complicate coordinated management (Macie and Hermansen 2002). All public and private land managers with jurisdiction over an ecosystem should cooperate and base their joint plans on the

best available conservation science, including consideration of disturbance regimes and minimum viable population sizes for key species. Managing at a watershed scale will require interagency cooperation and crossing political boundaries, particularly in the UCR watershed. The proportion of the Upper Coosa River watershed in Alabama is very small, with most of the watershed in Georgia and a small portion extending into Tennessee. What happens in these affects the watershed in AL, so improving conditions of the UCR watershed in Alabama will require cooperation across state boundaries. Because ecosystems are so complex and in many cases exceed our ability to understand them completely, managers should use "adaptive management," meaning that managed ecosystems should be monitored so that timely action can be taken to correct for faulty management or changing conditions.

In addition to incorporating broad-scale issues, planning should consider the cumulative ecological effects of an activity in a watershed because actions that are harmless in isolation can create serious problems when large numbers of people act in the same way (Freyfogle 1997). The current degraded status of many habitats and ecosystems represents the cumulative, long-term effects of numerous persistent, and often incremental impacts from a wide variety of land uses and human alterations. Previous land management decisions often were made independent of other human activities in watersheds. Consequently, the cumulative effect of incremental changes in land cover was never assessed, and water quality and quantity declined (Macie and Hermansen 2002). Property owners can contribute to natural resource problems because they do not always take into account the consequences their land use decisions may have on their neighbors. The current system encourages private landowners to make land use decisions that are in their own short-term best interest without regard for whether these decisions will be beneficial to the broader community (Macie and Hermansen 2002). There is also a lack of long-term commitment to assess cumulative effects, and it often is not economically feasible to study, manage, and restore at such large scales (Naiman 1992)

Land use planners are faced with decisions regarding whether, how, and in what pattern land is developed, parcelized, and used. In general, such land use decision making occurs without individual and cumulative impacts to biological resources being considered (Environmental Law Institute 2003). Preservation of our biological resources would receive tremendous help if biologically sensitive spatial planning was incorporated early in the development process. While land use planners and developers are beginning to show more interest in protecting biological diversity, these professionals often lack the necessary information to incorporate ecological principles into their decision making and to transform their traditional planning approaches into progressive, ecologically based conservation tools (Environmental Law Institute 2003). Because the greatest threat to species and habitat is the increase in human population, land management decisions need to incorporate the principles of an ecosystem approach to decision-making (Dale et al. 2000, Flores et al. 1998, Zipperer et al. 2000). To encourage and facilitate better integration of ecological knowledge into land use and land management decision making, the Ecological Society of America developed general guidelines (Dale et al. 2000) to assist land use planners in evaluating the ecological consequences of their decisions. Without ecological planning and collaboration, we are faced with continual urban sprawl and the loss of the ecological uniqueness of many areas.

A vital aspect of measuring success involves assessing the effect of conservation efforts on the biological resource. To abate threats to the MCR and UCR watersheds, ALNHP identified numerous biological goals, within which lie the measures of biological success. Inherent within some of these desired results are monitoring programs that gather more detailed information relevant to progress. Many of the strategies developed in the Mid-Coosa River Basin Management Plan (Alabama Clean Water Partnership 2003) and TNC's Cumberland and Southern Ridge and Valley Ecoregion Plan (The Nature Conservancy 2003) could be applied to address these goals.

Goals

- Protect and maintain multiple, viable populations of all local scale conservation targets ensuring that, for each species, enough populations are protected to conserve their remaining natural range of ecological and genetic diversity.

- Add biomonitoring to the water quality monitoring efforts in the watersheds, using species such as mussels, caddisflies or other aquatic invertebrates, and fish species sensitive to changes in water quality

- Protect and, where possible, restore riparian vegetation.

- Maintain or improve water quality and hydrologic function within the watershed.

- Maintain or restore the natural ecological processes that maintain this ecosystem, including fire and habitat connectivity, to the extent possible.

- Maintain or restore the condition and long-term viability of portions of the main stem Coosa River that have not been inundated by impoundments, such as the Weiss Bypass Channel, and all tributaries where feasible.

- Increase conservation awareness and promote a land ethic within the watershed through education and outreach.

- Prevent the spread of established exotic invasive species, prevent the establishment of new invasive species, and eradicate existing populations of exotic invasive species where feasible.

- Conserve key parcels through easements, acquisitions, or government funded programs such as the USFWS Landowner Incentive Program and the various Farm Bill conservation programs.

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LITERATURE CITED

Ahlstedt, S. A. 1986. Cumberlandian mollusk conservation program, Activity 1: mussel distribution surveys. Tennessee Valley Authority, Division of Services and Field Operations, Norris, Tennessee. TVA/ONRED/AWR-86/15. 125 pages.

Alabama Agricultural Experiment Station. 1984. Vertebrate wildlife of Alabama. Alabama Agricultural Experiment Station, Auburn University, Auburn University, Alabama, USA. 44 pages.

Alabama Army National Guard. 2003. Draft environmental assessment for enhanced training and operations at the Fort McClellan Army National Guard Training Center, Calhoun County, Alabama. Prepared by AMEC Earth & Environmental, Inc., Huntsville, Alabama, USA. 161 pages + appendices.

Alabama Clean Water Partnership. 2003. Mid-Coosa River basin management Plan. Alabama Clean Water Partnership, Montgomery, Alabama, USA. 154 pages.

Alabama Department of Conservation and Natural Resources. 2002. Alabama regulations 2002-2003: game, fish, and fur bearing animals. Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama, USA. 136 pages.

Alabama Department of Environmental Management. 2000. Alabama's 303(d) list and information (on-line). Available online at <http://www.adem.state.al.us/WaterDivision/WQuality/303d/WQ303d.htm>.

_____. 2002a. Alabama's 2002 water quality report to Congress (Clean Water Act §305(b) report). Alabama Department of Environmental Management, Montgomery, Alabama, USA. [Available online at <http://www.adem.state.al.us/WaterDivision/WQuality/305b/WQ305bReport.htm>].

_____. 2002b. Surface water quality screening assessment of the Coosa River Basin -- 2000. Alabama Department of Environmental Management, Environmental Indicators Section, Montgomery Branch -- Field Operations Division, Aquatic Assessment Unit. Montgomery, Alabama, USA. 194 pages + Appendices. [Available online at <http://www.adem.state.al.us/FieldOps/WQReports/SWQSCoosa00.pdf>].

Alabama Natural Heritage Program. 1994. Natural heritage inventory of Fort McClellan, Main Post: federal endangered, threatened, candidate species and state-listed species. Unpublished report submitted to United States Army Corps of Engineers, Mobile District and Fort McClellan, Anniston, Alabama. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA.

Alabama Soil and Water Conservation Committee. 1998. Alabama watershed assessment. Available online at <http://www.swcc.state.al.us/watershedmenu.htm>.

Allen, A. W. 1995. Agricultural ecosystems. Pages 423-426 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC, USA. 530 pp.

Anderson, B. W. and R. D. Ohmart. 1985. Riparian vegetation as a mitigating process in stream and river restoration. Pages 41-80 *in* J. Gore, editor. The restoration of rivers and streams: theories and experience. Butterworth, Stoneham, Massachusetts, USA. 280 pages.

Arnold, C. L., Jr. and C. J. Gibbons. 1996. Impervious surface coverage: the emergence of a key environmental indicator. Journal of the American Planning Association 62:243-258.

Arthur, M. A., G. B. Coltharp, and D. L. Brown. 1998. Effects of BMPs on forest streamwater quality in eastern Kentucky. Journal of the American Water Resources Association 34:481-495.

Ashton, R. E., Jr. 1986. Green salamander. Pages 57-58 *in* R. H. Mount, editor. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Aust, W. M. and C. R. Blinn. 2004. Forestry best management practices for timber harvesting and site preparation in the eastern Unites States: an overview of water quality and productivity research during the past 20 years. Water, Air, & Soil Pollution: Focus 4(1):5-36.

Bailey, M. R. 1997. Survey of the breeding birds of Anniston Army Depot, Alabama. Unpublished final report submitted to the United States Fish and Wildlife Service, Southeast Region, Atlanta Georgia. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA. 19 pages.

Bailey, R. G. 1995. Description of the ecoregions of the United States, 2nd edition. Miscellaneous Publication 1391. United States Forest Service, Washington, DC, USA. 108 pages.

Barbour, R. W. and W. H. Davis. 1969. Bats of America. The University Press of Kentucky. Lexington, Kentucky, USA. 286 pages.

Basnyat, P. 1998. Valuation of forested buffers. Dissertation. Auburn University, Auburn, Alabama, USA. 202 pages.

_____., L. D. Teeter, K. M. Flynn, and B. G. Lockaby. 1999. Relationships between landscape characteristics and nonpoint source pollution inputs to coastal estuaries. Environmental Management 23:539-549.

Batcher, M. S. 2000. Element stewardship abstract for *Ligustrum* spp. – privet. The Nature Conservancy, Wildland Invasive Species Team, Department of Vegetable Crops & Weed Sciences, University of California, Davis, California, USA. 10 pages. [Available online at <http://tncweeds.ucdavis.edu/esadocs/documnts/ligu_sp.pdf>].

Beck, J. M. 1995. Using GIS to evaluate potential critical nonpoint sources in Alabama's Fish River watershed. Thesis, Auburn University, Auburn, Alabama, USA.

Beck, R. A. 1991. Red-cockaded woodpecker, *Picoides borealis* (Vieillot). Pages 513-514 *in* Terwilliger, K, coordinator. Virginia's endangered species: Proceedings of a symposium. The McDonald and Woodward Publishing Company, Blacksburg, Virginia, USA. 672 pages.

Bent, A. C. 1939. Life histories of North American woodpeckers. United States National Museum Bulletin 174.

Bergmann, C and J. M. Swearingen. 1999. Kudzu *Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida. Online publication. <http://www.nps.gov/plants/alien/fact/pulo1.htm>. Accessed July 2004.

Best, T. L. 2004. Gray myotis *Myotis grisescens* Howell. Pages 179-180 *in* R. E. Mirarchi, M. A. Bailey, T. M. Haggerty, and T. L. Best, editors. Alabama wildlife. Volume 3. Imperiled amphibians, reptiles, birds, and mammals. The University of Alabama Press, Tuscaloosa, Alabama, USA. 225 pages.

Bitter, S. D. and J. K. Bowers. 1994. Bioretention as a water quality best management practice. Watershed Protection Techniques 1(3):114-116.

Bogan, A. E. and J. M. Pierson. 1993. Survey of the aquatic gastropods of the Coosa River Basin, Alabama: 1992. Final report submitted to the Alabama Natural Heritage Program[SM], Montgomery, Alabama, Contract Number 1923. 13 pages + Appendices.

Bogan, A. E., J. M. Pierson, and P. Hartfield. 1995. Decline in the freshwater gastropod fauna in the Mobile Bay basin. Pages 249-252 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC, USA. 530 pp.

Boschung, H. 1986. Pygmy sculpin. Pages 11-12 *in* R. H. Mount, editor. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Bowker, R. G. 1991. Pygmy sculpin (*Cottus pygmaeus*) recovery plan. Prepared for the United States Fish and Wildlife Service , Southeast Region, Atlanta, Georgia, USA. 13 pages.

Boyce, S. G. and W. H. Martin. 1993. The future of the terrestrial communities of the Southeastern United States. Pages 339-366 *in* W. H. Martin, S. G. Boyce, and A. C. Echternact, editors. Biodiversity of the southeastern United States: upland terrestrial communities. John Wiley & Sons, New York, New York, USA. 373 pages.

Braun, E. L. 1950. Deciduous forests of eastern North America. Blackburn Press. Caldwell, New Jersey, USA. 596 pages.

Brim Box, J. and J. D. Williams. 2000. Unionid mollusks of the Apalachicola Basin in Alabama, Florida, and Georgia. Alabama Museum of Natural History Bulletin 21. The University of Alabama, Tuscaloosa, Alabama, USA. 143 pages.

Bury, R. B., P. S. Corn, C. K. Dodd, Jr., R. W. McDiarmid, and N. J. Scott, Jr. 1995. Amphibians. Pages 1243-127 *in* LaRoe, E. T., G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U. S. Department of the Interior, National Biological Service, Washington, DC., USA. 530 pages.

Castelle, A., A. Johnson, and C. Conolly. 1994. Wetland and stream buffer size requirements – a review. Journal of Environmental Quality 23:878-882.

Cheschier, G. M., J. W. Gilliam, R. W. Skaggs, and R. G. Broadhead. 1991. Nutrient and sediment removal in forested wetlands receiving pumped agricultural drainage water. Wetlands 11:87-103.

Civco, D. L. and J. D. Hurd. 1997. Impervious surface mapping for the state of Connecticut. Proceedings of the 1997 ASPRS/ACSM Annual Convention, Seattle, Washington. 3:124-135. [Available online at <http://resac.uconn.edu/publications/tech_papers/pdf_paper/Civco_and_Hurd_ASPRS_1997.pdf>]

Clark, D. R., Jr., F. M. Bagley, and W. W. Johnson. 1988. Northern Alabama colonies of the endangered gray bat *Myotis grisescens*: organochlorine contamination and mortality. Biological Conservation 43:213-225.

Clark, E. H., J. A. Haverkamp, and W. Chapman. 1985. Eroding soils: the off-farm impacts. The Conservation Foundation, Washington, DC.

Cline, G. R. 2004. Green salamander *Aneides aeneus* (Cope and Packard). Pages 29-30 *in* R. E. Mirarchi, M. A. Bailey, T. M. Haggerty, and T. L. Best, editors. Alabama wildlife. Volume 3. Imperiled amphibians, reptiles, birds, and mammals. The University of Alabama Press, Tuscaloosa, Alabama, USA. 225 pages.

Consortium of Alabama Environmental Groups. 2003. Locating potential sources of point and non-point pollution on Alabama water bodies using infrared imaging and high-resolution digital photography obtained from low-flying private aircraft. Final technical report submitted to the U.S. Environmental Protection Agency. 78 pages.

Cooper, J. R., J. W. Gilliam, R. B. Daniels and W. P. Robarge. 1987. Riparian areas as filters for agricultural sediment. Soil Science Society of America Journal 51:416-420.

Corser, J. D. 2001. Decline of disjunct green salamander (*Aneides aeneus*) populations in the southern Appalachians. Biological Conservation 97:119-126.

Dale, V., S. Brown, R. Haeuber, N. Hobbs, N. Huntly, R. Naiman, W. Riesbame, M. Turner, and T. Valone. 2000. Ecological Society of America report: ecological principles and guidelines for managing the use of land. Ecological Applications 10:639-670.

Dennis, J. V. 1971. Utilization of pine resin by the red-cockaded woodpecker and its effectiveness in protecting roosting and nest sites. Pages 78-86. *in* R. L. Thompson, editor. Ecology and management of the red-cockaded woodpecker: proceedings of a symposium. Bureau of Sport Fisheries and Wildlife and Tall Timbers Research Station, Tallahassee, Florida, USA. 188 pages.

DeVries, D. R. 1994. The ecology and current status of the endangered tulotoma snail. Endangered Species Program Annual Performance Report, Grant Number E-1, Study 9. submitted to Nongame Wildlife Program, Alabama Department of Conservation and Natural Resources, Montgomery, Alabama, USA. Department of Fisheries and Allied Aquacultures, Auburn University, Auburn, Alabama, USA. 47 pages.

Deyrup, M. and R. Franz. 1994. Rare and endangered biota of Florida, Volume IV: invertebrates. University Press of Florida, Gainesville, Florida, USA. 798 pages.

Emanuel, C. 1998. Monitoring report for Alabama leatherflower, *Clematis socialis*. Unpublished contract report. Alabama Natural Heritage Program, Montgomery, Alabama, USA. 5 pages + Attachment.

_____. 2002. Restoration management of the green pitcher plant, *Sarracenia oreophila* (Kearney) Wherry, in Alabama: report for 1996-2002. Unpublished report submitted to the United States Fish and Wildlife Service, Jackson, Mississippi. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA. 60 pages + appendix.

Environmental Law Institute. 2003. Conservation thresholds for land use planners. Environmental Law Institute, Washington, DC, USA. 55 pages.

Environmental Systems Research Institute. 2000. Downloadable data – Census 2000 TIGER/line data. Available online at <http://www.esri.com/data/download/census2000_tigerline/index.html>. Accessed June 2003.

Etnier, D. A. 1997. Jeopardized southeastern freshwater fishes: a search for causes. Pages 87-104 *in* G. W. Benz and D. E. Collins, editors. Aquatic fauna in peril: the southeastern perspective. Special Publication 1, Southeast Aquatic Research Institute, Lenz Design and Communications, Decatur, Georgia, USA. 554 pages.

Evans, R. D. 2001. Historical and contemporary distributions of aquatic mollusks in the Upper Conasauga River system of Georgia and Tennessee. Thesis. University of Tennessee, Chattanooga, Tennessee, USA. 277 pp.

Fischer, R. and J. Fischenich. 2000. Design recommendations for riparian corridors and vegetated buffer strips. United States Army Corp of Engineers Ecosystem Management and Restoration Research Program Technical Notes Collection (ERDC TN-EMRRP-SR-24), US Army Engineer Research and Development Center, Vicksburg, Mississippi, USA. 17 pages. [Available online at <http://www.dnr.state.wi.us/org/water/wm/dsfm/shore/documents/sr24.pdf>]

Fischer, R., C. Martin, and J. Fischenich. 2000. Improving riparian buffer strips and corridors for water quality and wildlife. Pages 457-462 *in* P. Wiginton and R. Beschta, editors. Riparian ecology and management in multi-land use watersheds. American Water Resources Association, Middleburg, Virginia, TPS-00-2.

Flanagan, M. and D. L. Civco. 2001. Subpixel impervious surface mapping. American Society for Photogrammetry and Remote Sensing 2001 Annual Convention, St. Louis, Missouri April 23-27, 2001. Online at <http://resac.uconn.edu/publications/tech_papers/pdf_paper/Flanagan_and_Civco_ASPRS_2001.pdf>. Accessed 15 November 2003.

Flather, C. H., L. A. Joyce, and C. A. Bloomgarden. 1994. Species endangerment patterns in the United States. USDA Forest Service General Technical Report RM-241. Fort Collins, Colorado, USA. 42 pages.

Flores, A., S. T. A. Pickett, W. C. Zipperer, R. V. Pouyat, and R. Pirani. 1998. Adopting a modern ecological view of the metropolitan landscape: the case of a greenspace system for the New York City region. Landscape and Urban Planning 39:295-308.

Florida Caribbean Science Center. 2001. Asian clam, *Corbicula fluminea* (Müller, 1774) (Mollusca: Corbiculidae). United States Geological Survey Nonindigenous Species Information Bulletin 2001-001. [Available online at <http://www.fcsc.usgs.gov/corbicula3.pdf>].

Folkerts, G. W. 2004. Seepage salamander *Desmognathus aeneus* Bishop and Brown. Pages 31-33 *in* R. E. Mirarchi, M. A. Bailey, T. M. Haggerty, and T. L. Best, editors. Alabama wildlife. Volume 3. Imperiled amphibians, reptiles, birds, and mammals. The University of Alabama Press, Tuscaloosa, Alabama, USA. 225 pages.

Freeman, J. D., A. S. Causey, J. W. Short, and R. R. Haynes. 1979. Endangered, threatened, and special concern plants of Alabama. Botany and Microbiology Departmental Series #3. Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 25 pages.

Freyfogle, E. T. 1997. Illinois life: an environmental testament. University of Illinois Law Review 1997:1081-1108.

Gangloff, M. M. 2003. The status, physical habitat associations, and parasites of freshwater mussels in the upper Alabama River drainage, Alabama. Dissertation. Auburn University, Auburn, Alabama, USA. 217 pages.

Georgia Department of Natural Resources. 1999. Protected animals of Georgia. Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Wildlife-Natural Heritage Section, Social Circle, Georgia, USA. 247 pages.

Gilliam, J. W. 1994. Riparian wetlands and water quality. Journal of Environmental Quality 23:896-900.

Godron, M. and R. T. T. Forman. 1983. Landscape modification and changing ecological characteristics. Pages 12-28 *in* H. A. Mooney and M Godron, editors. Disturbance and ecosystems: components of response. Springer-Verlag, New York, New York, USA. 292 pages.

Godwin, J., J. Hilton, and M. Bailey. 1994. Faunal and floral survey of Anniston Army Depot and Coosa River Annex: federal endangered, threatened, and candidate species. Unpublished report submitted to Anniston Army Depot, Anniston, Alabama. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA. 56 pages.

Goodrich, C. 1922. The Anculosae of the Alabama River drainage. Miscellaneous Publications, Museum of Zoology, University of Michigan 7:1-57.

Griffin, D. M. 1980. Analysis of non-point pollution export from small catchments. Journal of the Water Pollution Control Federation 52:780-790.

Haag D. A. and T. E. Dickinson. 2000. Effects of riparian buffer width on high-elevation songbird communities. pages 137–40. *in*: Proceedings, From science to management and back: a science forum for southern interior ecosystems of British Columbia. C. Hollstedt, K. Sutherland, and T. Innes (editors). Southern Interior Forest Extension and Research Partnership, Kamloops, B.C. [Available online at <http://www.forrex.org/publications/FORREXSeries/ss1/paper36.pdf>].

Haag, W. R. 2004a. Coosa moccasinshell *Medionidus parvulus* (Lea). Page 25 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

_____. 2004b. Southern clubshell *Pleurobema decisum* (Lea). Pages 100-101 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

____. 2004c. Southern pigtoe *Pleurobema georgianum* (Lea). Page 73 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

_____. 2004d. Ovate clubshell *Pleurobema perovatum* (Conrad). Page 75 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

_____. and M. L. Warren, Jr. 1997. Host fishes and reproductive biology of six freshwater mussel species from the Mobile Basin, USA. Journal of the North American Benthological Society 16:576-585.

_____., M. L. Warren, and M. Shillingsford. 1999. Host fishes and host-attracting behavior of *Lampsilis altilis* and *Villosa vibex* (Bivalvia: Unionidae). American Midland Naturalist 141:149-157.

Hairston, J. E. and L. Stribling. 1995. Nonpoint source (NPS) pollution of Alabama waters. Alabama Cooperative Extension System. ANR-790 Water Quality 4.1. [Available online at <http://www.aces.edu/department/extcomm/publications/anr/anr-790/WQ4.1.pdf>]

Hall, J. S. and N. Wilson. 1966. Seasonal populations and movements of the gray bat in the Kentucky area. American Midland Naturalist 96:497-498.

Hall, R. J. and J. Williams. 2000. Conservation of southeastern mussels. United States Geological Survey, Biological Resources Division, Florida Caribbean Science Center, Gainesville, Florida, USA. 2 pages. [Available online at <http://cars.er.usgs.gov/southeastmussels.pdf>]

Harding, J. S., E. F. Benfield, P. V. Bolstad, G. S. Hefman, and B. D. Jones, III. 1998. Stream biodiversity: the ghost of land use past. Proceedings of the National Academy of Science 95:14843-14847.

Harper, R. M. 1943. Forest of Alabama. Monograph 10. Wetumpka Printing Co., Wetumpka, Alabama, USA.

Harris. S. C., P. E. O'Neil, and P. K. Lago. 1991. Caddisflies of Alabama. Geological Survey of Alabama Bulletin 142. Geological Survey of Alabama, Biological Resources Division, Tuscaloosa, Alabama, USA. 442 pages.

Harris, S. C. and T. M. Lawrence. 1978. Environmental requirements and pollution tolerance of Trichoptera. United States Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, United States. 310 pages.

Harrison, J. R. 1967. Observations on the life history, ecology and distribution of *Desmognathus aeneus aeneus* Brown and Bishop. American Midland Naturalist 77:356-370.

Hart, B. 2002. Status survey of the eastern indigo snake (*Drymarchon couperi* Holbrook), black pine snake (*Pituophis melanoleucus lodingi* Blanchard), and southern hognose snake (*Heterodon simus* Linnaeus) in Alabama. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA. 49 pages.

Hartfield, P. 1991. Status review of eleven mussel species endemic to the Mobile River basin. U.S. Fish and Wildlife Service, Jackson, Mississippi, USA. 21 pages.

_____. 1993. Status review of aquatic snails in the Coosa River, Alabama. U. S. Fish and Wildlife Service, Jackson, Mississippi, USA. 26 pages.

_____. and E. Hartfield. 1996. Observations on the conglutinates of *Ptychobranchus greenii* (Conrad, 1834) (Mollusca: Bivalvia: Unionidae). American Midland Naturalist 135:370-375.

Heard, W. H. 1970. Eastern freshwater mollusks (II). The south Atlantic and gulf drainages. Malacologia 10(1):23-27.

Hershler, R., J. M. Pierson, and R. S. Krotzer. 1990. Rediscovery of *Tulotoma magnifica* (Conrad) (Gastropoda: Viviparidae). Proceedings of the Biological Society of Washington 103:815-824.

Hicks, A. L. 1995. Impervious surface area and benthic macroinvertebrate response as an index of impact from urbanization on freshwater wetlands. Thesis. Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, Massachusetts, USA.

Hinkle, C. R., W. C. McComb, J. M. Safley Jr., and P. A. Schmalzer. 1993. Mixed mesophytic forests. Pages 203-253 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: upland terrestrial communities. John Wiley & Sons, New York, New York, USA. 373 pages.

Horan, R. D. and M. O. Ribaudo. 1999. Policy objectives and economic incentives for controlling agricultural sources of nonpoint pollution. Journal of the American Water Resources Association 35:1023-1035.

Hudson, M. K. 1993. Endangered bat cave survey: Alabama priority 1, 2, 3 and other caves 1995 report. Endangered Species Program Annual Performance Report submitted to U.S. Fish and Wildlife Service, Grant Number E-1, Study 12. Nongame Wildlife Program, Alabama Department of Conservation and Natural Resources, Montgomery, Alabama, USA. 44 pages.

_____. 1995. Endangered bat cave survey: Alabama priority 1, 2, 3 and other caves 1995 report. Endangered Species Program Annual Performance Report submitted to U.S. Fish and Wildlife Service, Grant Number ES-1-3, Study 12. Nongame Wildlife Program, Alabama Department of Conservation and Natural Resources, Montgomery, Alabama, USA. 44 pages.

Hurd, J. C. 1974. Systematics and zoogeography of the Unionacean mollusks of the Coosa River drainage of Alabama, Georgia, and Tennessee. Dissertation. Auburn University, Auburn, Alabama, USA. 240 pp.

Jackson, C. R., C. A. Sturm, and J. M. Ward. 2001. Timber harvest impacts on small headwater stream channels in the coast ranges of Washington. Journal of the American Water Resources Association 37:1533-1549.

Jackson, J. A. 1971. The evolution, taxonomy, distribution, past populations, and current status of the red-cockaded woodpecker. Pages 4-29 *in* R. L. Thompson, editor. Ecology and management of the red-cockaded woodpecker: proceedings of a symposium. Bureau of Sport Fisheries and Wildlife and Tall Timbers Research Station, Tallahassee, Florida, USA. 188 pages.

Johnson, P. D. 2004. Painted rocksnail *Leptoxis taeniata* (Conrad). Page 141 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

Johnson, R. and B. Wehrle. 2004. Threatened and endangered species of Alabama: a guide to assist with forestry activities. Online publication available at <http://www.pfmt.org/wildlife/endangered/default.htm>.

Johnston, C. 1999. Nest site selection by the pygmy sculpin (*Cottus pygmaeus*) in Coldwater Spring, Calhoun County, Alabama. Unpublished report to the United States Fish and Wildlife Service, Jackson, Mississippi. Department of Fisheries and Allied Aquacultures, Auburn University, Auburn, Alabama. 14 pages.

Jones, R. L. 1992. Additional studies of *Aster georgianus*, *A. patens*, and *A. phlogifolius* (Asteraceae). Sida 15:305-315.

Keeler, J. K. 1986. Red-cockaded woodpecker (*Picoides borealis*). Pages 78-79 *in* R. H. Mount, editor. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Klein, R. D. 1979. Urbanization and stream quality impairment. Water Resources Bulletin 15:948-963.

Kral, R. 1978. A new species of *Xyris* (sect. *Xyris*) from Tennessee and northwestern Georgia. Rhodora 80:444-447.

_____. 1982. A new *Clematis* from northeastern Alabama. Rhodora 84:285-291.

_____. 1983. A report on some rare, threatened, or endangered forest-related vascular plants of the South. United States Forest Service Technical Publication R8-TP2. United States Forest Service, Athens, Georgia, USA. 1,305 pages.

Krotzer, R. S. 1984. The ecological life history of the blue shiner, *Notropis caeruleus* (Jordan), from the upper Conasauga River, Georgia. Thesis. Samford University, Birmingham, Alabama, USA. 37 pages.

Kuhajda, B. R. 2004. Coldwater darter *Etheostoma ditrema* Ramsey and Suttkus. Pages 229-230 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

Knopf, F. L. R. R. Johnson, T. Rich, F. B. Samson, and R. C. Szaro. 1988. Conservation of riparian ecosystems in the United States. Wilson Bulletin 100:272-284.

Lenat, D. R. 1988. Water quality assessment of streams using a qualitative collection method for benthic macroinvertebrates. North American Benthological Society Journal 7:222-223.

Lennartz, M. R., H. A. Knight, J. P. McClure, and V. A. Rudis. 1983. Status of red-cockaded woodpecker nesting habitat in the south. Pages 13-19 *in* D. A. Wood, editor. Proceedings of the red-cockaded woodpecker symposium II. Florida Game and Freshwater Fish Commission, Tallahassee, Florida, USA.

Li, H. W. 1995. Non-native species. Pages 427-428 *in* LaRoe, E. T., G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U. S. Department of the Interior, National Biological Service, Washington, DC., USA. 530 pages.

Loeb, S. C., W. D. Pepper, and A. T. Doyle. 1992. Habitat characteristics of active and abandoned red-cockaded woodpecker colonies. Southern Journal of Applied Forestry 16(3):120-125.

Lodge, D. M. 1993. Species invasions and deletions: community effects and responses to climate and habitat change. Pages 367-387 *in* P. M. Karieva, J. G. Kingsolver, and R. B. Huey, editors. Biotic interactions and global change. Sinauer Associates, Sunderland, Massachusetts, USA.

Lowrance, R. R., R. L. Todd, and L. E. Asmussen. 1984. Nutrient cycling in an agricultural watershed: streamflow and artificial drainage. Journal of Environmental Quality 13:27-32.

Lydeard, C. and R. L. Mayden. 1995. A diverse and endangered aquatic ecosystem of the southeastern United States. Conservation Biology 9:800-805.

Macie, E. A. and L. A. Hermansen, editors. 2002. Human influences on forest ecosystems: the southern wildland-urban interface assessment. United States Department of Agriculture, Forest Service General Technical Report SRS-55. United States Forest Service, Southern Research Station, Asheville, North Carolina, USA. 160 pages.

Marshall, L. and K. Wills. 2003. Alabama's mountain treasures: the unprotected wildlands of the Bankhead and Talladega National Forests. The Wilderness Society, Washington, D.C., USA. 64 pages.

Master, L. L., S. R. Flack, and B. A. Stein, editors. 1998. Rivers of life: critical watershed for protecting freshwater biodiversity. The Nature Conservancy, Arlington, Virginia, USA. 71 pages.

Matthews, J. F., J. R. Allison, R. T. Ware, Sr., and C. Nordman. 2002. *Helianthus verticillatus* Small (Asteraceae) rediscovered and redescribed. Castanea 67:13-24.

May, C. W., R. R. Horner, J. R. Karr, B. W. Mar, and E. B. Welch. 1997. Effects of urbanization on small streams in the Puget Sound Lowland Ecoregion. Watershed Protection Techniques 2:485-494.

McCaleb, J. E. 1973. Some aspects of the ecology and life history of the pygmy sculpin, *Cottus pygmaeus* Williams, a rare spring species of Calhoun County, Alabama (Pisces: Cottidae). Thesis. Auburn University, Auburn, Alabama, USA. 82 pages.

McDonnell, M. J., S. T. A. Pickett, P. Groffman, P. Bohlen, R. V. Pouyat, W. C. Zipperer, R. W. Parmelee, M. M. Carreiro, and K. Medley. 1997. Ecosystem processes along an urban-to-rural gradient. Urban Ecosystems 1:21-36.

Mettee, M. F., P. E. O'Neil, and J. M. Pierson. 1996. Fishes of Alabama and the Mobile basin. Oxmoor House, Birmingham, Alabama, USA. 820 pages.

Miller, James H. 2003. Nonnative invasive plants of southern forests: a field guide for identification and control. United States Forest Service General Technical Report SRS–62. United States Department of Agriculture, Forest Service, Southern Research Station, Asheville, North Carolina, USA. 93 pages. [Available online at <http://www.invasive.org/eastern/srs/index.html>].

Miller, M. and M. Sankaran. 1991. Alabama Natural Heritage Program 1991 bat cave survey report. Unpublished report. Alabama Natural Heritage Program[SM], Montgomery, Alabama, USA.

Mirarchi, R. E., editor. 2004. Alabama wildlife. Volume 1. A checklist of vertebrates and selected invertebrates: aquatic mollusks, fishes, amphibians, reptiles, birds, and mammals. The University of Alabama Press, Tuscaloosa, Alabama, USA. 209 pages.

Monroe, M. C., A. W. Bowers, and L. A. Hermansen. 2003. The moving edge: perspectives on the southern interface. Southern Wildland-Urban Interface Assessment Focus Group report. United States Forest Service General Technical Report SRS-63. United States Forest Service, Southern Research Station, Asheville, North Carolina, USA. 35 pages.

Mortimer, M. J. and R. J. M. Visser. 2004. Timber harvesting and flooding: emerging legal risks and potential mitigations. Southern Journal of Applied Forestry 28:69-75.

Mount, R. H. 1975. The reptiles and amphibians of Alabama. The University of Alabama Press, Tuscaloosa, Alabama, USA. 347 pages.

_____. 1976. Amphibians and reptiles. Pages 66-79 *in* Boschung, H., editor. Endangered and threatened plants and animals of Alabama. Alabama Museum of Natural History Bulletin 2. University of Alabama, Tuscaloosa, Alabama, USA. 93 pages.

_____., editor. 1986. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Myers, R. L. 1990. Scrub and high pine. Pages 150-193 *in* Myers, R. L., and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida, USA. 765 pages.

Naiman, R. 1992. New perspectives for watershed management: balancing long-term sustainability with cumulative environmental change. Pages 3-11 *in* R. J. Naiman, editor. Watershed management: balancing sustainability and environmental change. Springer-Verlag, New York, New York, USA. 542 pages.

_____., H. Décamps, and M. Pollock. 1993. The role of riparian corridors in maintaining regional biodiversity. Ecological Applications 3:209-212.

National Research Council. 2002. Riparian areas: functions and strategies for management. National Academy Press, Washington, DC, USA. 444 pages.

NatureServe. 2002. Element occurrence data standard. Nature Serve, Arlington, Virginia, USA. 201 pages. [Available online at <http://whiteoak.natureserve.org/eodraft/all.pdf>]

Neves, R. J., A. E. Bogan, J. D. Williams, S. A. Ahlstedt, and P. H. Hartfield. 1997. Status of aquatic mollusks in the southeastern United States: a downward spiral of diversity. Pages 43-85 *in* G. W. Benz and D. E. Collins, editors. Aquatic fauna in peril: the southeastern perspective. Special Publication 1, Southeast Aquatic Research Institute, Lenz Design and Communications, Decatur, Georgia, USA. 554 pages.

Nordman, C. 1998. Survey report on *Helianthus verticillatus* in Tennessee. Unpublished report submitted to the United States Fish and Wildlife Service, Jackson, Mississippi, USA. 7 pages.

Noss, R. F. and B. Csuti. 1994. Habitat fragmentation. Pages 237-264 *in* G. K. Meffe and R. C. Carroll, editors. Principles of conservation biology. Sinauer Associates, Sunderland, Massachusetts, USA. 600 pages.

Noss, R. F., E. T. LaRoe III, and J. M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. Biological Report 28. United States Department of the Interior, National Biological Service, Washington, DC, USA. 58 pages.

Noss, R. F. and R. L. Peters. 1995. Endangered ecosystems: a status report on America's vanishing habitat and wildlife. Defenders of Wildlife, Washington, DC, USA. 132 pages.

Olivera, F., D. R. Maidment, and R. J. Charbeneau. 1996. Spatially distributed modeling of storm water runoff and non-point source pollution using geographic information systems. Center for Research in Water Resources On-line Report 96-4. [Available online at <http://www.ce.utexas.edu/prof/olivera/disstn/abstract.htm>].

Orr, D. 1990. The virtue of conservation education. Conservation Biology 4:219-220.

Osbourne, L. L. and D. E. Kovacic. 1993. Riparian vegetated buffer strips in water-quality restoration and stream management. Freshwater Biology 29:243-258.

Palmer, S. 1986. Some extinct mollusks of the U.S.A. Atala 13(1):1-7.

Palmer, W. M. and A. L. Braswell. 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, North Carolina, USA. 412 pages.

Parmalee, P. W. and A. E. Bogan. 1998. The freshwater mussels of Tennessee. The University of Tennessee Press. Knoxville, Tennessee, USA. 328 pages.

Patrick, W. H., Jr. 1994. From wastelands to wetlands. Journal of Environmental Quality 23:892-896.

Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC, USA. 587 pages.

Pierson, J. M. and R. S. Krotzer. 1987. The distribution, relative abundance, and life history of the blue shiner, *Notropis caeruleus* (Jordan). Prepared for the Alabama Nongame Wildlife Coordinator, Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 105 pages.

Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross, and R. M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. EPA/444/4-89-001. United States Environmental Protection Agency, Assessment and Watershed Protection Division, Washington, DC, USA.

Plant Conservation Alliance. 2000. Alien plant invaders of natural areas. Plant Conservation Alliance, [Available online at <http://www.nps.gov/plants/alien/>].

Puckett, L. J. 1994. Nonpoint and point sources of nitrogen in major watersheds of the United States. Water-Resources Investigations Report 94-4001. United States Geological Survey, National Water Quality Assessment Program, Reston, Virginia, USA.

Ramsey, J. S. 1986. Coldwater darter. pages 16-17 *in* R. H. Mount, editor. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Ramsey, J. S. and J. M. Pierson. 1986. Blue shiner. pages 12-13 *in* R. H. Mount, editor. Vertebrate animals of Alabama in need of special attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama, USA. 124 pages.

Randall, J. and J. Marinelli. 1996. Invasive plants: weeds of the global garden. Brooklyn Botanic Garden Club, Inc. Handbook No. 149. 111 pages.

Reddy, K. R. and P M. Gale. 1994. Wetland processes and water quality: a symposium overview. Journal of Environmental Quality 23:875-877.

Rempel, R. 2002. Patch Analyst 2.2 for ArcView. Available online at <http://flash.lakeheadu.ca/~rrempel/patch/>.

Ribaudo, M. O. 1989. Water quality benefits from the Conservation Reserve Program. United States Department of Agriculture, Resources and Technology Division, Economic Research Service. Agricultural Economic Report 606. 30 pages.

Richards, W. J. and L. W. Knapp. 1964. *Percina lenticula*, a new percid fish, with a redescription of the subgenus *Hadropterus*. Copeia 4:690-701.

Richter, B. D., D. P. Braun, M. A. Mendelson, and L. L. Master. 1997. Threats to imperiled freshwater fauna. Conservation Biology 11:1081-1093.

Ricketts, T. H., E. Dinerstein, D. Olson, C. J. Loucks, W. Eichbaum, D. Della Sala, K. Kavanagh, P. Hedao, P. Hurley, K. Carney, R. Abell, and S. Walters. 1999. Terrestrial ecoregions of North America. Island Press, Washington, D. C., USA. 508 pages.

Ridd, M. K. 1995. Exploring a V-I-S (Vegetation-impervious surface-soil) model for urban ecosystem analysis through remote sensing: comparative anatomy for cities. International Journal of Remote Sensing 16:2165-2185.

Schemske, D. W., B. C. Husband, M. H. Ruckelshaus, C. Goodwillie, I. M. Parker, and J. G. Bishop. 1994. Evaluating approaches to the conservation of rare and endangered plants. Ecology 75:584-606.

Schnell, D. E. 1980. Notes on the biology of *Sarracenia oreophila* (Kearney) Wherry. Castanea 45:166-170.

Schueler, T. R. 1994a. The importance of imperviousness. Watershed Protection Techniques 1(1):100-111.

_____. 1994b. Use of cluster development to protect watersheds. Watershed Protection Techniques 1(3):137-140.

Schultz, J. and R. Cruse. 1992. Effectiveness of vegetated buffer strips. Final Report. Leopold Center for Sustainable Agriculture, Ames, Iowa, USA.

Seaber, P. R., F. P. Kapinos, and G. L. Knapp. 1987, Hydrologic unit maps: U.S. Geological Survey Water-Supply Paper 2294.

Shea, M. M. 1992. Status survey report on *Platanthera integrilabia*. Unpublished report prepared for the United States Fish and Wildlife Service, Asheville, North Carolina. Kentucky State Nature Preserve Commission, Frankfort, Kentucky, USA. 152 pages.

Simberloff, D. 1993. Species-area and fragmentation effects on old growth forests: prospects for longleaf pine communities. Pages 1-4 *in* S. M. Hermann, editor. The longleaf pine ecosystem: ecology, restoration, and management. Tall Timbers Fire Ecology Conference Proceedings, Number 18. Tall Timbers Research Station, Tallahassee, Florida, USA.

Skeen, J. N., P. D. Doerr, and D. H. Van Lear. 1993. Oak-hickory-pine forests. Pages 1-33 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: upland terrestrial communities. John Wiley & Sons, New York, New York, USA. 373 pages.

Small, J. K. 1933. Manual of the southeastern flora. The University of North Carolina Press. Chapel Hill, North Carolina, USA. 1,554 pages.

Smith, R. K., P. L. Freeman, J. V. Higgins, K. S. Wheaton, T. W. FitzHugh, A. A. Das, and K. J. Ernstrom. 2002. Priority areas for freshwater conservation action: a biodiversity assessment of the southeastern United States. The Nature Conservancy, Arlington, Virginia, USA. 68 pages.

Southeast Exotic Pest Council. 2003a. Southeast Exotic Pest Council invasive plant manual – kudzu. Online publication. <http://www.invasive.org/eastern/eppc/kudzu.html>. Accessed July 2004.

_____. 2003b. Southeast Exotic Pest Council invasive plant manual – privet. Online publication. <http://www.invasive.org/eastern/eppc/privet.html>. Accessed July 2004.

Steedman, R. J. 1988. Modification and assessment of an index of biotic integrity to quantify stream quality in southern Ontario. Canadian Journal of Fisheries and Aquatic Sciences 45:492-501.

Stein, B. A. 2002. States of the Union: ranking America's biodiversity. A NatureServe report prepared for The Nature Conservancy. NatureServe, Arlington, Virginia, USA. 25 pages.

_____. and S. R. Flack, editors. 1996. America's least wanted: alien species invasions of U. S. ecosystems. The Nature Conservancy, Arlington, Virginia, USA. 32 pages. [Available online at <http://www.natureserve.org/library/americasleastwanted2003.pdf>]

_____., L. S. Kutner, and J. S. Adams. 2000. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York, New York, USA. 399 pages.

Stein, C. B. 1976. Gastropods. Pages 21-41 *in* H. Boschung, editor. Endangered and threatened species of Alabama. Bulletin of the Alabama Museum of Natural History 2.

Stewart, J. H. and R. Larson. 1995. Blue shiner (*Cyprinella caerulea*) recovery plan. Prepared for United States Fish and Wildlife Service, Southeast Region, Atlanta, Georgia. United States Fish and Wildlife Service, Jackson, Mississippi, USA. 20 pages.

Stiles, R. A. and M. L. Warren, Jr. 2004. Pygmy sculpin *Cottus paulus* Williams. Pages 182-183 *in* R. E. Mirarchi, J. T. Garner, M. F. Mettee, and P. E. O'Neil, editors. Alabama Wildlife. Volume 2. Imperiled aquatic mollusks and fishes. The University of Alabama Press, Tuscaloosa, Alabama, USA. 255 pages.

Stuart, J. D. 1998. Effect of fire suppression on ecosystems and diversity. Pages 45-47 *in* M. J. Mac, P. A. Opler, C. E. P. Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources: volume 1. United States Department of the Interior, U.S. Geological Survey, Reston, Virginia, USA. 436 pages.

Swearingen, J. M. 1999. Japanese stilt grass *Microstegium vimineum* (Trin.) Camus. Online publication. <http://www.se-eppc.org/publications.cfm> Accessed July 2004.

Tabit, C. R., and G. M. Johnson. 2002. Influence of urbanization on the distribution of fishes in a southeastern Upper Piedmont drainage. Southeastern Naturalist 1:253-268.

The Nature Conservancy. 1999. Ecoregional map of the United States. May 1999 edition. The Nature Conservancy, Arlington, Virginia, USA.

_____. 2000. The five-s framework for site conservation: a practitioner's handbook for site conservation planning and measuring conservation success. The Nature Conservancy. Arlington, Virginia, USA.

_____. 2003. The Cumberlands and Southern Ridge & Valley ecoregion: a plan for biodiversity conservation. The Nature Conservancy. Arlington, Virginia, USA. 76 pages + appendices.

Thomas, J. L. 1976. Plants. Pages 5-14 *in* Boschung, H., editor. Endangered and threatened plants and animals of Alabama. Alabama Museum of Natural History Bulletin 2. University of Alabama, Tuscaloosa, Alabama, USA. 93 pages.

Tim, U. S. and R. Jolly. 1994. Evaluating agricultural nonpoint-source pollution using integrated geographic information systems and hydrologic/water quality model. Journal of Environmental Quality 23:25-35.

Tim, U. S., S. Mostaghimi, and V. O. Shanholtz. 1992. Identification of critical nonpoint pollution source areas using geographic information systems and water quality modeling. Water Resources Bulletin 28:877-887.

Troup, R. L. and S. T. McDaniel. 1980. Current status report on *Sarracenia oreophila*. United States Fish and Wildlife Service, Atlanta, Georgia, USA. 62 pages.

Tu, M. 2000. Element stewardship abstract for *Microstegium vimineum*, Japanese stilt grass, Nepalese browntop, Chinese packing grass. The Nature Conservancy, Wildland Invasive Species Team, Department of Vegetable Crops & Weed Sciences, University of California, Davis, California, USA. 8 pages. [Available online at <http://tncweeds.ucdavis.edu/esadocs/documnts/micrvim.pdf>].

Tuberville, T. D., J. R. Bodie, J. B. Jensen, L. LaClaire, and J. W. Gibbons. 2000. Apparent decline of the southern hog-nosed snake, *Heterodon simus*. Journal of the Elisha Mitchell Scientific Society. 116:19-40.

Turner, M. G., S. R. Carpenter, E. J. Gustafson, R. J. Naiman, and S. M. Pearson. 1998. Land use. Pages 37-61. *in* M. J. Mac, P. A. Opler, C. E. P. Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources: volume 1. United States Department of the Interior, U.S. Geological Survey, Reston, Virginia, USA. 436 pages.

Tuttle, M. D. 1979. Status, causes of decline, and management of endangered gray bats. Journal of Wildlife Management 43:1-17.

Unites States Army Corps of Engineers. 1997. Draft environmental impact statement: disposal and reuse of Fort McClellan, Alabama, Volume I – Main Report. United States Army Corp of Engineers, Mobile District, Anniston, Alabama, USA.

United States Census Bureau. 2000a. Redistricting census topologically integrated geographic encoding and referencing system (TIGER)/ line files [machine-readable data files]. Prepared by the U.S. Census Bureau, Washington, DC. Available online at <http://www.census.gov/geo/www/tiger/index.html>. Accessed December 2003.

_____. 2000b. U.S. Census Bureau, American fact finder (online). Available online at <http://factfinder.census.gov/servlet/BasicFactsServlet>. Accessed December 2003.

_____. 2000c. Census of population and housing, summary population and housing characteristics. PHC-1-2, Alabama. Washington, D.C., USA. 354 pages.

_____. 2001. Census 2000 redistricting data (Public Law 94-171) summary file - technical documentation. Available online at <http://www.census.gov/prod/cen2000/doc/pl94-171.pdf>. Accessed June 2004.

United States Environmental Protection Agency. 1999. Envirofacts warehouse toxics release inventory. Available online at <http://www.epa.gov/enviro/html/tris/tris_info.htm>. Accessed June 2003.

_____. 2001a. Better assessment science integrating source and nonpoint sources: BASINS, Version 3.0 user's manual. United States Environmental Protection Agency, Office of Water. EPA-823-C-01-004. [Available online at <http://www.epa.gov/waterscience/basins/bsnsdocs.html>]

_____. 2001b. U.S. EPA BASINS metadata. Available online at <http://www.epa.gov/waterscience/basins/metadata.htm>. Accessed June 2003.

_____. 2002a. National water quality inventory: 2000 report (EPA-841-R-02-001). United States Environmental Protection Agency, Office of Water. Washington, D.C., USA. 207 pages + Appendices. [Available online at <http://www.epa.gov/305b/>]

_____. 2002b. Urbanization and streams: studies of hydrologic impacts. U.S. Environmental Protection Agency, Office of Water, Washington, D.C., USA. [Available online at <http://www.epa.gov/owow/nps/urbanize/report.html>].

_____. 2003. Superfund information systems: CERCLIS hazardous waste sites database. Available online at <http://www.epa.gov/superfund/sites/cursites/index.htm>. Accessed June 2003.

_____. and United States Department of Agriculture. 1998. Clean water action plan: Restoring and protecting America's waters. United States Environmental Protection Agency. EPA-840-R-98-001. Washington, D.C., USA.

United States Fish and Wildlife Service. 1970. Appendix D – United States list of endangered native fish and wildlife. Federal Register 35:16047-16048.

_____. 1976. Endangered and threatened wildlife and plants; determination that two species of butterfly are threatened species and two species of mammals are endangered species. Federal Register 41:17736-17740. [Available online at <https://ecos.fws.gov/docs/frdocs/1976/76-12291.pdf>]

_____. 1979. Endangered and threatened wildlife and plants; endangered status for *Sarracenia oreophila*. Federal Register 44:54922-54923.

_____. 1982. Gray bat recovery plan. United States Fish and Wildlife Service, Denver, Colorado, USA. 21 pages + appendices.

_____. 1985. Red-cockaded woodpecker recovery plan. United States Fish and Wildlife Service, Atlanta, Georgia, USA. 88 pages.

_____. 1986. Endangered and threatened wildlife and plants; endangered status for *Clematis socialis*. Federal Register 51:34420-34422. [Available online at <https://ecos.fws.gov/docs/frdocs/1986/86-21756.pdf>]

_____. 1988a. Endangered and threatened wildlife and plants; threatened status for *Marshallia mohrii*. Federal Register 53:34698-34701. [Available online at <https://ecos.fws.gov/docs/frdocs/1988/88-20298.pdf>].

_____. 1988b. Endangered and threatened wildlife and plants; determination of endangered status for *Ptilimnium nodosum*. Federal Register 53:37978-37982. [Available online at <https://ecos.fws.gov/docs/frdocs/1988/88-22151.pdf>].

_____. 1989. Alabama leather flower recovery plan. United States Fish and Wildlife Service, Jackson, Mississippi, USA. 21 pages.

_____. 1990a. Harperella (*Ptilimnium nodosum*) recovery plan. United States Fish and Wildlife Service, Newton Corner, Massachusetts, USA. 60 pages.

_____. 1990b. Endangered and threatened species of the southeastern United States (the red book) FWS Region 4 – Kral's water-plantain. Available online at <http://endangered.fws.gov/i/q/saq63.html>.

_____. 1990c. Endangered and threatened wildlife and plants: threatened status for *Sagittaria secundifolia* (Kral's water-plantain). Federal Register 55:13907-13911. [Available online at <https://ecos.fws.gov/docs/frdocs/1990/90-8678.pdf>].

_____. 1991a. Endangered and threatened species of the southeastern United States (the red book) FWS Region 4 – gray bat. Available online at <http://endangered.fws.gov/i/a/saa4l.html>.

_____. 1991b. Endangered and threatened wildlife and plants: endangered status determined for the tulotoma snail. Federal Register 56:797-800. [Available online at <https://ecos.fws.gov/docs/frdocs/1991/91-484.html>].

_____. 1991c. Recovery plan for Mohr's Barbara's buttons. United States Fish and Wildlife Service, Jackson, Mississippi, USA. 15 pages.

_____. 1991d. Endangered and threatened wildlife and plants; endangered status for the plant *Xyris tennesseensis* (Tennessee yellow-eyed grass). Federal Register 56:34151-34154. [Available online at <https://ecos.fws.gov/docs/frdocs/1991/91-17759.html>].

_____. 1991e. Recovery plan: Kral's water-plantain. United States Fish and Wildlife Service, Southeast Region, Atlanta, Georgia, USA. 15 pages.

_____. 1992a. Endangered and threatened wildlife and plants; threatened status for two fish, the goldline darter (*Percina aurolineata*) and blue shiner (*Cyprinella caerulea*). Federal Register 57:14786-14790. [Available online at <https://ecos.fws.gov/species_profile/Species_FRDoc#V01>]

_____. 1992b. Endangered and threatened species of the southeastern United States (the red book) FWS Region 4 – Tulotoma snail (*Tulotoma magnifica*) – online version. Available online at <http://endangered.fws.gov/i/g/sag0b.html>.

_____. 1992c. Endangered and threatened species of the southeastern United States (the red book) FWS Region 4 – Tennessee yellow-eyed grass (*Xyris tennesseensis*) – online version. Available online at <http://endangered.fws.gov/i/q/saq6r.html>.

_____. 1993. Endangered and threatened wildlife and plants; endangered status for eight freshwater mussels and threatened status for three freshwater mussels in the Mobile River drainage. Federal Register 58:14330-14340. [Available online at <https://ecos.fws.gov/docs/frdocs/1993/93-6162.pdf>]

_____. 1994a. Green pitcher plant recovery plan, 2nd revision. United States Fish and Wildlife Service, Jackson, Mississippi, USA. 23 pages.

_____. 1994b. Recovery plan for Tennessee yellow-eyed grass (*Xyris tennesseensis* Kral). United States Fish and Wildlife Service, Jackson, Mississippi, USA. 24 pages.

_____. 1997a. Gray bat. Endangered Species Fact Sheet. United States Fish & Wildlife Service, Region 3, Fort Snelling, Minnesota, USA. Available online at <http://midwest.fws.gov/endangered/mammals/grbat_fc.html>.

_____. 1997b. Technical/Agency draft Mobile River basin ecosystem recovery plan. United States Fish and Wildlife Service, Jackson Mississippi, USA. 128 pages.

_____. 1998. Endangered and threatened wildlife and plants; endangered status for three aquatic snails, and threatened status for three aquatic snails in the Mobile River Basin of Alabama. Federal Register 63:57610-57620. [Available online at <http://endangered.fws.gov/r/fr98651.html>]

_____. 1999. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates or proposed for listing as endangered or threatened; annual notice of findings on recycled petitions; and annual description of progress on listing actions. Federal Register 64:57534-57547. [Available online at <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1999_register&docid=fr25oc99-26.pdf>]

_____. 2000. Draft environmental assessment and land protection plan: proposed establishment of Mountain Longleaf National Wildlife Refuge, Calhoun County, Alabama. United States Fish and Wildlife Service, Atlanta, Georgia, USA.

_____. 2002. Candidate and listing priority assignment form: *Helianthus verticillatus* Small. United States Fish and Wildlife Service, Southeast Region, Jackson, Mississippi, USA. 7 pages.

_____. 2003a. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. United States Fish and Wildlife Service, Atlanta, Georgia, USA. 296 pages.

_____. 2003b. Endangered and threatened wildlife and plants; proposed designation of critical habitat for three threatened mussels and eight endangered mussels in the Mobile River basin; proposed rule. Federal Register 68:14752-14832. [Available online at <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2003_register&docid=fr26mr03-19.pdf>]

_____. 2003c. Mountain Longleaf National Wildlife Refuge (online). Available at <http://southeast.fws.gov/mountainlongleaf/> Accessed March 2003.

_____. 2004a. A blueprint for the future of migratory birds: Migratory Bird Program strategic plan 2004-2014. United States Fish and Wildlife Service, Migratory Birds and State Programs, Arlington, Virginia, USA. 22 pages.

_____. 2004b. Endangered and threatened wildlife and plants; designation of critical habitat for three threatened mussels and eight endangered mussels in the Mobile River basin; final rule. Federal Register 69:40084-40171.

United States Forest Service. 1985. Cheaha Wilderness management supplement, Talladega National Forest Alabama. United States Department of Agriculture, Forest Service.

_____. 2003. Draft environmental impact statement for the revised land and resource plan: national forests in Alabama. United States Department of Agriculture, Forest Service Southern Region Management Bulletin R8-MB 107C.

United States Geological Survey. 2002. National land cover data. Available online at <http://landcover.usgs.gov/natllandcover.html>. Accessed November 2002.

United States Geological Survey 2004. Accuracy assessment of 1992 national land cover data. Available online at <http://landcover.usgs.gov/accuracy/index.asp>. Accessed 26 April 2004.

United States National Park Service. 1991. Special resource study, Little River Canyon Area – Cherokee, DeKalb, and Etowah counties, Alabama. Division of Planning, Design and Compliance, Southeast Region, National Park Service. 116 pages.

_____. 2003. Welcome to the Little River Canyon National Preserve. Online publication available at <http://www.nps.gov/liri/home/home.htm>. Accessed July 2003.

Vogelmann, J. E., S. M. Howard, L. Yang, C.R. Larson, B. K. Wylie, and N. Van Driel. 2001. Completion of the 1990s National Land Cover Data set for the conterminous United States from Landsat Thematic Mapper data and ancillary data sources. Photogrammetric Engineering and Remote Sensing 67:650-652.

Walsh, S. J., N. M. Burkhead, and J. D. Williams 1995. Southeastern freshwater fishes. Pages 144-147 *in* LaRoe, E. T., G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U. S. Department of the Interior, National Biological Service, Washington, DC., USA. 530 pages.

Wang, L., J. Lyons, and P. Kanehl. 2001. Impacts of urbanization on stream habitat and fish across multiple spatial scales. Environmental Management 28:255-266.

_____., _____., _____., R. Bannerman, and E. Emmons. 2000. Watershed urbanization and changes in fish communities in southeastern Wisconsin streams. Journal of the American Water Resources Association 36:1173-1189.

Ware, S., C. Frost, and P. D. Doerr. 1993. Southern mixed hardwood forest: the former longleaf pine forest. Pages 447-493 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, editors. Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley and Sons, Inc., New York, New York, USA. 502 pages.

Warren, M. L. and B. M. Burr. 1994. Status of freshwater fishes of the United States: overview of an imperiled fauna. Fisheries 19: 6-18.

Wear, D. N. and J. G. Greis. 2002. The southern forest resource assessment: summary report. General Technical Report SRS-54. United States Department of Agriculture, Forest Service, Southern Research Station, Asheville, North Carolina, USA. 103 pages.

Weiss, K. 1995. Stormwater and the Clean Water Act: municipal separate storm sewers in the moratorium. Pages 47-62 *in* United States Environmental Protection Agency. Enhancing urban watershed management at the local, county, and state levels: national conference on urban runoff management, Cincinnati, Ohio. EPA/625/R-95/003. United States Environmental Protection Agency, Office of Research and Development, Center for Environmental Research Information, Chicago, Illinois, USA. 450 pages.

Weller, C. M., M. C. Watzin, and D. Wang. 1996. Role of wetlands in reducing phosphorous loading to surface water in eight watersheds in the Lake Champlain basin. Environmental Management 20:731-739.

Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent, and vegetation. Office of Public Service & Outreach, Institute of Ecology, University of Georgia, Athens, Georgia, USA. 59 pages.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C., USA.

Williams, J. D. 1968. A new species of sculpin, *Cottus pygmaeus*, from a spring in the Alabama River Basin. Copeia 2:334-342.

_____. and G. K. Meffe. 1998. Nonindigenous species. Pages 117-129 *in* M. J. Mac, P. A. Opler, C. E. P. Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources: volume 1. United States Department of the Interior, U.S. Geological Survey, Reston, Virginia, USA. 436 pages.

_____. and R. J. Neves. 1995. Freshwater mussels: a neglected and declining aquatic resources. Pages 177-179 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. 1995. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U. S. Department of the Interior, National Biological Service, Washington, DC., USA. 530 pages.

_____., M. L. Warren, Jr., K. S. Cummings, J. L. Harris, and R. J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9):6-22.

World Wildlife Fund. 2004. Living waters – conserving the source of life: the economic values of the world's wetlands. World Wildlife Fund - International, Gland/Amsterdam. 32 pages.

Yang, L., S. V. Stehman, J. H. Smith, and J. D. Wickham. 2001. Thematic accuracy of MRLC land cover for the eastern United States. Remote Sensing of Environment 76:418-422.

Zettler, L. W. and J. E. Fairey, III. 1990. The status of *Platanthera integrilabia*, an endangered terrestrial orchid. Lindleyana 5(4):212-217.

Zhou, Y. 2000. Count points in polygon extension for ArcView. Available online on ESRI's ArcScripts pages: <http://arcscripts.esri.com/details.asp?dbid=1545991760>.

Zhu, Z., L. Yang, S. V. Stehman, and R. L. Czaplewski. 2000. Accuracy assessment for the U.S. Geological Survey regional land-cover mapping program: New York and New Jersey region. Photogrammetric Engineering & Remote Sensing 66:1425-1435.

Zipperer, W. C. 1993. Deforestation patterns and their effects on forest patches. Landscape Ecology 8:177-184.

_____., J. Wu, R. V. Pouyat, and S. T. A. Pickett. 2000. The application of ecological principles to urban and urbanizing landscapes. Ecological Applications 10:685-688.