Monitoring of Watersheds Associated with Alabama State Parks Utilizing Chemical, Physical and Biological Assessments

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Alabama Department of Environmental Management
Field Operations Division
Environmental Indicators Section
1890 Congressman W.L. Dickinson Drive
Montgomery, Alabama 36109

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Preface

This project was funded or partially funded by the Alabama Department of Environmental Management utilizing a Clean Water Act Section 104(b)(3) water quality management grant provided by the U.S. Environmental Protection Agency Region 4.

Comments or questions related to this report should be addressed to:

Alabama Department of Environmental Management
Field Operations Division
Environmental Indicators Section
P.O. Box 301463
Montgomery, AL 36130-1463

EXECUTIVE SUMMARY

The State of Alabama depends on the tourism industry as a significant source of annual revenue. Significant expenditures are made each year to promote the use of Alabama's State Parks for recreation by residents and non-residents alike. There are 24 State Parks in Alabama encompassing 49,651 acres. Most of these parks have some type of waterbody such as a lake, reservoir or stream as a vital component of the recreational aesthetics. Some parks are located near or within major metropolitan areas and are, or have the potential to be, adversely impacted by urban growth and development. The objectives of this project were the following:

1) Provide information consistent with, and important to, the implementation of Alabama's watershed management strategy using a statewide basin approach;

2) Assess the water quality of flowing streams in the watersheds associated with the State Parks from a chemical, biological and habitat perspective;

3) Identify current and potential causes and sources of impairments;

4) Identify non or minimally impaired streams that may be considered for water use classification upgrade to Outstanding Alabama Water (OAW).

Reconnaissance of potential watersheds was begun in January 1998 and continued through March. Nine of the State Parks were determined to have watersheds that could be assessed within or adjacent to the park boundaries. There were 29 sampling sites and 10 ecoregional reference sites with drainage areas ranging from 0.3 – 86.8 mi^2. These sites were located in 11 counties, 3 ecoregions and 6 different river basins with 12 sub-watersheds.

An estimate of watershed land use activities was derived from data sets that EPA developed from LandSat data collected over several years between 1988 and 1993. Surface water was collected for chemical analysis during the spring (May), summer (July) and fall (September). Aquatic macroinvertebrate

communities were assessed at all wadeable sites. Assessments were made at 34 of the 39 sites during May and early June. In an effort to further characterize the water quality of selected stream reaches, biological assessments of the fish communities were conducted at 18 sites during June and July.

Blue Springs State Park is a 103-acre park located 6 miles east of Clio, Alabama in Barbour County. Water quality assessments were conducted at 3 sites inside the park. Biochemical oxygen demand levels were higher during the spring (1.8 mg/L) at the upstream site on the West Fork Choctawhatchee River than the site just downstream of the confluence with Blue Springs (0.2 mg/L). Nitrate/nitrite levels of 1.0 mg/L during the summer at the upstream site indicated possible nutrient enrichment when compared to the ecoregional reference site (0.1 mg/L). The West Fork Choctawhatchee locations in the park were too deep to conduct wadeable biological assessments.

Bucks Pocket State Park is a 2,000-acre park located 2 miles north of Grove Oak, Alabama in Dekalb, Jackson and Marshall Counties. Potential sampling sites within the park boundaries were not flowing during the sampling events. Alternate sites on Kirby, South Sauty, Straight and Stringer Creeks, outside of the boundaries were chosen for assessment. The habitat quality of the four sites was assessed as “excellent” and the aquatic macroinvertebrate communities were evaluated to be in ‘“fair” or “good” condition with 11 to 14 Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa present. Index of Biotic Integrity assessments indicated the biological health of the fish communities to be in “very poor” or “poor” condition. The biological health of the fish community is likely impacted by low stream flow during the summer, limited habitat with a dominance of bedrock and land use within watershed as indicated by water chemistry data. Nitrate/nitrite levels ranged from 1.1 mg/L to 1.4 mg/L in the spring. Pasture, row crops and residential activities in the watershed could be responsible for the measured nitrate/nitrite levels.

Cheaha State Park is located atop Cheaha Mountain, 2,407 feet above sea level. The park is just south of Anniston on the Cleburne and Clay county line in the Coosa River basin. Flow was inadequate at the sites within the park

for chemical or biological assessments. Two alternate sites on Cheaha Creek were chosen for monitoring. Habitat assessments indicated in-stream habitat quality to be “excellent”. The number of EPT taxa (21 and 20) indicated the macroinvertebrate communities to be in “excellent” condition. Water quality assessments did not indicate impairment.

Chewacla State Park is located 4 miles south of Auburn, Alabama in Lee County. Two sites in the park and 4 sites in the watershed were chosen for assessments. Habitat quality was assessed as “good” at 4 sites and “excellent” at 2 sites. Sedimentation resulting from residential development in the watershed, occurred at several of the sites. The number of EPT taxa collected ranged from 3 to 18, indicating the macroinvertebrate communities were in “poor”, “fair” and “good” condition. The biological health of the fish communities varied from “poor/fair” to “good” condition. Water quality results from one of the sites on Chewacla Creek indicated total dissolved solids, conductivity, nitrates/nitrites, ammonia and total Kjeldahl nitrogen to be higher than the upstream site on Chewacla Creek.

Claude D. Kelley State Park is north of Atmore, Alabama in Escambia and Monroe Counties. Three sites in and around the park were sampled. Habitat assessments indicated habitat quality was “good” at all sites. The aquatic macroinvertebrate communities were evaluated to be in “good” condition with 14 to 18 EPT taxa present. Water quality assessments from two sites on the Little River had fecal coliform bacteria levels >400 colonies/100 ml and biochemical oxygen demand levels of 2.8 mg/L during the summer after a heavy rainfall. Otherwise, water quality assessments did not reveal any evidence of impairment.

DeSoto State Park is 3 miles east of Fort Payne, Alabama in Dekalb County. Four sites in the watershed were chosen for assessments. Habitat quality was assessed as “excellent” while the aquatic macroinvertebrate communities were evaluated to be in “fair” to “good” condition with 11 to 14 EPT taxa present. Water chemistry results did not indicate impairment.

Oak Mountain State Park is located 15 miles south of Birmingham, Alabama in Shelby County. Dry Brook and Peavine Branch were sampled at 2 locations outside the park. Habitat quality and the macroinvertebrate community were assessed to be in "good" condition. Dissolved oxygen (4.8 mg/L) was lower than the Fish and Wildlife water quality standard of 5.0 mg/L during the summer at Dry Brook. Fecal coliform bacteria levels (>1050 colonies/100 ml) in the summer were considerably higher than those observed in the spring at Peavine Branch.

Paul M. Grist State Park is located 15 miles north of Selma, Alabama in Dallas County. Assessments were conducted at two sites in the watershed of the park. The in-stream habitat was assessed to be "good". Six and eight EPT taxa were collected indicating the macroinvertebrate communities to be in "fair" condition. The fish community was evaluated to be in "fair" condition at the Valley Creek site downstream of Valley Creek Lake. Water quality assessments indicated fecal coliform bacteria levels >655 colonies/100 ml and biochemical oxygen demand levels in excess of 2.7 mg/L during the summer sampling event.

Joe Wheeler State Park is located in Lauderdale County, near Rogersville, Alabama. Sites on Neely Branch and First Creek were chosen for assessment. The habitat quality of Neely Branch was evaluated as "good" and six EPT taxa were collected, suggesting the macroinvertebrate community to be in "poor" condition. Biochemical oxygen demand ranged from 0.9 to 3.0 mg/L and nitrate/nitrite levels ranged from 1.2 to 2.0 mg/L during the sampling events. The habitat quality of First Creek was assessed as "excellent". The macroinvertebrate community was assessed to be in "fair" condition with 10 EPT taxa present. Biochemical oxygen demand (3.0 mg/L) was higher during the spring sampling event and fecal coliform bacteria levels were 270 colonies/100ml during the summer sampling event.

Eight of the study sites were determined to be of adequate quality that the associated segments should be considered for water use classification upgrade. These eight stream segments and Blue Springs (spring itself) are located within the boundaries or watersheds of State Parks and exhibited characteristics that warrant further evaluation using ADEM's screening process for determining Outstanding Alabama Water Candidate Segments.

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INTRODUCTION

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MATERIALS AND METHODS

Study Areas

All State Park watersheds were reviewed utilizing topographic maps to determine which parks had potentially wadeable streams as a vital part of their aesthetics. Several parks focused water related activities entirely on a reservoir waterbody including Lake Guntersville, Lake Martin and Walter F. George etc. These parks were not included in this study. Reconnaissance of potential watersheds began in January 1998 and continued through March. This effort was conducted to observe the stream size, potential for wading and continuous flow during the study period. Notes were made pertaining to stream accessibility, watershed land use, habitat assessments and limited physical and chemical

measurements. A global positioning system (GPS) unit was used to collect a satellite correctable latitude and longitude for each site.

Upon completion of the reconnaissance work, nine of the State Parks were determined to have watersheds that could be assessed within, or adjacent to, the park boundaries (Figure 1 and Table1). There were 29 sampling sites and 10 ecoregional reference sites with drainage areas ranging from 0.3 – 86.8 mi^2. These sites were located in 11 counties, 3 ecoregions and 6 different river basins with 12 sub-watersheds.

Land Use Assessments

An estimate of watershed land use activities was derived from data sets developed by EPA from LandSat data collected over several years between 1988 and 1993. The watershed boundaries were taken from a digital hydrologic unit code map developed by the Geological Survey of Alabama (GSA) from USGS quad sheet maps. The units used to describe these watersheds are the 11 digit sub-watershed codes developed by the U.S. Geological Survey (USGS) and Soil Conservation Service (NRCS).

The land use information is stored in a grid, which encompasses the entire State. In the grid each pixel represents 30x30 m^2 and contains information about the land use/landcover of that area. The number of pixels in each land use category within each sub-watershed was calculated and divided by the sum for the percent land use within each sub-watershed. Using Arc/INFO and Arcview, the sub-watershed boundaries, which contained the sampling locations, were used to clip out the land use information. The land use is for the entire sub-watershed and may be different than that of the land draining to a particular sampling point. See land use maps for a visual estimate of upstream land use.

Water Quality Assessments

Surface water was collected for chemical analysis at each of the 39 sampling sites during the spring (May), summer (July) and fall (September) of 1998, except when the stream was not flowing. Water temperature, pH, specific

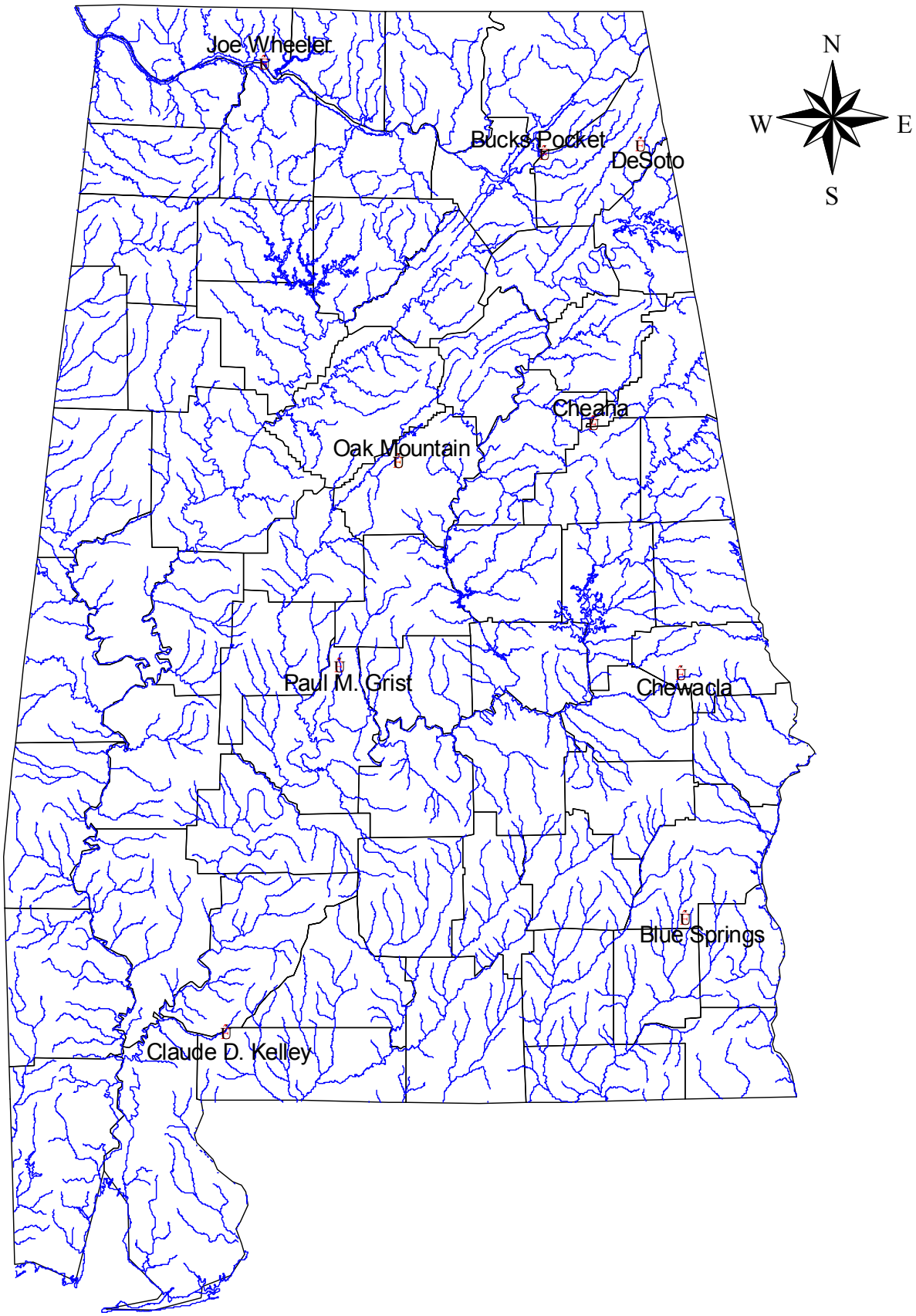


Figure 1: Selected State Parks for which associated watersheds were studied.

Table 1. Station locations for the State Parks Study.

Stream	Station	Basin	Ecoregion	County	Latitude	Longitude
			Blue Springs			
Blue Spring	BSPB-1	Choctawahatchee River	65e	Barbour	31.6620	-85.5061
West Fork Choctawhatchee	WCHB-1	Choctawahatchee River	65e	Barbour	31.6619	-85.5057
West Fork Choctawhatchee	WCHB-2	Choctawahatchee River	65e	Barbour	31.6567	-85.5070
			Bucks Pocket			
Kirby Creek	KIRD-1	Tennessee River	71	Jackson	34.5326	-85.9509
South Sauty Creek	SSCD-1	Tennessee River	71	Dekalb	34.4986	-85.9297
Straight Creek	STGD-1	Tennessee River	71	Dekalb	34.5050	-85.9362
Stringer Creek	STND-1	Tennessee River	71	Jackson	34.5205	-85.9680
*Bryant Creek	BYTJ-1	Tennessee River	68	Jackson	34.6470	-85.8426
			Cheaha			
Cheaha Creek	CHE-1	Coosa River	68	Clay	33.4586	-85.8733
Cheaha Creek	CHEC-3	Coosa River	68	Clay	33.4590	-85.8416
*Talladega Creek	TCT-5	Coosa River	68	Talladega	33.3785	-86.0301
			Chewacla			
Chewacla Creek	CHWT-1	Tallapoosa River	65d	Lee	32.5480	-85.4804
Chewacla Creek	CHWT-3	Tallapoosa River	65d	Lee	32.5614	-85.3723
Moores Mill Creek	MMLT-1a	Tallapoosa River	65d	Lee	32.5855	-85.4497
Moores Mill Creek	MMLT-1c	Tallapoosa River	65d	Lee	32.5569	-85.4699
Nash Creek	NAST-1	Tallapoosa River	65d	Lee	32.5550	-85.4257
Robinson Creek	ROBT-1	Tallapoosa River	65d	Lee	32.5634	-85.3898
*Hurricane Creek	HCR-1	Tallapoosa River	65d	Randolph	33.1755	-85.5983

*Ecoregional reference site

Table 1. Continued

Stream	Station	Basin	Ecoregion	County	Latitude	Longitude
			Claude D. Kelly			
Chitterling Creek	CHTE-1	Alabama River	65f	Escambia	31.2429	-87.4772
Little River	LTLE-2	Alabama River	65f	Escambia	31.2596	-87.4903
Little River	LTLM-2	Alabama River	65f	Monroe	31.2740	-87.4800
*Bear Creek	BRE-1	Blackwater River	65f	Escambia	33.0333	-86.7096
*Halls Creek	HLB-1	Mobile--Tensaw	65f	Baldwin	31.0526	-87.8370
			DeSoto			
Hurricane Creek	HURD-1	Coosa River	68	Dekalb	34.4214	-85.6013
Straight Creek	STRD-1	Coosa River	68	Dekalb	34.4737	-85.6064
West Fork Little River	WFLD-1	Coosa River	68	Dekalb	34.5086	-85.6087
West Fork Little River	WFLD-2	Coosa River	68	Dekalb	34.4979	-85.6162
*Little Canoe Creek	LCNE-1	Coosa River	67	Etowah	33.9707	-86.1804
			Oak Mountain			
Dry Brook	DRYS-1	Cahaba River	68	Shelby	33.3387	-86.7616
Peavine Branch	PEAS-1	Cahaba River	68	Shelby	33.2968	-86.7488
*Weogufka Creek	WGFC-1	Coosa River	68	Coosa	33.0729	-86.2485
			Paul M. Grist			
Valley Creek	VLYD-1	Alabama River	65i	Dallas	32.5750	-86.9847
Valley Creek	VLYD-2	Alabama River	65i	Dallas	32.6212	-86.9955
Unnamed trib to Valley Cr	UVLD-1	Alabama River	65i	Dallas	32.6145	-86.9820
*South Sandy Creek	SSB-1	Black Warrior River	65i	Bibb	32.9692	-87.3977
*Swift Creek	SWFC-1	Alabama River	65i	Chilton	32.7215	-86.6916
			Joe Wheeler			
Neely Branch	NLYW-1	Tennessee River	71	Lauderdale	34.8163	-87.3011
First Creek	FIRW-1	Tennessee River	71	Lauderdale	34.8509	-87.3206
*Indian Camp Creek	INCL-1	Tennessee River	71	Lauderdale	34.9243	-87.6211

*Ecoregional reference site

conductance and dissolved oxygen were measured *in situ* with a Hydrolab™ Surveyor IV Multiprobe. Turbidity was measured with a turbidimeter. Stream discharge was estimated by measuring stream velocity at six to ten intervals in an abbreviated crossectional area method. Surface water for chemical analysis was collected as a grab sample, preserved and transported with appropriate chain of custody as outlined in ADEM Field Operations Standard Operating Procedures and Quality Control Assurance Manual, Volume I -Physical/Chemical (1994). ADEM's Central Laboratory analyzed each sample for the following: total dissolved solids (TDS), total suspended solids (TSS), biochemical oxygen demand (BOD-5), total alkalinity, hardness, total phosphorus ($T\text{-}PO_4$), nitrates/nitrites (NO_3/NO_2), ammonia (NH_3), total Kjeldahl nitrogen (TKN) and chloride (CL^-). The Bioassay Unit of Field Operations analyzed samples collected for fecal coliform bacteria. Duplicate field parameters and water samples were collected at 10% of the sampling events for Quality Assurance/Quality Control.

Habitat, Macroinvertebrate and Fish Assessments

Habitat Assessments

Environmental Indicators Section (EIS) staff surveyed each wadeable stream station in May and June 1998 by determining the reach to be assessed and collecting information regarding stream sediment, substrate and water quality characteristics. Habitat assessments were conducted using the methods developed by Barbour and Stribling (1994). The characterization of in-stream habitat quality is necessary for appropriate interpretation of biological community data. The habitat assessment method uses 11 to 12 parameters depending on the stream reach morphology. The habitat parameters evaluate stream bottom substrate characteristics, in-stream cover, channel morphology, canopy cover, riparian and bank stability. The result of the assessment is a numerical score used to estimate the stream habitat quality as excellent, good, fair or poor.

Aquatic Macroinvertebrate Community

The aquatic macroinvertebrate communities were assessed at all wadeable sites during May/June. A modified multihabitat bioassessment method was utilized to determine the integrity of the macroinvertebrate communities (ADEM 1996). Benthic macroinvertebrates were collected from all productive in-stream habitats available at each sampling site. These included: riffles, CPOM (course particulate organic matter), rocks and/or logs, undercut banks, sand and macrophytes. The samples collected from each habitat were preserved separately and returned to the laboratory for processing and identification. The organisms from the generally pollution sensitive Ephemeroptera (E, mayflies), Plecoptera (P, stoneflies) and Trichoptera (T, caddisflies) were identified to the lowest possible taxonomic level, generally genus. The total number of EPT taxa identified at each station is termed the EPT Index. For each station, this index was compared to EPT Index data collected from least impaired ecoregion reference stations to indicate the health of each stream reach. A designation of excellent, good, fair or poor was assigned to each station.

Fish Community

Historically, the primary biological assessments conducted by ADEM's Environmental Indicators Section have been of the aquatic macroinvertebrate communities. In an effort to also incorporate fish community assessment into the biological assessment program, 18 sites were selected for fish assessments in this project. Where conducted, assessments of both aquatic communities result in a more complete assessment of in-stream biological integrity. These assessments were conducted during the months of June and July. The sampling protocol, developed by Geological Survey of Alabama (GSA 1998), uses a time based multihabitat approach. A 3-person crew sampled all available habitat including riffles, snags, pools, runs and rootbanks, using a 8 ft, 3/16"-mesh minnow seine and backpack electro-shocker. Each sample required 30 to 40 minutes to complete. Samples were fixed with 10% formalin and transported to

the laboratory. Seventy-percent ethanol was used to preserve the samples after identification to species, enumeration and weighing.

The data were analyzed using a slight modification of the Index of Biotic Integrity (Karr 1981). The modified IBI examines 12 metrics of the fish community related to species richness (# of species) and composition, trophic composition, fish abundance and condition. The total number of fish captured was standardized to catch per hour for purposes of calculating one metric. Each metric was given a score according to the associated criteria and totaled to determine the IBI score. The integrity of the fish community was determined to be excellent, good, fair, poor, or very poor based on the total IBI score.

In the protocol GSA developed for ADEM, several metrics utilized by Karr (1981) were substituted with ones that were more appropriate for the Black Warrior drainage. The metrics and scoring criteria for the Black Warrior were deemed applicable for the sites in this study (P. O'Neil, pers. comm. 1999). However, as ADEM collects additional samples statewide, modifications may need to be made to some metrics and /or scoring criteria.

Assessment of Stream Condition

Fish and macroinvertebrate communities may respond to changes in water quality in different ways and to varying degrees over time. Consequently, monitoring changes in biological communities can detect impairment from non-point source pollution, which can be infrequent or low level.

The fish community seems particularly well suited to identifying impairments due to habitat modification. The macroinvertebrates provide more information about water column effects as potential causes of impairment. In addition each group has different recovery rates with macroinvertebrates generally quicker to recover than fish (Yoder and Rankin 1995).

Chain of Custody

Chain of Custody of all chemical and biological samples was maintained as described in ADEM Field Operations Standard Operating Procedures and Quality Control Assurance Manual, Volumes I and II (1994 and 1996).

RESULTS AND DISCUSSION

Blue Springs State Park

Blue Springs is a 103-acre park located 6 miles east of Clio, Alabama in Barbour County. The spring, for which it is named supplies cool water year-round for the swimming pool, making it a popular attraction. Camping and picnic areas are available near the banks of the West Fork Choctawhatchee River as well as in wooded areas.

Blue Springs State Park is in the Upper West Fork Choctawhatchee sub-watershed (03140201-050), which has a drainage area of 141.6 mi^2. Land use estimates for this sub-watershed consisted of primarily deciduous (24.3%), mixed (22.4%) and evergreen (13.6%) forests (Table 2 and Figure 2). Pasture and row crops were observed to be the primary land use activities during reconnaissance of the watershed upstream of the park. Two construction/stormwater authorizations were active in the watershed.

Three locations associated with the park were assessed during this study. Blue Spring (BSPB-1) was sampled along with two sites on the West Fork Choctawhatchee River upstream (WCHB-1) and downstream (WCHB-2) of the confluence of Blue Spring. These sites are located within the boundaries of the park. A habitat assessment was performed on the West Fork Choctawhatchee (WCHB-2) site just downstream of confluence with Blue Springs (Table 3). Habitat quality was estimated to be “good”; however, the reach had insufficient stable habitat with sediment deposition apparent. Sand comprised approximately 77% of the substrate (Table 4). The West Fork Choctawhatchee River locations were too deep to conduct biological assessments utilizing wadeable stream methods. Water quality assessments were performed on the three sites (Appendix A). Biochemical oxygen demand levels were higher during the spring sampling event (1.8 mg/L) at the upstream site on the West Fork (WCHB-1) than the site just downstream of the confluence with Blue Springs (WCHB-2) (0.2 mg/L). Nitrate/nitrite levels of 1.0 mg/L during the summer at the upstream site

(WCHB-1) indicated possible nutrient enrichment when compared to Hurricane Creek (0.1 mg/L) which is the ecoregional reference site. Water quality measurements from Blue Springs (BSPB-1) were not elevated.

Table 2. Estimated percent land use of subwatersheds in the State Parks Study.

	Subwatershed																			
	Upper West Fork Choctawhatch	South Sauty Creek	Jones Creek	Cheaha Creek	Talladega Creek	Chewacla Creek	Hurricane Creek	Little River	Blackwater River	Upper Tensaw	West Fork Little River	Bear Creek	Little Canoe Creek	Cahaba Valley Creek	Weogufka Creek	Valley Creek	Big Sandy Creek	Swift Creek	Second Creek	Upper Shoal Creek
Land Use Catagories	% Land Use																			
Open Water	0.4	0.3	2.6	0.3	0.2	0.6	0.7	0.2	0.1	3.8	0.7	0.6	0.4	0.8	0.1	0.3	0.1	0.4	9.3	1.1
Low Intensity Residential	0.1	0.3	0.1	0.4	1.3	2.0	0.2	0.0	0.0	0.1	0.2	0.1	0.0	5.4	0.1	1.8	0.1	0.1	0.3	0.1
High Intensity Residential	0.0	0.1	0.0	0.1	0.3	0.5	0.0	0.0		0.0				1.0		0.3		0.0	0.0	
Comm/Industrial/Transport	0.1	0.2	0.1	0.2	0.5	1.0	0.3	0.1	0.0	0.1	0.1	0.1	0.1	3.2	0.2	0.4	0.3	0.1	0.4	0.1
Bare Rock/Sand								0.0										0.0		
Quarry/Strip Mines/Gravel Pits			0.0		0.0	0.1								1.7						
Transitional	0.1		0.5	3.1	0.8	1.2	1.0	6.6	3.4	1.7	3.5	0.4	0.2	1.0	1.5	1.3	2.2	1.6		0.7
Deciduous Forest	24.3	16.8	25.7	34.7	42.9	33.4	43.3	6.7	4.9	3.4	31.9	35.0	51.1	36.2	39.7	22.3	31.4	23.0	28.6	59.8
Evergreen Forest	13.6	8.2	8.4	18.5	16.4	11.9	19.6	38.0	67.4	34.1	19.0	14.7	11.4	11.7	18.6	23.0	21.0	17.7	3.0	1.3
Mixed Forest	22.4	18.3	19.4	25.9	25.4	27.2	29.8	19.6	14.7	14.4	37.4	27.0	22.4	27.1	29.5	34.2	37.2	26.0	7.8	11.5
Grasslands/Herbaceous																				
Pasture/Hay	7.6	27.0	21.3	8.1	5.3	5.8	3.1	10.5	4.5	2.8	5.1	12.8	10.6	7.7	6.7	4.8	2.1	7.3	28.5	16.9
Row Crops	25.0	25.7	20.8	8.5	4.7	9.9	1.8	13.0	4.3	1.4	2.1	9.2	3.3	2.8	2.7	6.7	2.1	13.8	21.6	8.0
Other Grasses (urban/recreational)	0.1	0.1	0.1	0.3	0.6	0.7	0.2	0.1	0.0	0.1			0.2	1.1	0.1	0.7	0.0	0.1	0.2	0.1
Woody Wetland	6.2	3.0	0.5		1.6	5.7	0.1	5.0	0.6	35.5	0.0	0.1	0.4	0.2	1.0	4.2	3.2	9.5	0.2	0.3
Herbaceous Wetland	0.1	0.1	0.4		0.1	0.2	0.0	0.2	0.0	2.7			0.0	0.0	0.0	0.1	0.1	0.6		0.1

Figure 2
Upper West Fork of the Choctawhatchee Subwatershed Landuse
Blue Springs State Park
3140201050

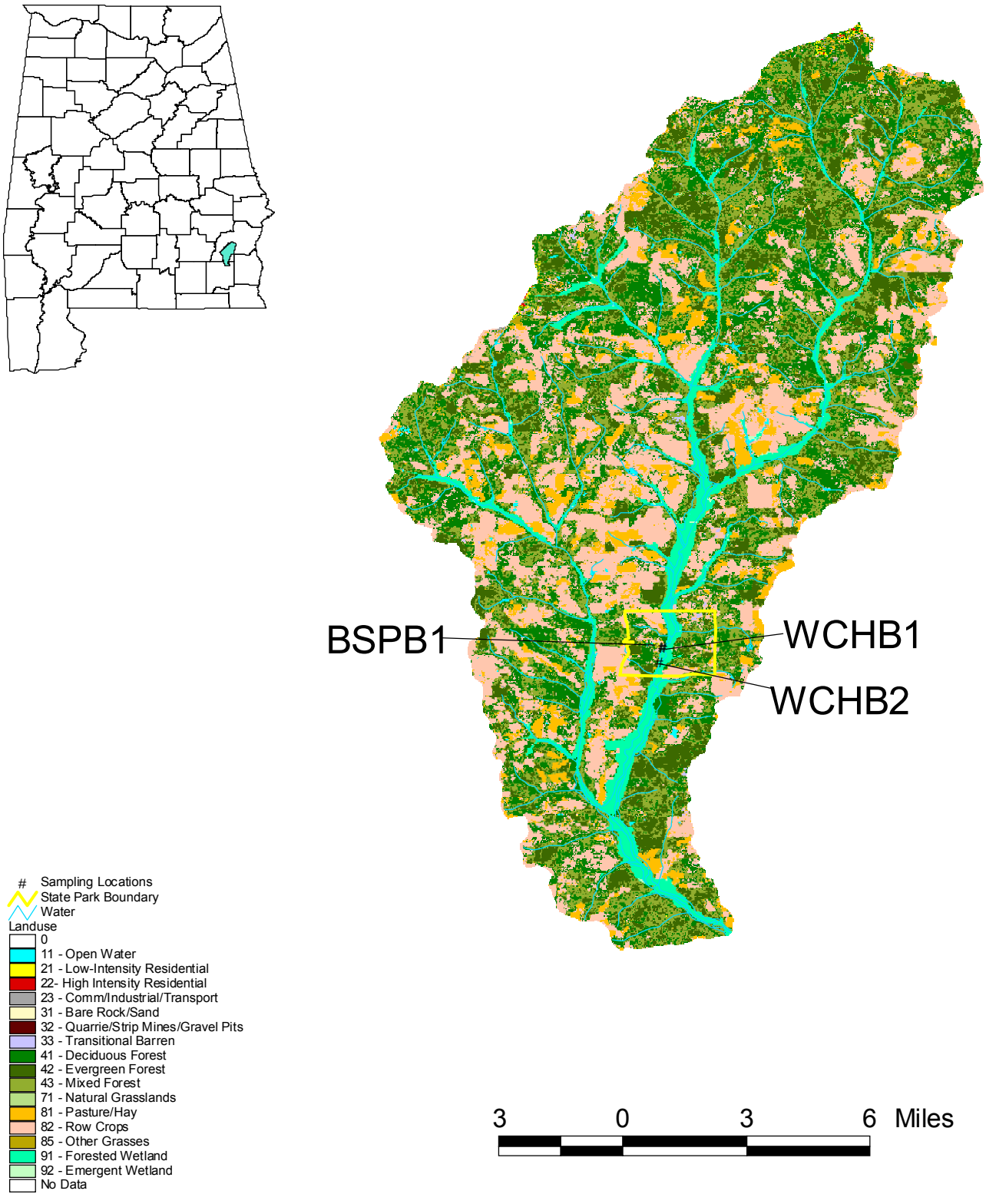


Table 3. Habitat quality and aquatic macroinvertebrate assessments for sites in the State Parks Study. In order to compare levels of habitat degradation between stations, values given for each of three major habitat parameters are presented as percent of maximum score.

	Station											
	Bucks Pocket				**Reference**	DeSoto			**Reference**	**Reference**	Cheaha	
Parameter	KIRD-1	SSCD-1	STGD-1	STND-1	**BYTJ-1**	HURD-1	STRD-1	WFLD-2	**LCNE-1**	**TCT-5**	CHE-1	CHEC-3
Habitat assessment form	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR
Instream habitat quality	76	83	79	79	81	78	86	99	78	91	92	90
Sediment deposition	78	63	70	85	88	89	65	95	68	93	76	86
% Sand	4	15	15	5	3	8	5	1	27	4	25	5
% Silt	10	2	2	3	1	2	15	1	2	1	3	1
Sinuosity	93	78	90	93	88	95	95	98	85	98	95	98
Bank and vegetative stability	86	85	90	79	90	91	94	96	46	88	77	89
Riparian zone measurements	83	90	90	50	90	95	100	100	76	78	75	93
% Canopy cover	30	30	50	70	70	70	90	30	50	50	50	70
% Maximum Score	83	82	84	78	87	89	84	98	71	89	84	92
Habitat Assessment Category	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent
EPT Taxa Collected	11	14	12	11	16	11	11	14	15	23	21	20
Aq. Macroinvertebrate Assess	Fair	Good	Good	Fair	Good	Fair	Fair	Good	Good	Excellent	Excellent	Excellent

	Claude D. Kelley			**Reference**	**Reference**				Chewacla			**Reference**
Parameter	CHTE-1	LTLE-2	LTLM-2	**BRE-1**	**HLB-1**	CHWT-1	CHWT-3	MMLT-1A	MMLT-1C	NAST-1	ROBT-1	**HCR-1**
Habitat assessment form	GP	GP	GP	GP	GP	RR	RR	RR	GP	RR	RR	RR
Instream habitat quality	59	56	51	48	42	76	53	45	29	85	65	63
Sediment deposition	84	84	75	31	75	65	48	46	58	79	50	54
% Sand	60	82	84	85	72	20	55	72	81	15	40	60
% Silt	2	3	3	1	3	20	3	10	5	1	5	7
Sinuosity	73	70	70	68	40	78	28	75	58	95	73	58
Bank and vegetative stability	48	46	58	73	60	86	53	61	69	88	79	70
Riparian zone measurements	78	93	90	90	90	76	93	90	93	100	98	89
% Canopy cover	90	70	90	50	90	30	90	70	70	70	90	90
% Maximum Score	68	69	68	69	62	78	59	58	57	88	74	71
Habitat Assessment Category	Good	Good	Good	Good	Good	Excellent	Good	Good	Good	Excellent	Good	Good
EPT Taxa Collected	14	17	18	10	8	6	8	5	3	18	12	20
Aq. Macroinvertebrate Assess	Good	Good	Good	Good	Fair	Fair	Fair	Fair	Poor	Good	Good	Excellent

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 3. Continued

Parameter	Station										
	Blue Springs	Oak Mountain		**Reference**	Paul M. Grist		**Reference**	**Reference**	Joe Wheeler		**Reference**
	WCHB-2	DRYS-1	PEAS-1	**WGFC-1**	VLYD-1	UVLD-1	**SSB-1**	**SWFC-1**	NLYW-1	FIRW-1	**INCL-1**
Habitat assessment form	GP	RR	RR	RR	GP	GP	GP	GP	RR	RR	RR
Instream habitat quality	46	75	60	77	54	43	53	56	53	59	89
Sediment deposition	80	73	73	51	76	81	79	73	84	81	90
% Sand	77	2	8	50	82	40	93	62	0	1	0
% Silt	3	6	4	1	10	0	1	3	3	2	1
Sinuosity	48	85	80	63	48	38	63	48	95	93	93
Bank and vegetative stability	66	69	58	63	74	73	75	75	49	70	89
Riparian zone measurements	66	62	88	90	95	84	95	90	86	90	60
% Canopy cover	70	50	90	70	30	70	70	70	90	50	70
% Maximum Score	64	73	70	72	70	66	73	71	71	78	84
Habitat Assessment Category	Good	Good	Good	Good	Good	Good	Good	Good	Good	Excellent	Excellent
EPT Taxa Collected	----	18	16	19	8	6	13	15	6	10	23
Aq. Macroinvertebrate Assess.	----	Good	Good	Excellent	Fair	Fair	Good	Good	Poor	Fair	Excellent

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 4. Physical characteristic estimates of sites in the State Parks Study.

Station	Area (mi^2)	Width (ft.)	Depth (ft.) Riffle	Run	Pool	%Substrate Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Stick/Wood	CPOM	Mud-Muck
Blue Springs															
BSPB-1	N/A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCHB-1	86.8	non-wadeable													
WCHB-2	86.8	40	n/a	3+	>3.5	0	0	0	0	77	3	1	3	1	15
Bucks Pocket															
KIRD-1	16.3	50	1.0	1.5	2	80	2	2	1	4	10	0	0	1	0
SSCD-1	44	35	0.8	1.0	1.5	55	5	9	9	15	2	0	3	2	0
STGD-1	12.7	30	1.0	1.5	2	60	5	10	5	15	2	0	1	2	0
STND-1	14.2	30	0.5	1.5	2.5	65	10	8	6	5	3	1	1	1	0
BYTJ-1	41.8	50	0.5	1.0	1.5	80	10	2	2	3	1	0	1	1	0
Cheaha															
CHE-1	5.7	30	0.8	1.0	4.5	2	21	35	10	25	3	0	2	2	0
CHEC-3	1.3	15	0.3	0.8	1.5	20	10	39	20	5	1	1	2	2	0
TCT-5	70	50	0.8	1.0	3.5	5	16	20	50	4	1	0	2	2	0
Chewacla															
CHWT-1	45.1	30	0.5	1.5	4	10	20	10	18	20	20	0	2	0	0
CHWT-3	10.1	15	0.3	1.5	3.5	0	2	10	15	55	5	2	8	3	0
MMLT-1a	4.1	15	0.3	0.5	1.5	9	2	0	3	72	10	0	2	2	0
MMLT-1c	11	18		0.5	3.5	0	0	0	10	81	5	0	2	2	0
NAST-1	2	12	0.3	1.5	4	13	40	20	10	15	1	0	1	0	0
ROBT-1	5.6	17	0.8	1.0	2	20	16	5	10	40	5	0	3	1	0
HCR-1	12	30	0.5	1.5	4	1	2	4	20	60	7	1	3	2	0
Claude D. Kelly															
CHTE-1	5.1	12	n/a	1.5	3	0	0	0	10	60	2	20	5	3	0
LTLE-2	19.5	18	n/a	2.0	4.5	0	0	0	3	82	3	0	7	5	0
LTLM-2	17.6	20	n/a	1.0	2	0	0	0	1	84	3	5	5	2	0
BRE-1	27	30	n/a	1.5	5	0	0	0	0	85	1	1	10	3	0
HLB-1	19	20	n/a	1.0	2	0	0	0	10	72	3	2	8	5	0
DeSoto															
HURD-1	6.4	15	0.3	0.4	3	80	2	1	2	8	2	0	3	2	0
STRD-1	2.4	8	0.3	1.0	1.5	47	20	10	1	5	15	0	1	1	0
WFLD-1	39.1	non-wadeable													
WFLD-2	40.6	30	1.0	1.8	3	40	30	24	2	1	1	0	1	1	0
LCNE-1	23	15	0.3	1.0	3	0	0	30	30	27	2	1	5	5	0

Table 4. Continued.

Station	Area (mi^2)	Width (ft.)	Depth (ft.) Riffle	Run	Pool	%Substrate Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Stick/Wood	CPOM	Mud-Muck
Oak Mountain															
DRYS-1	6.3	15	0.5	1.5	2.5	0	10	39	39	2	6	0	3	1	0
PEAS-1	1.5	10	0.3	1.0	1.5	0	2	40	40	8	4		3	3	0
WGFC-1	13	20	0.6	0.8	2	1	1	4	40	50	1	0	2	1	0
Paul M. Grist															
VLYD-1	16	n/a													
VLYD-2	7.7	20	n/a	1.2	2.5	0	0	0	0	82	10	3	4	1	0
UVLD-1	0.3	7	n/a	1.5	2	0	0	0	0	40	0	40	15	5	0
SSB-1	21	20	n/a	1.5	3	0	0	0	0	93	1	0	3	3	0
SWFC-1	25	45	0.5	1.5	2.5	0	0	5	20	62	3	0	5	5	0
Joe Wheeler															
NLYW-1	4.6	15				70	20	3	2	0	3	0	1	1	0
FIRW-1	18	30	0.3	1.0	2	65	5	5	20	1	2	0	1	1	0
INCL-1	18	20	0.3	1.0	4	24	1	30	42	0	1	0	1	1	0

Bucks Pocket State Park

Bucks Pocket is a 2,000-acre park located 2 miles north of Grove Oak, Alabama in Dekalb, Jackson and Marshall Counties. The park is in the Tennessee River basin and Appalachian Mountain chain. Hiking, camping and picnicking are a few of the activities available in the park.

The park is located in the South Sauty Creek sub-watershed (06030001-220). This sub-watershed has a drainage area of 126.2 mi^2. EPA estimated land use for the sub-watershed was estimated to be primarily pasture/hay (27%), row crops (25.7%), mixed (18.3%) and deciduous (16.8%) forests (Figure 3). During reconnaissance efforts of the watersheds upstream of the sampling sites, pasture and row crops were observed to be the dominant land use activity. Six construction/stormwater authorizations were active in the watershed.

Stream locations within the park boundaries that were chosen for assessment based upon reconnaissance information were not flowing during the May/June visit. Four alternate streams were chosen from outside of the park boundaries, but were tributaries to South Sauty, the main stream flowing through the park. One of the sites sampled was on Kirby Creek (KIRD-1) with a drainage area of 16.3 m^2. Habitat quality was evaluated to be "excellent". The aquatic macroinvertebrate community was evaluated as "fair" with 11 EPT taxa collected (Table 3 and Appendix B). Fish assessments indicated the community to be "very poor" (Table 5 and Appendix C). There were a reduced number of fish species and a high percentage of herbivores, omnivores and sunfish present. The biological health of this fish community as well as the other sites (SSCD-1, STGD-1, STND-1) associated with Bucks Pocket are probably being impacted by natural low stream flow during the summer, limited habitat with a dominance of bedrock and land use within the watershed. Water quality results indicated nitrate/nitrite levels (1.1 mg/L) during the spring sampling event to be higher than most of the locations sampled in the study. Kirby Creek was not flowing during the fall thus water chemistry was not evaluated. Elevated nitrates/nitrites could be a result of agricultural and residential activities present in the watershed.

Figure 3
South Sauty Creek Subwatershed Landuse
Bucks Pocket State Park
6030001220

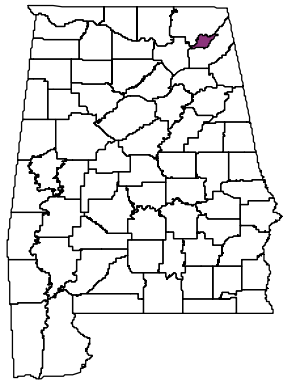


Table 5. Results of fish IBI assessments conducted at 18 sites in 1998 for the State Parks Study.

	Stations																	
	CHEC-3	CHE-1	DRYS-1	WGFC-1	VLYD-1	SSB-1	CHWT-1	CHWT-3	MMLT-1A	MMLT-1C	ROBT-1	NAST-1	HCR-1	KIRD-1	SSCD-1	STGD-1	STND-1	BYJT-1
Collection time (min.)	30	30	40	30	30	30	30	30	30	30	30	30	30	30	40	30	35	40
Collection Date	6/10	6/10	6/9	6/9	7/13	7/13	6/11	6/11	6/11	6/11	6/11	6/11	6/9	7/6	7/6	7/6	7/6	7/7
Area (sq mi)	1.3	5.7	6.3	13.0	16.0	21.0	45.1	10.1	4.1	11.0	5.6	2.0	12.0	16.3	44.0	12.7	14.2	41.8
Richness measures																		
# total species	3	12	12	12	14	18	14	13	12	13	15	15	16	6	6	8	6	5
# darter species	0	2	2	2	2	2	2	2	1	1	2	1	3	0	0	0	0	0
# minnow species	2	5	2	6	6	8	4	5	5	5	5	7	8	1	2	3	1	0
# sunfish species	1	2	3	2	2	3	2	2	1	3	4	3	2	3	3	3	3	4
# sucker species	1[a]	1	1	1	2	3	2	2	1	1	1	1	2	0	0	0	0	0
Tolerance/ intolerance																		
# intolerant species	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Trophic measures																		
# individuals	168	97	94	170	132	108	68	66	143	321	262	109	157	38	33	100	77	23
% omnivores and herbivores	0.0	9.3	6.4	4.7	10.6	4.6	41.2	15.2	19.6	13.4	5.3	40.4	3.8	55.3	36.4	34.0	3.9	4.4
% top carnivores	53.0[b]	2.1	1.1	0.0	0.8	0.9	2.9	0.0	2.1	1.9	0.4	1.8	0.0	2.6	0.0	2.0	6.5	0.0
Composition measures																		
% insectivorous cyprinids	39.0	39.2	0.0	58.8	75.8	83.3	20.6	47.0	74.8	70.4	84.7	35.8	60.5	0.0	12.1	6.0	0.0	0.0
% sunfish	8.0	5.2	41.5	11.1	6.8	4.6	2.9	33.3	0.7	11.8	2.7	19.3	1.3	42.1	54.5	55.0	41.6	95.7
Community health measures																		
# collected/ hour	336	194	141	340	264	216	136	132	286	642	524	218	314	76	50	200	132	35
% with disease/ anomalies	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IBI Score	36	46	32	42	43	46	36	40	42	42	48	38	46	22	20	28	28	24
Assessment*	P-F	F-G	P	F	F	F-G	P-F	F	F	F	G	P-F	F-G	VP	VP	P	P	VP-P
Sampling time	30	40	30	30	30	30	30		30	20								

a. # headwater species

b. % pioneer species

* P-F = Poor/Fair, F-G = Fair/Good, P = Poor, F = Fair, G = Good, VP = Very Poor, VP-P = Very Poor/Poor

The site on South Sauty Creek (SSCD-1) has a drainage area of 44 mi ^{2}. Habitat quality was assessed as “excellent”. The substrate was primarily bedrock (55%) and sand (15%). The macroinvertebrate community was in “good” condition with 14 EPT taxa collected. In contrast, the IBI assessment evaluated the fish community to be “very poor”, with low diversity and overall numbers of fish collected. Nitrates/nitrites were also elevated in South Sauty during the spring. Chloride levels (306 mg/L) in the fall were the highest documented from any site during the study. The wastewater treatment facility for the City of Henagar is located approximately 15 miles upstream of SSCD-1 on South Sauty Creek.

Habitat quality of Straight Creek (STGD-1) was assessed as “excellent”. The substrate was comprised of primarily bedrock (60%), sand (15%), cobble (10%), boulder (5%) and gravel (5%). Macroinvertebrate and fish communities were evaluated as “good” and “poor”, respectively. As observed at the other sites (KIRD-1, SSCD-1, STND-1), nitrate/nitrite levels were higher (1.2 mg/L) in the spring. Water chemistry was not measured during the fall due to the lack of flow. There was a sewage odor noted from the sediment during the visit in the spring. The documentation of filamentous algae and measured nitrate/nitrite levels suggests nutrient enrichment. Land use adjacent to this reach was observed to be pasture, row crops and residential, any of which could be responsible for the additional nutrients.

Stringer Creek (STND-1) habitat quality was evaluated as “excellent”. However, the width of the riparian zone was estimated only 20 to 50 feet at this site “due to encroachment by human activities”. Bedrock made up 65% of the substrate. There were 11 EPT taxa collected; thus, the macroinvertebrate community was considered to be in “fair” condition. The fish community was evaluated to be “poor”. In the spring nitrate/nitrite concentration was 1.4 mg/L and filamentous algae were observed suggesting possible nutrient enrichment. The dissolved oxygen concentration (4.9 mg/L) during the summer was lower than the Fish and Wildlife water quality standard of 5.0 mg/L. Lack of stream flow prevented water quality sampling during the fall.

Bryant Creek (BYTJ-1) is the reference site for the Southwestern Appalachians (68) ecoregion. This creek is in the Jones Creek sub-watershed (06030001-180). Estimated percent land use for the entire sub-watershed was similar to South Sauty sub-watershed with pasture/hay (21.3%), row crops (20.8%), mixed (19.4%) and deciduous (25.7%) forests. As with the other sites (KIRD-1, SSCD-1, STGD-1, and STND-1) habitat quality was "excellent" and the substrate was primarily bedrock. Although more EPT taxa (16) were present at this location than at previously mentioned locations, the macroinvertebrate community was only evaluated to be in "good" condition. The fish community was evaluated as "very poor/poor". The sample was very similar to the collections (KIRD-1, SSCD-1, STGD-1, and STND-1) made in the Bucks Pocket watershed consisting of few individuals, primarily of sunfish species. Several species of sunfish can dominate the fauna in disturbed streams in Alabama (O'Neil and Shepard 1998). The fish community in Bryant Creek is also probably being impacted by natural low stream flow during the summer, limited habitat with a dominance of bedrock and land use within the watershed. Nitrate/nitrite concentrations were 1.1 mg/L during the summer sampling event, which was several times higher than levels measured at Kirby, South Sauty, Straight and Stringer Creeks. Water quality was not measured during the fall due to lack of flow.

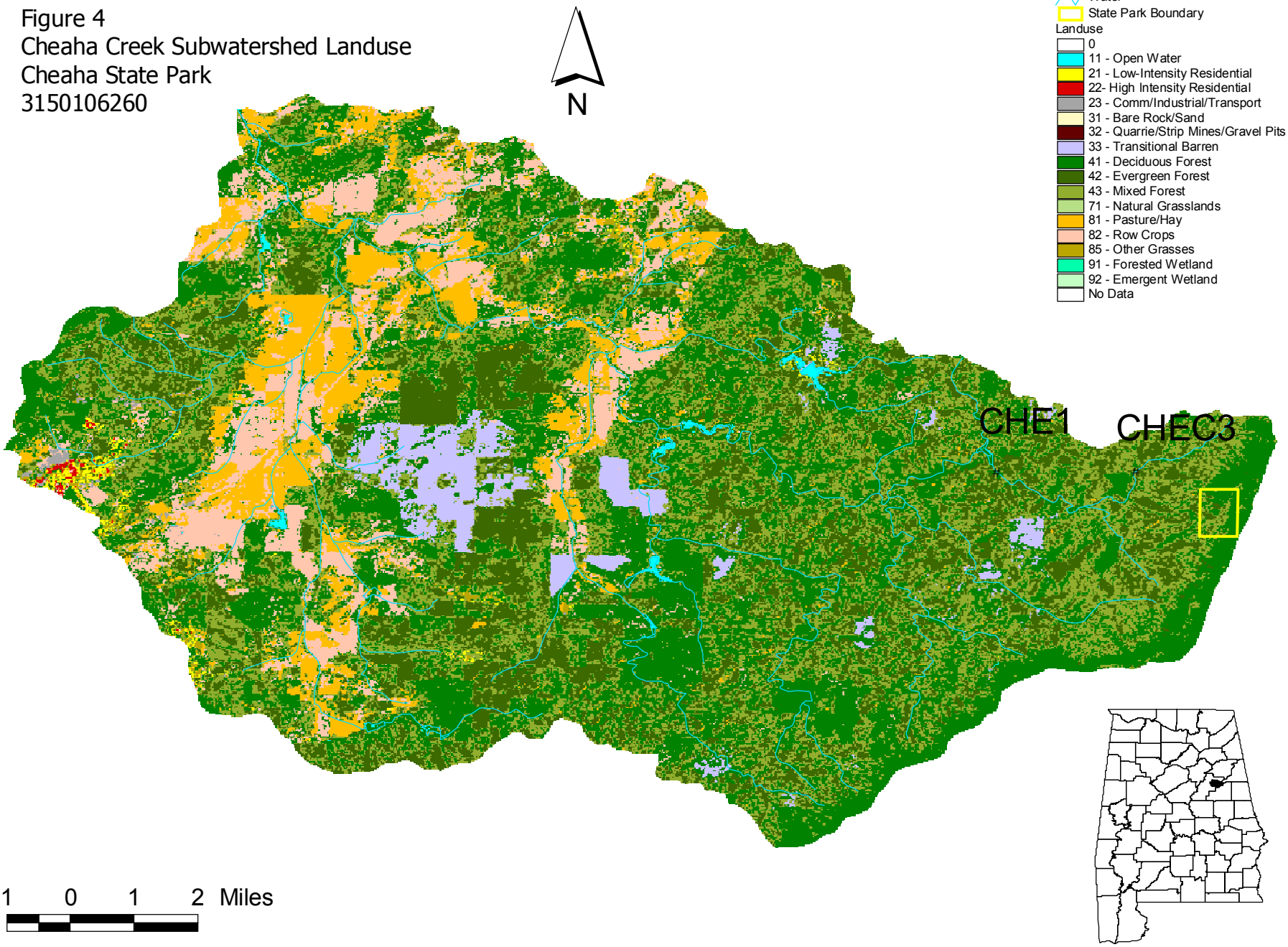
Cheaha State Park

Cheaha State Park is located atop Cheaha Mountain, 2,407 feet above sea level. The park is just south of Anniston on the Cleburne and Clay county line in the Coosa River basin. Hiking, biking, swimming and camping are a few of the activities possible in the park.

Cheaha State Park is in the Cheaha Creek (03150106-260) sub-watershed. It has a drainage area of 113.2 mi^2. Percent land use estimates indicated the sub-watershed to be primarily deciduous (34.7%), mixed (25.9%) and evergreen (18.5%) forests (Figure 4). Evidence of past timber harvests was observed during reconnaissance of the immediate watershed.

There was not adequate flow at the sites within the park for chemical or biological assessments. Two sites on Cheaha Creek outside the park were chosen for monitoring. Both sites on Cheaha Creek (CHE-1, CHEC-3) are located in the Talladega National Forest. One of the sites (CHE-1) was located just upstream of Lake Chinnabee. Habitat assessments indicated habitat to be "excellent" at both sites with riffle/run type morphology. The number of EPT taxa (21 and 20) indicated the macroinvertebrate communities to be in "excellent" condition. Biological assessments of the fish communities were "fair/good" at the downstream location (CHE-1) and "poor/fair" at the uppermost site (CHEC-3). The drainage area of the upstream site (CHEC-3) was the smallest (1.3 mi^2) of all sites where fish assessments were performed. Headwater streams such as this will have different taxa composition resulting from the influence of small channel and substrate size, temporal flow and water availability (Ohio EPA 1987). The scoring criteria were modified as other studies have suggested for headwater streams (Ohio EPA, 1987 and Kentucky 1997). The IBI scoring criteria was adjusted for this site (CHEC-3) to include metrics related to the number of headwater species and percentage of pioneer species present. Headwater species are those permanent residents of small creeks, which indicate stable habitat quality and low environmental stress (O'Neil and Shepard 1998). Pioneer species are the first invaders of a stream after desiccation during periods of

Figure 4
Cheaha Creek Subwatershed Landuse
Cheaha State Park
3150106260



drought and also dominate in unstable environments affected by drought or environmental stress (O'Neil and Shepard 1998). Additional work needs to be done in small streams in Alabama such as this to get a better understanding of composition of the fish community. Water quality assessments did not indicate any impairment.

The reference site on Talladega Creek (TCT-5) was located in Talladega County in the Talladega Creek (03150106-330) sub-watershed. Estimated percent land use was similar to Cheaha Creek with deciduous (42.9%), mixed (25.4%) and evergreen (16.4%) forests. There was one construction/stormwater authorization issued in the watershed of this site. The habitat of this riffle/run creek was evaluated as "excellent". The substrate was primarily gravel (50%), cobble (20%) and boulder (16%). The macroinvertebrate community was assessed to be in "excellent" condition. Water quality assessments did not indicate any impairment.

Chewacla State Park

Chewacla State Park is located 4 miles south of Auburn, Alabama in Lee County. The park is in the Tallapoosa River basin and the Piedmont sub-ecoregion of the Southeastern Plains. A few activities of the 696-acre park are hiking, picnicking, swimming, camping and fishing.

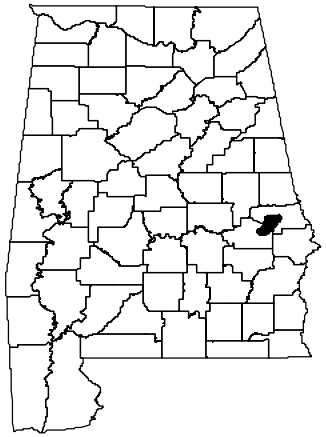
The park is in the Chewacla Creek (03150110-050) sub-watershed, which has a drainage area of 148 mi^2. Percent land use estimates (Figure 5) indicated deciduous (33.4%), mixed (27.2%) and evergreen (11.9%) forests as the primary activities. Over the last five years residential, commercial and industrial activities have increased tremendously around the city of Auburn. Thus, estimates of residential and commercial/industrial/transportation are probably low. One mining NPDES permit and 21 construction/stormwater authorizations were active in the watershed.

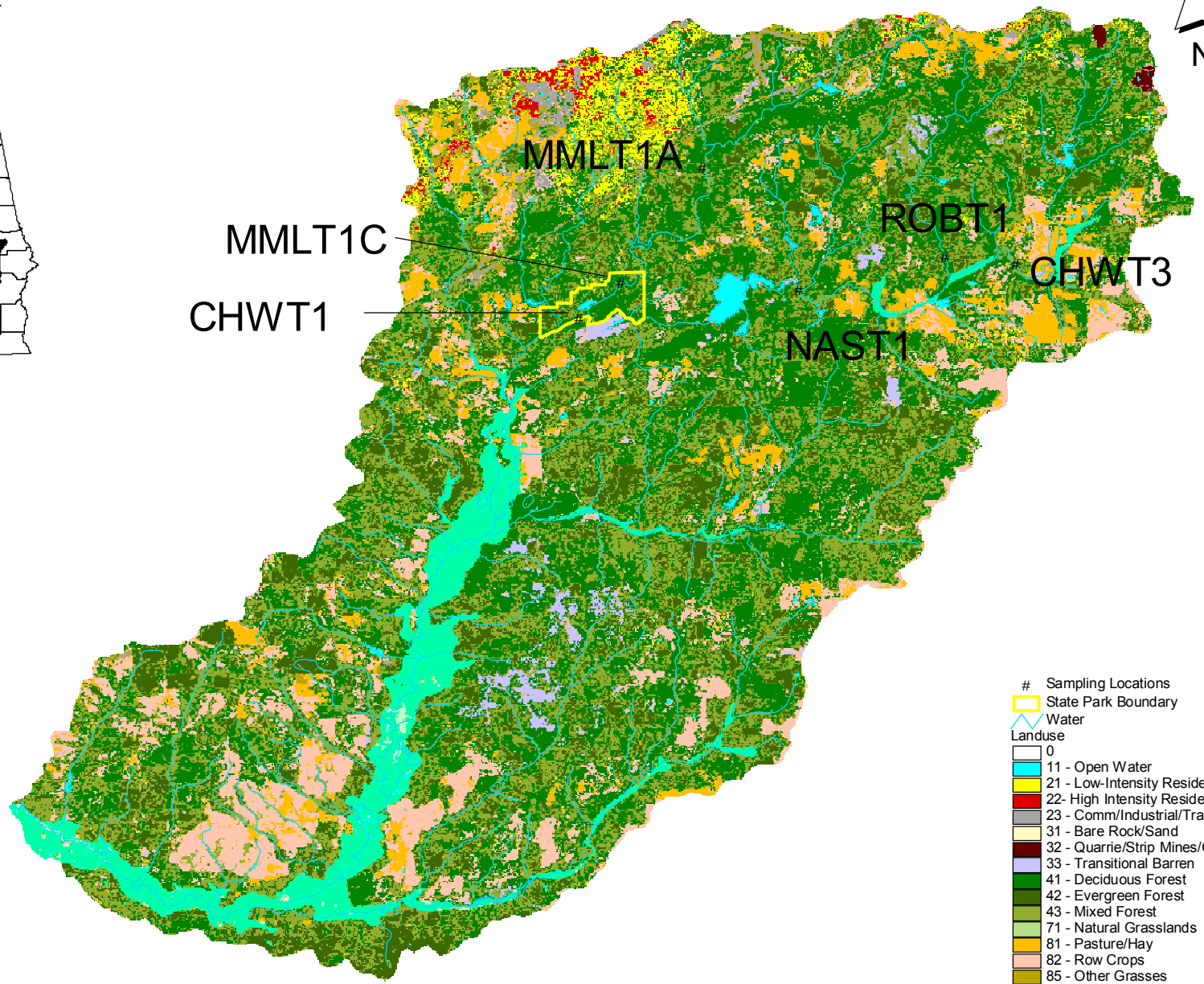
Two sites in the park (CHWT-1 and MMLT-1c) and 4 sites in the watershed (MMLT-1a, ROBT-1, NAST-1 and CHWT-3) were chosen for assessments. Chewacla Creek runs along the southern boundary of the park and Moores Mill Creek forms a 26-acre impoundment within the park.

One site on Chewacla Creek (CHWT-3) was sampled outside of the park and had a drainage area of 10.1 mi^2. The substrate of this riffle/run site was estimated to consist of 55% sand, 15% gravel, 10% cobble, 8% stick/wood, 5% silt, 3% CPOM, 2% boulder and 2% clay. Habitat quality was assessed to be in "good" condition, primarily influenced by the lack of in-stream habitat, increased sediment deposition and instability of the banks. The macroinvertebrate community was evaluated to be in "fair" condition. The IBI assessment indicated the fish community health to be in "fair" condition. Water quality measurements did not indicate impairment.

The other site sampled on Chewacla Creek (CHWT-1) was located approximately 8.4 miles downstream in the park. This site drained an area of 45.1 mi^2 and had riffle/run habitat that was evaluated to be "excellent". The substrate was comprised of relatively equal percentages of boulder, gravel, sand

Figure 5
Chewacla Creek Subwatershed Landuse
Chewacla State Park
3150110050





and silt. The estimate of 20% silt may be attributed to the quarry located <0.25 miles upstream. With an EPT taxa index of 6, the macroinvertebrate community was in "fair" condition. The fish community was evaluated to be in "poor/fair" condition. During the spring, summer and fall, water chemistry results indicated total dissolved solids and conductivity to be higher than the upstream site (CHWT-3). Nitrates/nitrites, ammonia and total Kjeldahl nitrogen were considerably higher than the upstream site during the spring and fall.

One site on Moores Mill Creek (MMLT-1a) was sampled outside the park and had a drainage area of 4.1 mi^2. This portion of the creek was characterized by riffle/run morphology and assessed to have "good" habitat. The sediment deposition (sand 72%) and limited in-stream habitat were similar to the downstream site. Five EPT taxa were collected rating the macroinvertebrate community health as "fair". IBI assessments suggested the fish community to be in "fair" condition. Nutrient enrichment was not indicated from the water chemistry assessments. It is apparent from assessments on these two sites on Moores Mill Creek and reconnaissance of the immediate watershed that sedimentation adversely impacts this creek. Fifteen of the 21 active construction/stormwater authorizations issued within the watershed were in the Moores Mill Creek drainage.

Another site sampled on Moores Mill Creek (MMLT-1c) was approximately 3.6 miles downstream of MMLT-1a, just upstream of Chewacla Lake in the park. This site was characterized by glide/pool morphology. Habitat quality was evaluated as only "good" due to heavy sediment deposition and <10% in-stream stable habitat. The substrate was approximately 81% sand and the majority of the pools were small and shallow. The park superintendent indicated this creek to be the source of a sedimentation problem in Chewacla Lake (J. Shivers, pers. comm. 1998). Biological assessments of the macroinvertebrate community indicated it to be in "poor" condition with 3 EPT taxa. The fish community was rated as "fair". Water chemistry results did not indicate any impairment.

Nash Creek (NAST-1) was sampled just upstream of the confluence with Chewacla Creek. The substrate of this site was comprised primarily of 40%

boulder and 20% cobble. The habitat assessment indicated that habitat quality was “excellent”. The macroinvertebrate community was evaluated as “good” with 18 EPT taxa. Biological assessments of the fish community rated it as “poor” to “fair”. Fecal coliform bacteria were elevated (>1120 colonies/100ml) during the spring. ADEM’s Fish and Wildlife water quality standard is a geometric mean of 1,000 colonies /100 ml on a monthly average and 200 colonies /100 ml June through September for incidental water contact and recreation. The frequency of sampling was inadequate to calculate a geometric mean and to determine if Nash Creek was in violation of these standards. Possible sources for the elevated fecal coliform bacteria levels were not evident. Other water quality measurements did not indicate impairment.

The drainage area of the location on Robinson Creek (ROBT-1) is 5.6 mi^2 and is about a half-mile upstream of the confluence with Chewacla Creek. Habitat quality was “good”. Sediment deposition was moderate with an estimated 50% of the substrate affected. Macroinvertebrate community health was evaluated as “good” with 12 EPT taxa collected. Assessments of the fish community indicated “good” condition. Water quality measurements did not indicate impairment. Preliminary reconnaissance work noted that the land use on these watersheds was generally forest and residential.

Hurricane Creek (HCR-1), located in Randolph County, was used as a reference site for the Piedmont (65d) ecoregion. The NRCS sub-watershed for Hurricane Creek (03150109-060) has a drainage area of 48.1 mi^2. Land use was estimated to be primarily deciduous (43.3%), mixed (29.8%) and evergreen (19.6%) forests. Habitat quality was evaluated as only “good” due to sediment deposition and lower in-stream habitat, which was similar to 3 of the 6 sites sampled near Chewacla. Twenty EPT taxa were collected indicating the macroinvertebrate community was in “excellent” condition. The fish community was evaluated to be in “fair/good” condition. Fecal coliform bacteria levels were elevated (600 colonies/100 ml) during the fall as compared to the spring and summer, which was likely due to a recent rain event and increase of stream discharge. Other water quality results did not provide any indication of

impairment. The fact that habitat and biological health of these reference site communities is for the most part better than the sites in the Chewacla Creek watershed further illustrates the impact of residential, commercial and industrial development on the Chewacla Creek watershed.

Claude D. Kelley State Park

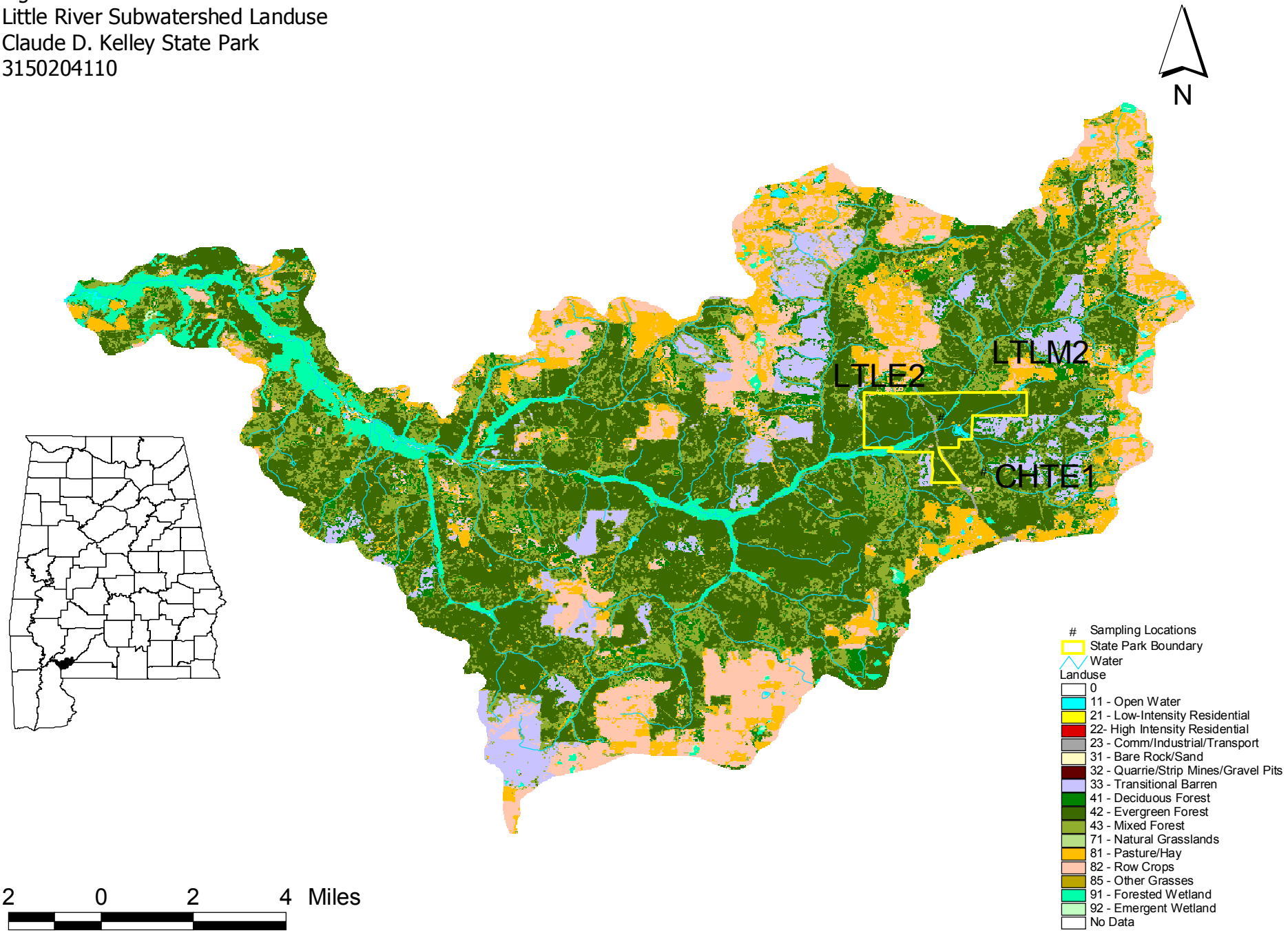
This 960-acre park is located north of Atmore, Alabama in Escambia and Monroe Counties. This park is in the Alabama River basin and Southern Pine Plains and Hills ecoregion. In addition to camping, there is a 25-acre lake that provides fishing and swimming.

Claude D. Kelley is in the Little River sub-watershed (03150204-110), which has a drainage area of 148.1 mi^2. Land use (Figure 6) consisted of primarily evergreen forest (38%), mixed forest (19.6%), row crops (13%) and pasture/hay (10.5%). Reconnaissance of the immediate watershed discovered row crops and silviculture to be the primary land use activity. One stormwater authorization and one NPDES mining permit were active in the watershed. Three sites in and around the park along with two ecoregional reference sites were assessed using aquatic macroinvertebrates and water chemistry. The elevated water level resulting from Hurricane Georges prohibited biological assessments of the fish community for the sites associated with this park.

A site on Little River (LTLE-2) was the only location sampled in the park. According to the park superintendent, an oil well was being installed less than 0.25 mi upstream of this site. The site was characterized by glide/pool morphology and the habitat quality was assessed as only "good" due to the lack of in-stream habitat and unstable stream banks. The substrate consisted of primarily sand (82%). The macroinvertebrate community was evaluated to be in "good" condition with 17 EPT taxa collected. Fecal coliform bacteria (>650 colonies/100 ml) and biochemical oxygen demand (2.8 mg/L) levels were higher in the summer than in other seasons. However, on the day samples were collected in the summer, stream discharge was unusually high from heavy rainfall the previous day.

The second site sampled on Little River (LTLM-2) was approximately 1.3 miles upstream in Monroe County north of the park. This site was also characterized by glide/pool morphology and had very similar in-stream habitat and substrate. The habitat and macroinvertebrate assessments rated both the

Figure 6
Little River Subwatershed Landuse
Claude D. Kelley State Park
3150204110



habitat quality and the macroinvertebrate community condition as “good”. Water quality assessments indicated higher fecal coliform bacteria (400 colonies/100 ml) and biochemical oxygen demand levels (2.8 mg/L) during the summer after the heavy rainfall. Values measured for pH were low (5.2 to 5.7 s.u.) for this site as well as the other site (LTLE-2) on Little River. This is fairly typical for South Alabama tannic water, low alkaline streams. Otherwise, water quality assessments did not reveal any evidence of impairment.

Chitterling Creek (CHTE-1), a tributary to Little River Lake located in the park, was sampled upstream of the park boundary. Habitat quality was estimated to be only “good” due to the lack of in-stream habitat and unstable banks. Fourteen EPT taxa were collected indicating the macroinvertebrate community to be in “good” condition. Values measured for pH were also low (4.9 to 5.6 s.u.) during the study. Other water quality assessments did not indicate any impairment.

Bear and Halls Creeks were used as reference streams for the Southern Pine Plains and Hills ecoregion (65f). Bear Creek is in the Blackwater River sub-watershed (03140104-010) and has a drainage area of 121.9 mi^2. Percent land use was estimated to be primarily evergreen (67.4%) and mixed (14.7%) forests. Bear Creek at BRE-1 in Escambia County has a drainage area of 27 mi^2 and was assessed to have “good” habitat and macroinvertebrate community condition. However, the total number of EPT taxa collected was lower than the sites in the Little River sub-watershed. The substrate was primarily sand (85%); thus; in-stream stable habitat was sparse. The values for pH ranged from 5.1 s.u. in the spring to 4.1 s.u. in the fall, which are typical for this type stream. Other water quality values gave no indication of impairment.

Halls Creek, located in Baldwin County is in the Upper Tensaw sub-watershed (03160204-010), which has a drainage area of 244.8 mi^2. Percent land use was estimated to be primarily woody wetland (35.5%), evergreen (34.1%) and mixed (14.4%) forests. Halls Creek at HLB-1 drains 19 mi^2. The habitat quality was impaired primarily by lack of in-stream habitat and poor bank stability resulting in an assessment rating of only “good”. Substrate composition

was primarily sand (72%). The macroinvertebrate community was evaluated to be in “fair” condition with only 8 EPT taxa collected, which was considerably less than the number of taxa collected from the Little River and Chitterling Creek sites. The reason for the low number of EPT taxa is not clear from data collected in this study. The unusually high flows during the summer yielded elevated BOD (5.4 mg/L) and fecal coliform bacteria (260 colonies/100ml) as compared to the spring and fall sampling events.

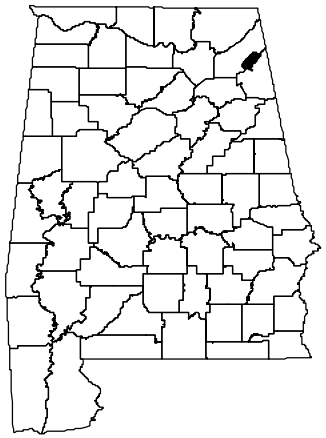
DeSoto State Park

DeSoto State Park is 3 miles east of Fort Payne, Alabama in Dekalb County. The 5,067-acre park ranges along the Little River in the Southwestern Appalachians ecoregion in the Coosa River drainage basin. Hiking, fishing, camping and swimming are just a few of the activities available at the park. The park is in the Bear Creek (03150105-110) and West Fork of the Little River (03150105-080) sub-watersheds.

Hurricane Creek (HURD-1) was sampled at a point outside of the park boundary. This site is in the Bear Creek sub-watershed (03150105-110), which has a drainage area of 79.7 mi^2. The primary land use activities (Figure 7) were estimated to be deciduous forest (35%), mixed forest (27%), evergreen forest (14.7%) and pasture/hay (12.8%). This creek was only flowing during the spring. The site was characterized by riffle/run morphology with substrate comprised of approximately 80% bedrock. Habitat quality was assessed as "excellent". Eleven EPT taxa were collected evaluating the condition of macroinvertebrate community as "fair". Water chemistry assessments did not indicate impairment.

Straight Creek (STRD-1) was sampled at a site within the park boundary. This site as well as the two sites on the West Fork of the Little River is in the sub-watershed of the West Fork of Little River (03150105-080). The estimated land use (Figure 8) of the 29 mi^2 sub-watershed was similar to the Bear Creek sub-watershed with mixed (37.4%), deciduous (31.9%) and evergreen (19%) forests. This creek was not flowing when visited in the fall. Habitat quality was evaluated to be "excellent". The substrate composition was 47% sand, 20% boulder, 15% silt, 10% cobble, 5% sand, 1% gravel, 1% wood and 1% CPOM. The macroinvertebrate community was assessed to be in "fair" condition with 5 EPT taxa collected. Total Kjeldahl nitrogen (1.4 mg/L), which includes organic nitrogen, was considerably higher during the summer than the values measured during the spring (<0.15 mg/L). Biochemical oxygen demand (1.1 mg/L) was also higher in the summer.

Figure 7
Bear Creek Subwatershed Landuse
Desoto State Park
3150105110



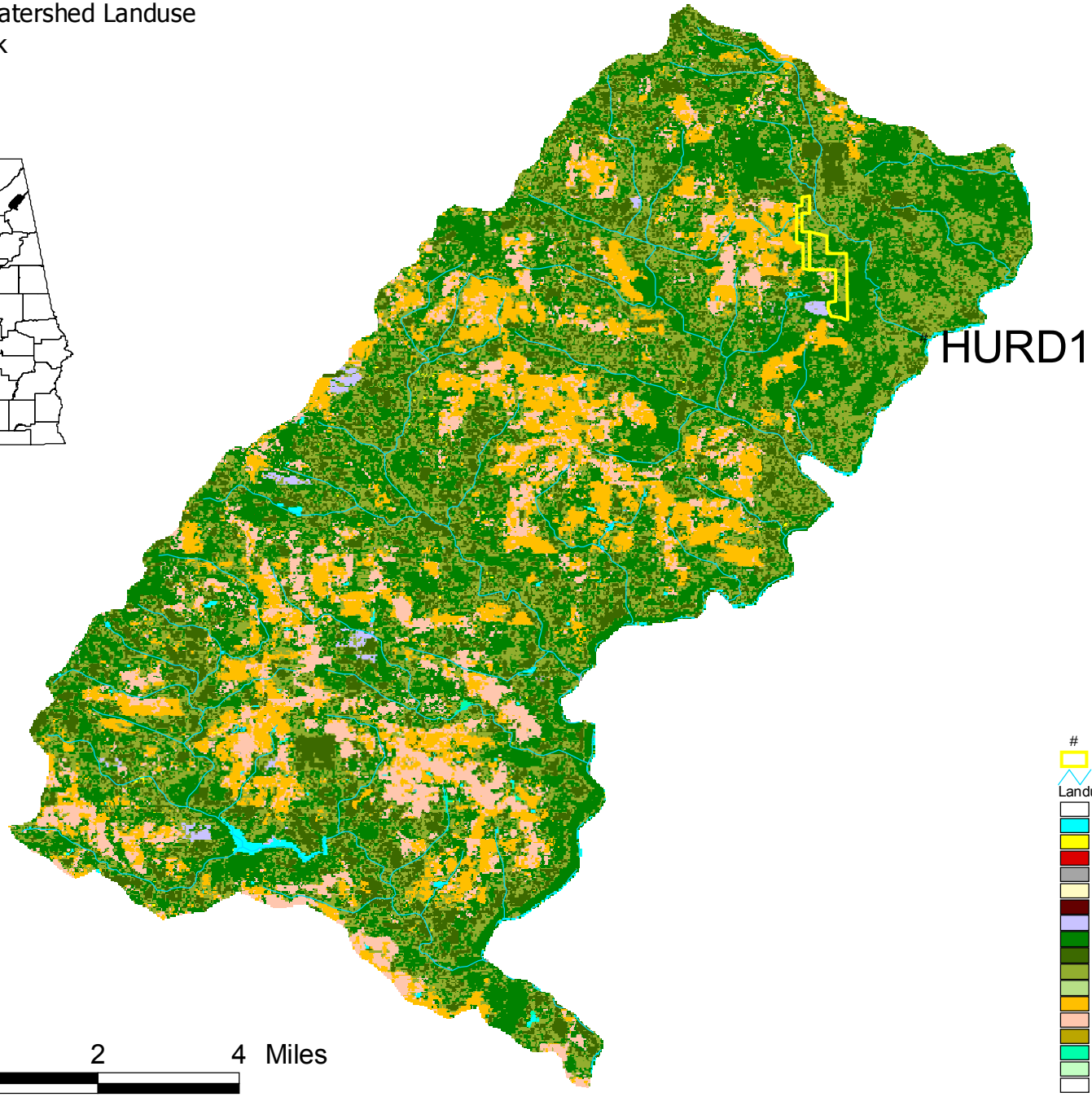
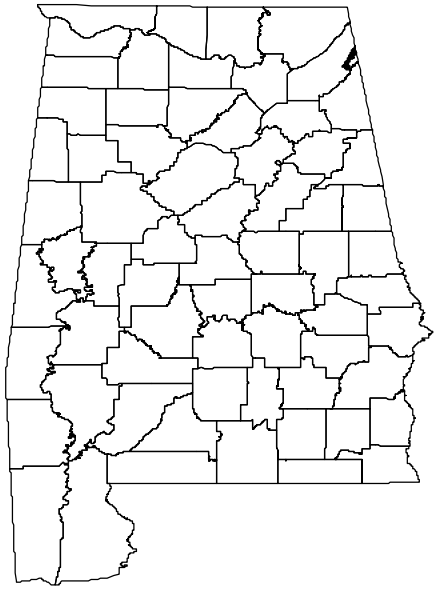
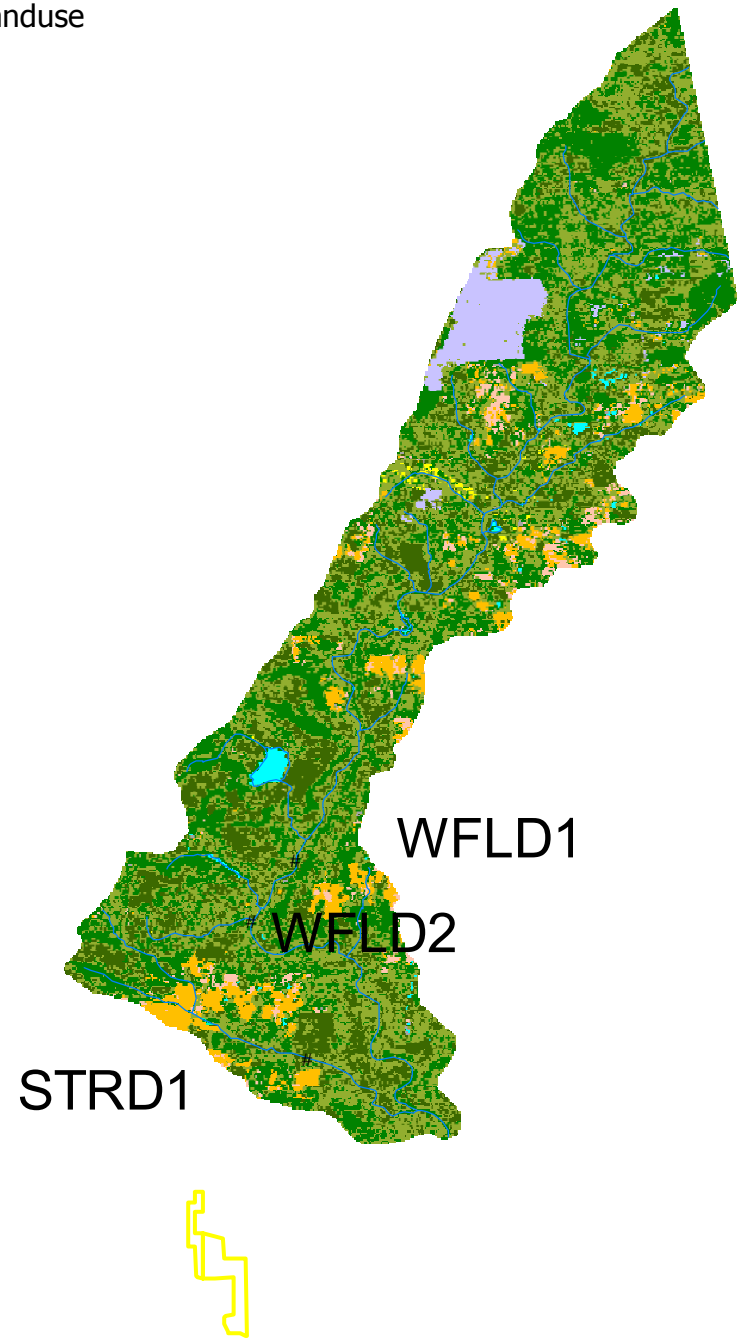


Figure 8
West Fork Little River Subwatershed Landuse
Desoto State Park
3150105080





An unwadeable site on the West Fork of the Little River (WFLD-1) was sampled north of the park boundary. Water chemistry was assessed once during the spring and did not indicate any impairment.

Another site assessed on the West Fork (WFLD-2) was 0.7 miles downstream of WFLD-1. The morphology of this location was riffle/run. The habitat assessment resulted in a score 98% of the maximum possible for an "excellent" rating. Substrate composition was primarily 40% bedrock, 30% boulder and 24% cobble. Assessments suggested the macroinvertebrate community to be in "good" condition with 14 EPT taxa collected. Water quality assessments did not suggest any impairment.

Little Canoe Creek (LCNE-1), in Etowah County was used as a reference site. This site is in the sub-watershed named Little Canoe Creek, which has a drainage area of 32 mi^2. Estimated land use was primarily deciduous forest (51.1%), mixed forest (22.4%), evergreen forest (11.4%) and pasture/hay (10.6%). Habitat quality was assessed as "good" due to lower scores for bank stability, riparian zone width and sediment deposition. Fifteen EPT taxa were collected indicating the macroinvertebrate community to be in "good" condition. The macroinvertebrate community was assessed to be in better condition than the communities at the Hurricane and Straight Creek sites. Total dissolved solids and conductance levels were higher than those measured at the West Fork, Straight Creek and Hurricane Creek sites.

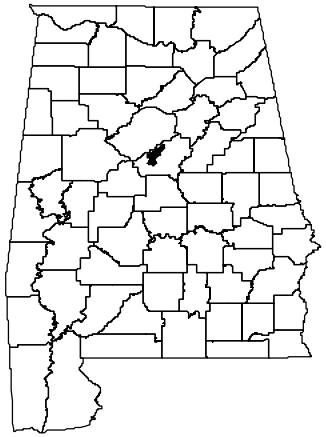
Oak Mountain State Park

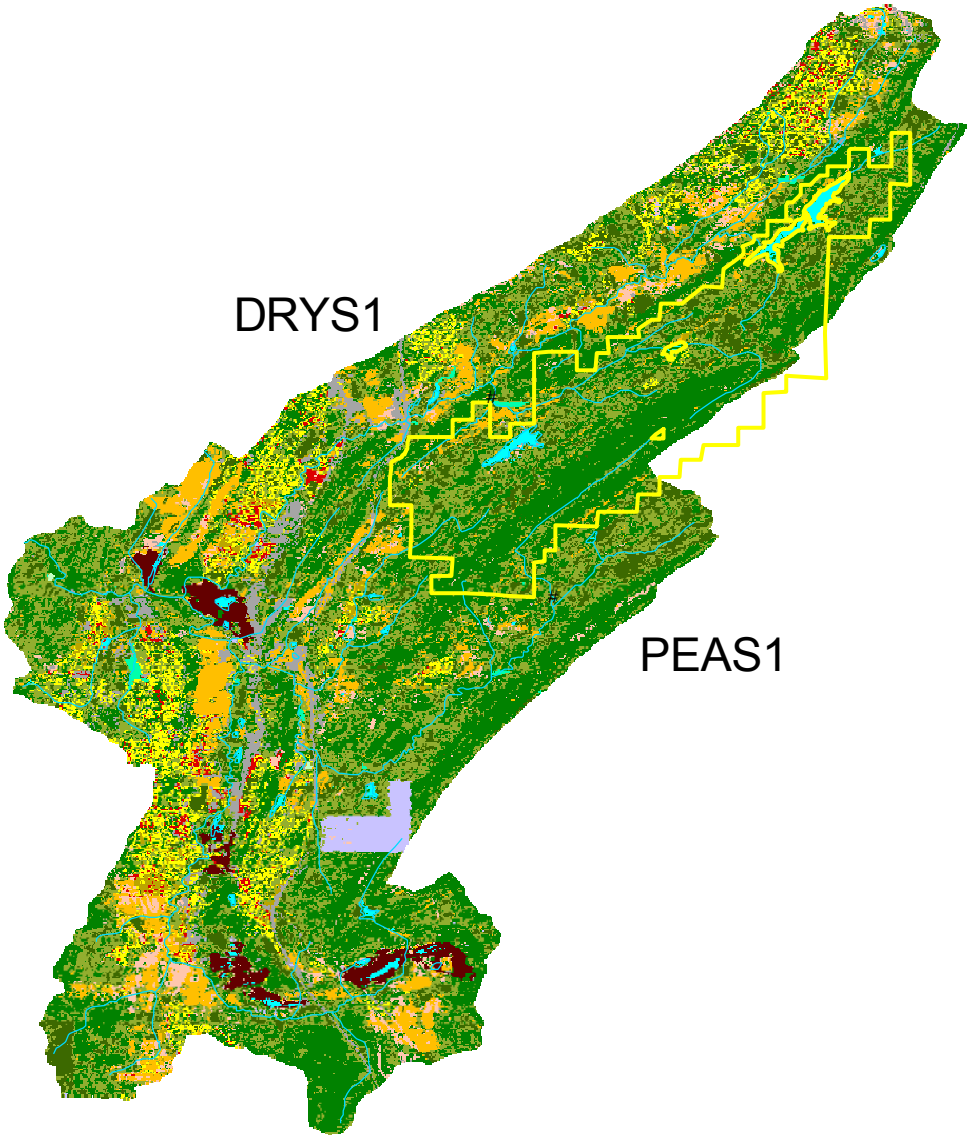
Oak Mountain State Park is located 15 miles south of Birmingham, Alabama in Shelby County. This 9,940-acre park is primarily a day use park with opportunities for biking, hiking, swimming, camping and fishing. The park is in the Cahaba River basin and Southwestern Appalachians ecoregion. Oak Mountain Park is in the Cahaba Valley Creek sub-watershed (03150202-040), which has a drainage area of 72.9 mi^2. Percent land use (Figure 9) was estimated to be primarily deciduous forest (36.2%), mixed forest (27.1%), evergreen forest (11.4%), pasture/hay (7.7%) and residential (6.4%). Reconnaissance of the immediate watersheds of the sites sampled observed residential and forests to be the primary land use activities. The State Park's golf course is just upstream of the Dry Brook sampling site.

Dry Brook (DRYS-1) originates on Oak Mountain inside the park but was sampled just outside the park boundary. This site has a drainage area of 6.3 mi^2 and was characterized by riffle/run morphology. Habitat quality was assessed as "good" due to decreased bank stability and limited riparian zone. The substrate was composed of primarily gravel (39%), cobble (39%) and boulder (10%). Eighteen EPT taxa were collected during biological assessments of the macroinvertebrate community indicating "good" condition. In contrast the fish community was assessed to be in "poor" condition with an IBI score of 32. The low IBI score can be primarily attributed to absence of insectivorous cyprinids. The abundance of this group of fish generally declines with increasing environmental stress; however, habitat quality, food availability and water quality data collected during the study did not indicate any reasons for the absences of insectivorous cyprinids. Dissolved oxygen (4.8 mg/L) was lower than the Fish and Wildlife water quality standard of 5.0 mg/L during the summer. Water quality assessments did not suggest any other impairment.

Peavine Branch (PEAS-1) also originates inside the boundaries of Oak Mountain State Park. This location drains an area of 1.5 mi^2. The reduced in-stream habitat and bank stability were the causes of impairment to habitat quality and the assessment rating of only "good". Cobble (40%) and gravel (40%) were

Figure 9
Cahaba Valley Creek Subwatershed Landuse
Oak Mountain State Park
3150202040





N

1 0 1 2 Miles

Sampling Locations
State Park Boundary
Water
Landuse
0
11 - Open Water
21 - Low-Intensity Residential
22- High Intensity Residential
23 - Comm/Industrial/Transport
31 - Bare Rock/Sand
32 - Quarrie/Strip Mines/Gravel Pits
33 - Transitional Barren
41 - Deciduous Forest
42 - Evergreen Forest
43 - Mixed Forest
71 - Natural Grasslands
81 - Pasture/Hay
82 - Row Crops
85 - Other Grasses
91 - Forested Wetland
92 - Emergent Wetland
No Data

the primary components of the substrate. The macroinvertebrate community was determined to be in "good" condition with 16 EPT taxa present. Fish assessments were not made at this location due to the small size of the stream and potential for discontinuance of stream flow during the summer. Fecal coliform bacteria levels (>1050 colonies/100 ml) in the summer were considerably higher than those observed in the spring (30 colonies/100 ml). Sources for the elevated fecal coliform bacteria levels were not evident. Water quality assessments were not made during the fall due to inadequate flow.

Weogufka Creek at WGFC-1 in Coosa County drains 13 mi^2 and was used as an ecoregional reference site. This location is in the sub-watershed of Weogufka Creek, which has a drainage area of 128.6 mi^2. The land use was estimated as primarily deciduous forest (39.7%), mixed forest (29.5%), evergreen forest (18.6%) and pasture/hay (6.7%). There were two current stormwater/ construction authorizations issued in the watershed. The habitat quality was assessed to be only "good" due to sediment deposition, decreased bank stability and in-stream habitat. The reach had a substrate composed of mostly sand (50%) and gravel (40%) with riffle/run morphology. The macroinvertebrate community was in "excellent" condition with 20 EPT taxa. An IBI assessment score of 42 indicated the fish community was in "fair" condition. Fecal coliform bacteria levels were higher in the spring (420 colonies /100 ml) and summer (570 colonies/100ml) as compared to the fall (83 colonies/100ml). Other water analyzes did not suggest any impairment.

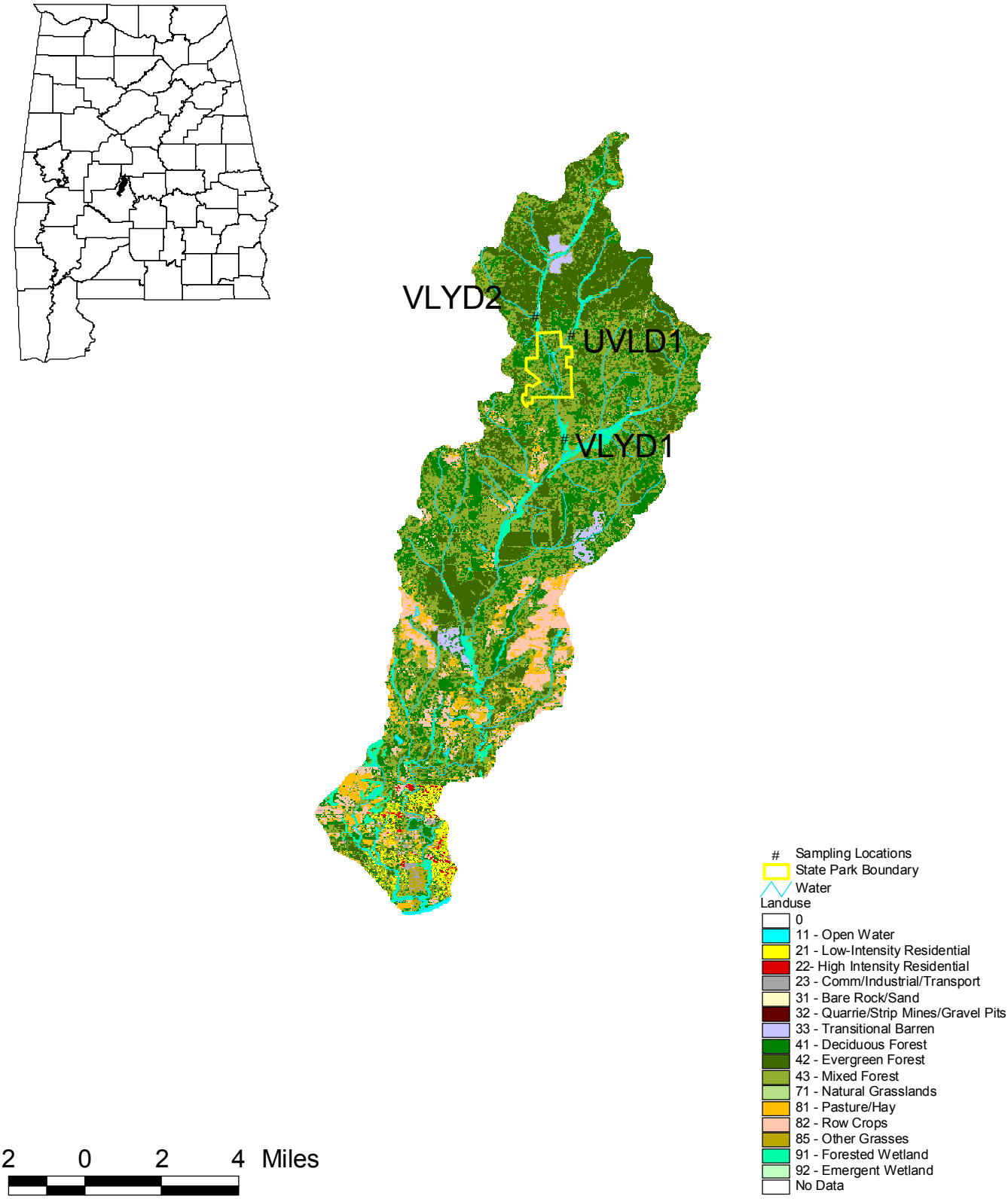
Paul M. Grist State Park

Paul M. Grist State Park is located 15 miles north of Selma, Alabama in Dallas County. The 1,080-acre park provides visitors with opportunities for camping, fishing, swimming and other recreational activities. The park lies within the Alabama River basin and the Fall Line Hills (65i) subregion of the Southeastern Plains ecoregion. The State Park is in the Valley Creek sub-watershed (03150201-250), which drains 67.4 mi^2. Percent land use (Figure 10) was estimated to be primarily mixed (34.2%), evergreen (23%) and deciduous (22.3%) forests. Reconnaissance of the immediate watershed of the study sites observed silviculture to be the primary land use activity.

A 100-acre impoundment on Valley Creek forms Valley Creek Lake inside the park. One sampling site was located 1.5 miles downstream of the lake on Valley Creek (VLYD-1). The morphology of this site was glide/pool. Habitat quality was evaluated as "good", but; impaired by sediment deposition and decreased in-stream habitat. Substrate composition consisted of primarily sand (82%) and silt (10%). Biological assessments of the macroinvertebrate community found only 8 EPT taxa for a "fair" rating. The fish community was evaluated to be in "fair" condition with an IBI score of 43. Fecal coliform bacteria levels (>1050 colonies /100ml) were higher during the summer as compared to the spring (87 colonies /100ml) and fall (160 colonies /100ml). Biochemical oxygen demand (4.4 mg/L) and total Kjeldahl nitrogen (0.7 mg/L) levels were also higher during the summer. These elevated values corresponded to heavy rainfall that occurred prior to and during the summer sampling event. Reconnaissance efforts revealed evidence of recent and historical silviculture activities in the watershed upstream of Valley Creek Lake.

Approximately 1.0 mile upstream of Valley Creek Lake was a second monitoring site on Valley Creek (VLYD-2). This location was immediately below the dam of a small impoundment. An impoundment can act as a catch basin altering stream flow and water chemistry, which in turn affects the habitat quality and biological communities immediately below the dam. For these reasons this

Figure 10
Valley Creek Subwatershed Landuse
Paul M. Grist State Park
3150201250



site was considered inappropriate for performing habitat or biological assessments. Water chemistry data was collected only during the spring and values were very similar to the downstream site (VLYD-1).

An unnamed tributary (UVLD-1) at the north end of Valley Creek Lake was sampled outside of the park. This site drained a very small area of 0.3 mi^2. Habitat quality was evaluated to be "good". However, decreased in-stream habitat was the primary source of habitat impairment, with stable habitat assessed as less than 30%. Substrate composition was primarily sand (40%) and clay (40%). Six EPT taxa were collected suggesting the macroinvertebrate community was in "fair" condition. During the summer, biochemical oxygen demand (2.7 mg/L) and fecal coliform bacteria was elevated (>630 colonies/ 100mL) as was observed at other stations on Valley Creek during the spring and summer. The higher values during the summer sampling event could also be attributed to increased flow, which was a result of the runoff from a recent rainfall.

South Sandy Creek (SSB-1)(21 mi^2), located in Bibb County, was used as a reference site for the Fall Line Hills subecoregion. This creek is in the Big Sandy Creek sub-watershed (03160113-030), which has a drainage area of 174.9 mi^2. Estimated percent land use was primarily mixed (37.2%), deciduous (31.4%) and evergreen (21%) forests. As with the sites (VLYD-1 and UVLD-1) associated with Paul M. Grist, the glide/pool habitat was evaluated to be "good" primarily due to decreased in-stream habitat. The substrate was composed of primarily sand (93%). The macroinvertebrate community was assessed to be in "good" condition with 13 EPT taxa present. The fish community was evaluated to be "fair/good" with an IBI score of 46. Biochemical oxygen demand and fecal coliform bacteria were elevated during the spring and summer.

Swift Creek (SWFC-1)(25 mi^2) located in Chilton County was also used as a reference site. This site is in the Swift Creek sub-watershed (03150201-150), which has a drainage area of 161.3 mi^2. The land use was estimated as primarily mixed forest (26%), deciduous forest (23%), evergreen forest (17.7%), row crops (13.8%) and pasture/hay (7.3%). It was determined that this site may not serve

as a adequate comparison to the other sites on Valley Creek due to the higher discharge measured during the spring. Therefore, this location was not sampled during the summer and fall. The habitat quality was assessed to be “good”, due to sediment deposition and decreased in-stream habitat. The substrate consisted of primarily sand (62%) and gravel (20%). There were 15 EPT taxa collected suggesting the macroinvertebrate community to be in “good” condition. Water chemistry data did not indicate any impairment.

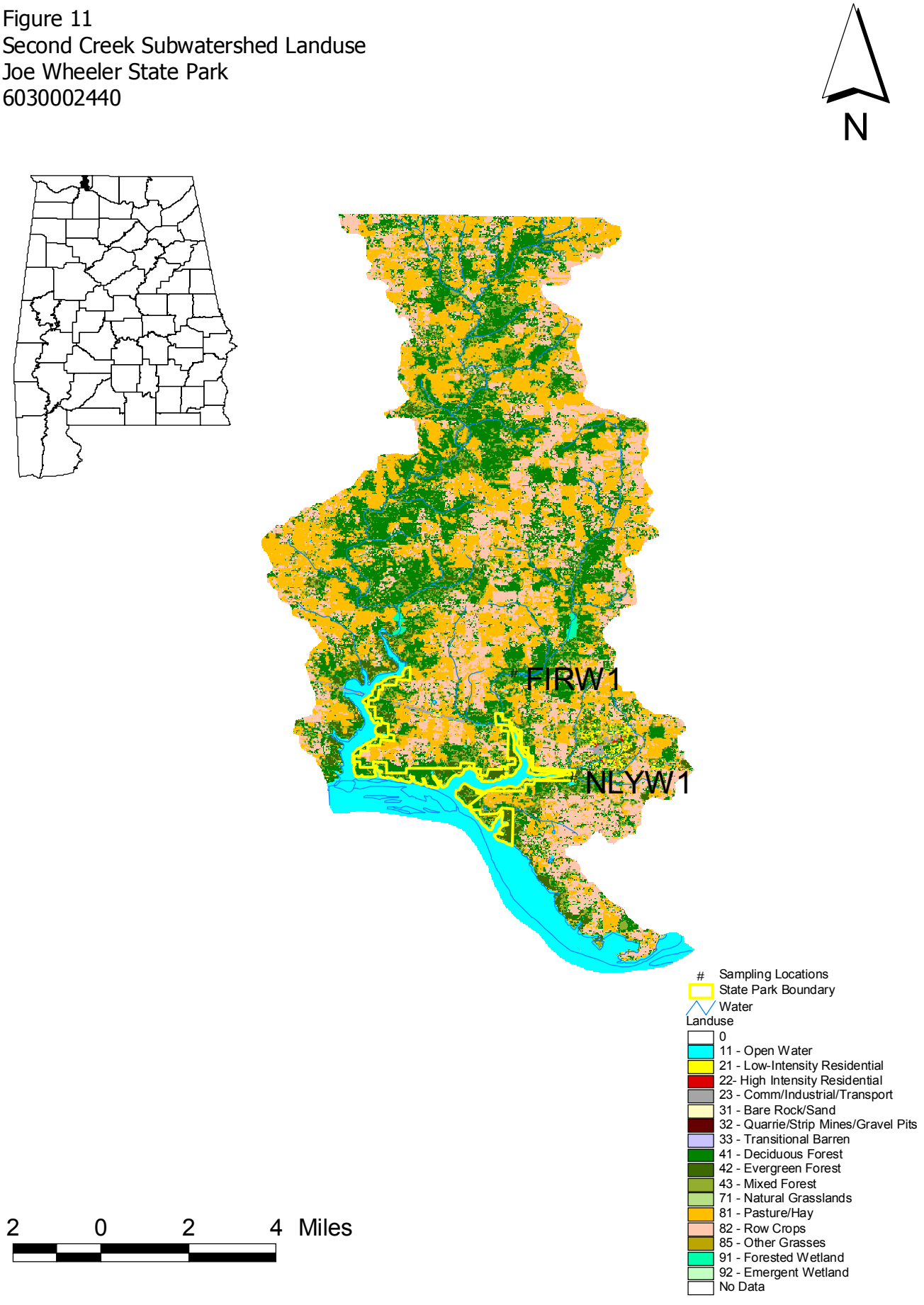
Joe Wheeler State Park

Joe Wheeler State Park is located in Lauderdale County, near Rogersville, Alabama. The park is 2,550 acres and offers opportunities for golfing, fishing, camping and swimming. The Tennessee River flows through the park, which is in the Interior Plateau ecoregion. The majority of Joe Wheeler State Park is in the Second Creek sub-watershed (06030002-440) with a drainage area of 79.9 mi^2. Estimated percent land use (Figure 11) consisted of primarily deciduous forest (28.6%), pasture/hay (28.5%) and row crops (21.6%). Reconnaissance also revealed pasture/hay and row crops to be the preferred land use in the immediate watershed.

Neely Branch (NLYW-1), a tributary to First Creek, was sampled at a point inside the park boundaries. The morphology of Neely Branch was riffle/run with a substrate composed of primarily bedrock (70%) and boulder (20%). The habitat quality was evaluated as only "good" due to insufficient in-stream habitat and fair bank stability. Only six EPT taxa were found suggesting the macroinvertebrate community to be in "poor" condition. Biochemical oxygen demand, nitrates/nitrites, total suspended solids and fecal coliform bacteria levels were elevated at various times during the sampling events. These numbers could be the result of the urban and residential influence on the watershed.

First Creek (FIRW-1) was sampled approximately 3.0 miles upstream of the confluence with the Tennessee River. The habitat of the riffle/run creek was assessed to be "excellent". The substrate was primarily sand (65%) and gravel (20%). The macroinvertebrate community was assessed to be in "fair" condition with 10 EPT taxa present. Biochemical oxygen demand (3.0 mg/L) was higher in the spring. Fecal coliform bacteria levels (270 colonies/100ml) were higher in the summer as was the flow (7.1 cfs). Nitrate/nitrite and total phosphorus levels were higher than levels measured at the ecoregional reference site (INCL-1). Reconnaissance revealed the watershed to be primarily open fields and pasture with cows, cotton and other row crops, all of which could be responsible for the higher nitrate/nitrite and total phosphorus levels.

Figure 11
Second Creek Subwatershed Landuse
Joe Wheeler State Park
6030002440



Indian Camp Creek (INCL-1) located in Lauderdale County was used as the ecoregion reference site. This creek is located in the Upper Shoal Creek sub-watershed (06030005-090), which has a drainage area of 30.2 mi^2. The land use was estimated to be primarily deciduous forest (59.8%), pasture/hay (16.9%) and mixed forest (11.5%). The habitat quality was evaluated to be "excellent" with the substrate composed primarily of gravel (42%), cobble (30%) and bedrock (24%). Biological assessments of the macroinvertebrate community documented the presence of 23 EPT taxa, which was 2 to 4 times the number of taxa found at the Neely Branch and First Creek sites, indicating "excellent" condition. Total suspended solids, biochemical oxygen demand and fecal coliform bacteria levels were elevated at various times during the sampling periods.

SUMMARY

State Parks are a valuable resource to the people of Alabama, providing opportunities for a variety of activities statewide. As the land use of the watersheds associated with these Parks changes, it is critical that alterations that may adversely impact water quality be screened and monitored closely. This study provided background information for ADEM on the watersheds in and around some of Alabama's State Parks. The habitat, biological and water quality assessments should provide the Department a baseline for future studies or management decisions on permit requests and assist other government agencies having regulatory and/or review authority related to development in these watersheds. Eight of the study sites were determined to be of adequate quality that the associated segments should be considered for water use classification upgrade. These eight stream segments (CHE-1, CHEC-3, ROBT-1, CHTE-1, LTLE-2, LTLM-2, WFLD-2, PEAS-1) and Blue Springs (BSPB-1)(spring itself) are located within the boundaries or watersheds of State Parks and exhibited characteristics that warrant further evaluation using ADEM's screening process for determining Outstanding Alabama Water Candidate Segments (Table 6).

Table 6. Summary of assessments conducted for the State Parks Study.

Stream	Station	Habitat Assessment Category	Macroinvertebrate Assessment Category	Fish Assessment Category
			Bucks Pocket	
Kirby Creek	KIRD-1	Excellent	Fair	Very Poor
South Sauty Creek	SSCD-1	Excellent	Good	Very Poor
Straight Creek	STGD-1	Excellent	Good	Poor
Stringer Creek	STND-1	Excellent	Fair	Poor
			Cheaha	
Cheaha Creek	CHE-1	Excellent	Excellent	Fair-Good
Cheaha Creek	CHEC-3	Excellent	Excellent	Poor-Fair
			Chewacla	
Chewacla Creek	CHWT-1	Excellent	Fair	Poor-Fair
Chewacla Creek	CHWT-3	Good	Fair	Fair
Moores Mill Creek	MMLT-1a	Good	Fair	Fair
Moores Mill Creek	MMLT-1c	Good	Poor	Fair
Nash Creek	NAST-1	Excellent	Good	Poor-Fair
Robinson Creek	ROBT-1	Good	Good	Good
			Claude D. Kelly	
Chitterling Creek	CHTE-1	Good	Good	-------
Little River	LTLE-2	Good	Good	-------
Little River	LTLM-2	Good	Good	-------
			DeSoto	
Hurricane Creek	HURD-1	Excellent	Fair	-------
Straight Creek	STRD-1	Excellent	Fair	-------
West Fork Little River	WFLD-2	Excellent	Good	-------
			Oak Mountain	
Dry Brook	DRYS-1	Good	Good	Poor
Peavine Branch	PEAS-1	Good	Good	-------
			Paul M. Grist	
Valley Creek	VLYD-1	Good	Fair	Fair
Unnamed trib to Valley Cr	UVLD-1	Good	Fair	-------
			Joe Wheeler	
Neely Branch	NLYW-1	Good	Poor	-------
First Creek	FIRW-1	Excellent	Fair	-------

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APPENDIX

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Blue Springs																		
BSPB-1																		
	980521	19.4	6.6	242	7.6	0.5	4.7	1	134	0.2	117	115.6	1	0.02	0.920	<0.015	<0.15	4.39
	980701	22	7.3	228	5.3	2.5	5.1	4	68	0.5	29	33.8	13	0.014	0.360	<0.015	<0.15	
	981006	19.1	7.2	237	4.7	0.6	8.6	<1	82	0.3	112	120.0	<1	0.03	0.950	<0.015	<0.15	4.94
WCHB-1																		
	980521	23.5	7.3	68	6.5	14.0		8	57	1.8	25	28.4	70	0.01	0.350	<0.015	<0.15	4.83
	980701	28	7.0	89	6.4	11.0		1	156	1.6	114	115.0	80	0.03	1.010	<0.015	<0.15	
	981006	23.2	6.8	59	5.9	10.2		6	13	0.3	45	25.7	123	0.02	<0.15	<0.015	0.60	5.90
WCHB-2																		
	980521	22.8	6.5	85	6.7	12.7	69.6	8	59	0.2	28	36.2	100	0.01	0.390	<0.015	<0.15	4.65
	980701	26	7.0	122	6.3	9.4	38.5	2	92				50					
	981006	22.9	6.6	72	6.0	9.6		8	26	0.4	31	32.3	98.5	0.02	0.195	<0.015	0.39	5.84
Bucks Pocket																		
KIRD-1																		
	980519	19.3	7.7	26	8.8	4.1	13.6	2	51	1.3	6	22.6	48	0.005	1.060	<0.015	<0.15	5.15
	980706	30.8	7.3	82	8.6		0.2	6	74	2.0	25	30.4	163	0.02	<0.003	<0.015	0.43	5.77
SSCD-1																		
	980519	18.6	8.0	91	11.0	2.5	22.8	1	59	0.6	10	24.2	42	0.02	1.180	<0.015	<0.15	5.25
	980707	23.5	7.3	195	6.8		3.4	3	135	0.8	31	35.7	23	0.06	0.570	<0.015	0.65	29.44
	980923					1.3	0.2	2	723	1.1	154	83.8	5	0.056	0.025	<0.015	0.78	305.95

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Bucks Pocket																		
STGD-1																		
	980519	19.1	8.1	61	13.9	3.0	9.3	1	50	0.5	1	19.4	49	0.007	1.190	<0.015	<0.15	5.52
	980707	22.3	7.3	80	7.6		0.8	3	70	1.2	14	28.7	90	<0.004	0.360	<0.015	<0.15	6.25
STND-1																		
	980519	19.3	7.9	58	11.2	4.6	8.6	1	52	0.8	4	20.8	215	<0.004	1.400	<0.015	<0.15	5.32
	980706	23.3	6.6	68	4.9		0.2	7	77	1.4	20	23.6	77	0.04	0.120	<0.015	0.69	5.61
BYTJ-1																		
	980519	19.3	7.8	48	9.4	5.6	19.7	1	38	0.2	5	16.4	38	0.005	0.770	<0.015	<0.15	9.36
	980706	24.7	6.5	72	7.3		2.1	7	87	1.8	10	23.9	90	0.05	1.060	<0.015	0.48	6.94
Cheaha																		
CHE-1																		
	980512	17.5	5.9	25	9.3	2.1	11.2	1	26	0.6	6	5.6	11	<0.004	0.020	<0.015	<0.15	3.34
	980727	24	7.2	23	7.7	1.3	0.9	1	34	1.1	10	7.6	1	0.004	0.020	<0.015	<0.15	
	980901	23.1	6.7	30	7.4	1.7	0.2	1	31	0.1	20	9.6	3	0.04	0.030	<0.015	<0.15	4.30
CHEC-3																		
	980512	18	6.0	23	9.1	1.6	3.5	2	39	0.5	50	5.3	7	0.004	0.020	<0.015	<0.15	3.29
	980727	22.9	6.0	18	7.6	3.4	0.5	2	44	1.0	7	5.6	9	<0.004	0.070	<0.015	<0.15	
	980901	21.8	6.4	17	8.1	1.6	0.2	1	33	0.1	12	5.4	25	0.04	0.110	<0.015	<0.15	3.99
TCT-5																		
	980512	18	5.7	36	9.6	8.7	122.0	1	56	0.4	7	11.0	62	0.007	0.080	<0.015	<0.15	3.30
	980727	24.1	7.1	35	7.8	6.7	43.1	1	45	2.1	15	13.3	13	<0.004	0.060	<0.015	<0.15	
	980901	23.8	7.0	38	7.6	4.5	21.4	1	33	0.1	30	16.1	11	<0.004	0.070	<0.015	<0.15	4.02

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Chewacla																		
CHWT-1																		
	980513	22	7.6	186	9.0	12.8	22.3	4	134	0.1	69	76.5	17	<0.004	2.140	1.590	2.17	4.26
	980701	24.2	7.9	218	8.5	5.1	10.7	1	137	0.9	95	105.0	64	<0.004	0.590	<0.015	<0.15	4.32
	980902	22.1	7.9	360	9.3	1.9	1.8	<1	210	0.3	84	150.0	27	0.04	8.580	3.470	3.75	5.01
CHWT-3																		
	980513	22.5	6.6	86	7.4	20.0	5.1	10	60	1.0	35	30.0	270	0.02	0.060	<0.015	0.22	4.78
	980701	26.3	7.1	118	6.0	16.0	1.5	8	92	1.1	49	48.6	110	0.01	0.200	<0.015	<0.15	4.78
	980902	23.2	7.1	191	6.2	9.7	0.5	4	116	0.4	22	98.0	80	0.04	0.130	<0.015	<0.15	5.53
MMLT-1a																		
	980513	23	7.3	96	8.6	21.6	3.4	4	94	0.8	32	33.4	210	<0.004	0.280	<0.015	<0.15	4.67
	980701	26.8	7.5	116	8.5	11.0	0.6	2	80	1.0	45	46.7	150	<0.004	0.340	<0.015	<0.15	4.97
	980902	23.5	7.3	125	8.0	9.8	0.3	<1	80	0.6	120	50.6	11	0.04	0.180	<0.015	<0.15	5.59
MMLT-1c																		
	980513	19	6.8	101	8.6	18.0	7.2	6	88	0.2	30	35.7	195	<0.004	0.200	<0.015	<0.15	4.62
	980701	25.3	7.7	121	7.3	10.0	2.0	2	78	0.7	47	49.8	57	<0.004	0.180	<0.015	<0.15	4.67
	980902	23.3	7.1	128	7.1	7.3	0.7	<1	79	0.8	41	50.8	55	0.04	0.050	<0.015	<0.15	5.89
NAST-1																		
	980513	21	6.9	56	8.8	10.8	3.7	2	66	0.5	34	11.1	>1120	0.02	0.170	<0.015	<0.15	4.20
	980701	25.4	7.6	50	7.8	8.1	0.9	3	60	1.1	20	15.0	52	0.02	0.180	<0.015	<0.15	4.18
	980902	23.3	7.1	57	8.5	4.9	0.3	3	58	0.2	10	20.1	36	0.04	0.100	<0.015	<0.15	4.92

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Chewacla																		
ROBT-1																		
	980513	19	6.8	52	8.8	8.7	4.3	4	82	0.5	13	12.0	203	0.009	0.165	<0.015	<0.15	4.33
	980701	24.1	7.1	49	7.7	11.0	1.6	2	54	1.0	19	14.1	168	0.008	0.125	<0.015	<0.15	4.30
	980902	22.7	6.8	55	7.7	22.2	0.4	5	62	0.1	23	17.0	39	0.05	0.050	<0.015	<0.15	5.02
HCR-1																		
	980512	19.5	5.6	19	9.1	3.3	18.4	2	39	0.5	4	4.1	25	<0.004	0.050	<0.015	<0.15	3.26
	980629	22.3	6.5	13	7.8	2.3	7.2	2	25	1.1	23	<1	32	<0.004	0.070	<0.015	<0.15	3.24
	980901	21.4	6.3	19	9.0	57.1	9.6	16	40	0.9	10	5.9	600	0.051	0.230	<0.015	<0.15	3.86
Claude D. Kelly																		
CHTE-1																		
	980527	22.8	5.6	23	6.6	7.0	5.9	5	34	0.9	3	4.9	38.5	<0.004	0.400	<0.015	<0.15	5.60
	980714	23.5	5.2	30	6.1		8.0	6	47	1.1	10	6.1	173	0.006	0.200	<0.015	0.15	7.25
	981005	22.6	4.9	22	6.6	5.7	10.1	13	45	1.4	3	5.7	190	0.005	0.160	<0.015	<0.15	6.22
LTLE-2																		
	980527	21.9	5.7	22	7.0	8.5	14.5	5	34	0.8	3	5.3	32	<0.004	0.350	<0.015	0.23	5.36
	980714	23.8	4.8	24	5.8	10.0	66.3	24	58	2.8	5	5.5	>650	0.03	0.240	<0.015	0.57	4.81
	981005	22.9	5.2	22	7.0	9.0	44.9	11	50	0.9	6	6.1	160	0.01	0.170	<0.015	<0.15	6.05
LTLM-2																		
	980527	22.5	5.7	22	7.1	9.8	10.6	5	41	0.8	4	5.6	133	<0.004	0.310	<0.015	<0.15	5.60
	980714	23.7	5.2	24	6.4	10.5	36.2	20	53	2.8	9	5.7	400	0.02	0.240	<0.015	<0.15	1.32
	981005	22.8	5.3	23	7.1	9.6	44.3	17	14	0.9	4	6.2	140	0.01	0.160	<0.015	<0.15	6.19

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Claude D. Kelly																		
BRE-1																		
	980528	21.5	5.1	16	7.1	3.1	15.3	2	25	1.0	1	3.6	23	<0.004	0.420	<0.015	<0.15	4.28
	980714	23.9	4.6	19	6.9		35.3	46	2	1.0	7	4.7	188	0.005	0.210	<0.015	0.22	4.24
	981005	23.1	4.1	18	6.8	3.3	57.1	8	48	0.7	1	3.3	49	0.01	0.140	<0.015	<0.15	4.79
HLB-01																		
	980527	23.9	5.4	15	7.4	4.1	17.3	2	28	1.0	3	3.0	44	<0.004	0.100	<0.015	<0.15	4.37
	980714	24.7	4.5	16	7.2		84.2	40	40	5.4	5	3.5	260	0.004	0.070	<0.015	0.33	3.96
	981005	23.5	4.4	14	7.8	10.0	71.1	26	42	0.3	2	3.2	190	0.008	0.030	<0.015	<0.15	4.67
DeSoto																		
HURD-1																		
	980520	17.1	6.7	19	7.7	4.8	1.7	2	14	0.1	5	6.1	73	0.02	0.180	<0.015	<0.15	3.33
STRD-1																		
	980520	17.2	6.5	26	8.4	3.0	0.4	2	21	0.2	2	8.4	23	0.04	0.260	<0.015	<0.15	3.40
	980706	21	6.7	34	7.5		0.1	4	51	1.1	12	11.5	45	<0.004	0.240	<0.015	1.42	3.78
WFLD-1																		
	980520	21.3	7.3	16	8.8	1.7		1	6.50	0.2	1.0	5.7	9	<0.004	0.060	<0.015	<0.15	3.18
WFLD-2																		
	980520	20.7	7.0	15	8.3		17.0	1	6	0.4	2	5.6	18	<0.004	0.040	<0.015	<0.15	3.16
	980706	27.5	6.8	30	7.7		0.6	1	38	0.8	5	10.4	8	0.038	0.150	<0.015	<0.15	3.77
	980923				7.7	3.0	3.6	1	5	0.6	9	6.2	7	0.006	0.071	0.029	<0.15	3.94

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
DeSoto																		
LCNE-1																		
	980520	21.7	7.4	159	8.7	5.4	13.4	1	81	0.8	59	72.2	67	0.01	0.200	<0.015	<0.15	3.43
	980707	23.7	7.5	189	7.7		6.8	3	122	0.8	91	86.6	47	0.06	0.240	<0.015	<0.15	3.68
	980923				7.6	2.9	2.7	5	106	0.2	105	107.0	59	<0.004	0.112	0.040	<0.15	3.68
Oak Mountain																		
DRYS-1																		
	980514	22	6.1	66	6.3	10.1	2.7	5	56	0.9	18	21.9	67	0.007	0.090	<0.015	0.15	1.33
	980728	25.3	7.2	102	4.8	6.8	0.1	1	87	1.0	35	40.1	43	0.004	0.090	<0.015	<0.15	
	980909	24.5	7.4	38	7.4	15.1	16.8	17	35	0.8	17	12.9	140	<0.004	0.030	<0.015	<0.15	4.00
PEAS-1																		
	980514	19	5.2	23	8.9	3.6	0.5	3	35	0.6	2	3.9	30	0.008	0.010	<0.015	<0.15	1.32
	980728	23.6	7.0	14	7.1	4.5	0.1	2	40	0.6	9	3.9	>1050	<0.004	0.060	<0.015	<0.15	
WGFC-1																		
	980514	20	6.2	26	8.4	11.1	15.6	6	59	0.9	12	17.4	420	0.008	0.100	<0.015	<0.15	1.33
	980728	24.9	7.2	58	7.0	13.1	5.8	12	11	0.5	25	23.3	570	<0.004	0.150	<0.015	<0.15	
	980909	21.5	7.2	51	6.3	5.2	0.3	4	40	1.0	19	18.0	83	<0.004	0.090	<0.015	<0.15	4.31

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Paul M. Grist																		
VLYD-1																		
	980506	23	6.0	34	8.0	6.4	8.7	5	35	2.7	6	8.0	87	<0.004	0.040	<0.015	0.22	3.64
	980713	26.8	6.5	32	6.6	8.8	5.1	14	60	4.4	15	11.5	>1050	0.04	0.050	<0.015	0.74	3.82
	980908	22.5	6.2	30	6.0	6.8	0.7	2	45	0.6	10	10.9	160	<0.004	0.080	<0.015	<0.15	4.57
VLYD-2																		
	980506	22	5.9	31	7.9	10.2	4.4	2	30	2.2	8	8.1	16	0.004	0.030	<0.015	0.30	3.56
UVLD-1																		
	980506	20	5.9	38	6.9	29.1	1.3	6	17	0.9	7	8.6	140	<0.004	0.090	0.070	0.47	3.76
	980713	24.7	6.5	38	5.8	26.9	1.5	9.5	57.5	2.8	20	11.8	>655	0.25	0.105	<0.015	0.48	3.76
	980908	22.9	6.2	40	5.4	16.4	0.1	4	59	0.6	15	12.0	>110	0.004	0.080	<0.015	<0.15	4.62
SSB-1																		
	980506	20.5	5.4	16	8.6	13.9	12.5	10	24	4.0	2	3.3	350	0.03	0.020	<0.015	<0.15	3.21
	980713	23.5	5.5	11	7.1	42.7	33.3	60	43	3.3	12	4.1	>1260	0.016	0.040	<0.015	<0.43	3.53
	980908	23.3	5.9	8	7.7	12.5	3.8	3	34	0.2	11	3.4	110	0.17	0.020	<0.015	<0.15	3.98
SWFC-1																		
	980506	22	5.7	34	8.6	9.9	24.4	9	30	0.6	5	8.7	130	0.04	0.510	<0.015	<0.15	4.52
Joe Wheeler																		
FIRW-1																		
	980603	23.6	7.3	112	8.8	2.0	7.0	1	98	3.0	1	48.4	120	0.01	0.820	<0.015	<0.15	4.14
	980722	22.7	7.6	117	8.6	2.2	7.1	78	1	0.5	46	62.0	270	<0.005	0.849	0.005	0.14	
	980916	21	7.5	139	9.3	1.4	4.1	3	83	0.7	56	62.0	52	0.122	0.772	<0.005	0.12	

Appendix A. Water quality variables measured during spring, summer and fall sampling events for State Parks Study 1998.

Station	Date	Water Temp. (C)	pH (s.u.)	Conductivity (umhos)	DO (mg/L)	Turbidity (ntu)	Flow (cfs)	TSS mg/L	TDS mg/L	BOD-5 mg/L	Total Alkalinity mg/L	Hardness mg/L	Fecal Coliform col/100 ml	T-PO4 mg/L	NO3/NO2 mg/L	NH3 mg/L	TKN mg/L	CL mg/L
Joe Wheeler																		
NLYW-1																		
	980603	21.6	7.3	104	8.5	4.3	0.9	2	114	3.0	45	41.2	150	0.007	2.030	<0.015	<0.15	5.17
	980722	24.6	7.5	119	7.7	2.1	0.4	82	<1	0.9	42	54.0	220	0.094	1.618	0.005	0.15	
	980916	26	7.5	140	8.0	1.9	0.6	8	86	1.8	53	58.0	1540	0.061	1.148	<0.005	0.34	
INCL-1																		
	980603	22.7	7.1	77	8.2	1.7	8.7	1	78	2.5	32	35.5	143	0.006	0.360	<0.015	<0.15	3.51
	980722	19.8	7.5	89	8.2	2.2	7.1	1	60	0.4		46.0	330	<0.005	0.469	<0.005	0.21	
	980916	22	7.5	100	8.8	0.8	3.9	186	62	0.3	42	46.0	108	0.08	0.350	<0.005	<0.04	

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

State Park	***Reference***					***Reference***	Little River State Park		
Station	***BYTJ 1***	SSCD 1	STGD 1	KIRD 1	STND 1	***LCNE 1***	HURD 1	STRD 1	WFLD 2
Date	***98-05-19***	98-05-19	98-05-19	98-05-19	98-05-19	***98-05-20***	98-05-20	98-05-20	98-05-20
EPT Taxa Richness	***15***	14	12	11	11	***15***	11	11	14
EPHEMEROPTERA									
Baetidae									
Heterocloeon									
Baetidae UNID dif	360	130	41	160	17	28	27	13	27
Baetidae UNID	17								
Baetiscidae									
Baetisca									
Caenidae									
Caenis			1		1	6			
Brachycercus									
Caenidae UNID									
Ephemerellidae									
Attenella	3								
Drunella	12		1	3					2
Ephemerella	6	18	40	94	16		38	5	
Eurylophella	7	8	21	4	18	4	3		20
Serratella									
Ephemerellidae UNID dif		1							
Ephemerellidae UNID	6								
Ephemeridae									
Hexagenia						1			
Heptageniidae									
Epeorus	6								
Heptagenia				1				3	
Leucrocuta									
Rhithrogena									
Stenacron	1					1			
Stenonema	5	1	7		6	59	2		12
Heptageniidae UNID		14		3			1		
Isonychidae									
Isonychia						31			
Leptophlebiidae									
Habrophlebia									
Paraleptophlebia									

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***BYTJ 1***	SSCD 1	STGD 1	KIRD 1	STND 1	***LCNE 1***	HURD 1	STRD 1	WFLD 2
Leptophlebiidae UNID dif				1	1			3	
Leptophlebiidae UNID		4							
Tricorythidae									
Tricorythodes									
PLECOPTERA									
Chloroperlidae									
Haploperla									
Chloroperlidae UNID dif									
Leuctridae									
Leuctra		2				1	14	1	5
Nemouridae									
Amphinemura		12			2		4	4	
Peltoperlidae									
Tallaperla								1	
Perlidae									
Acroneuria									3
Agnetina									
Attaneuria									
Beloneuria									
Neoperla									2
Paragnetina									
Perlesta	27		31	22	6	4	5		36
Perlidae Unid									
Perlodidae									
Isoperla	7	24	3	197	26	11	133	50	
Pteronarcyidae									
Pteronarcys	3								
TRICHOPTERA									
Brachycentridae									
Brachycentrus	1								
Micrasema	72								
Calamoceratidae									
Anisocentropus									
Glossosomatidae									
Glossosoma		5	2					1	
Hydropsychidae									
Ceratopsyche	35	60	3	138					
Cheumatopsyche		35	8	1	43	139	4		8
Diplectrona									

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***BYTJ 1***	SSCD 1	STGD 1	KIRD 1	STND 1	***LCNE 1***	HURD 1	STRD 1	WFLD 2
Hydropsyche		24				116		10	20
Potamyia									
Hydropsychidae UNID dif									
Hydropsychidae UNID	6								
Hydroptilidae									
Hydroptila					2				
Hydroptilidae UNID									
Lepidostomatidae									
Lepidostoma									
Leptoceridae									
Oecetis		2	6			1			
Mystacides							5		
Nectopsyche									
Limnephilidae									
Pycnopsyche		4							
Limnephilidae UNID dif									
Molannidae									
Molanna	1								
Odontoceridae									
Psilotreta									
Philopotamidae									
Chimarra						18			
Dolophilodes								1	
Philopotamidae UNID dif									
Polycentropodidae									
Cernotina									
Cyrnellus									1
Neureclipsis									
Polycentropus				1					1
Psychomyiidae									
Lype						20	1		2
Psychomyia									
Rhyacophilidae									
Rhyacophila									1

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

	State Park	Reference	Chewacla State Park					
	Station	***HCR 1***	MMLT 1 a	MMLT 1 c	CHWT 1	CHWT 3	ROBT 1	NAST 1
	Date	***98-05-12***	98-05-13	98-05-13	98-05-13	98-05-13	98-05-13	98-05-13
	EPT Taxa Richness	***20***	5	3	6	8	12	18
	EPHEMEROPTERA							
	Baetidae							
	Heterocloeon							
	Baetidae UNID dif	22	15	7	1	16	89	338
	Baetidae UNID							
	Baetiscidae							
	Baetisca							
	Caenidae							
	Caenis					6		1
	Brachycercus							
	Caenidae UNID							
	Ephemerellidae							
	Attenella						18	
	Drunella							
	Ephemerella	7						
	Eurylophella	15					2	1
	Serratella	5						1
	Ephemerellidae UNID dif							
	Ephemerellidae UNID							
	Ephemeridae							
	Hexagenia					4		
	Heptageniidae							
	Epeorus							
	Heptagenia	5					2	
	Leucrocuta							
	Rhithrogena	7						
	Stenacron	18					7	
	Stenonema	55	4		2	103	35	24
	Heptageniidae UNID						1	
	Isonychidae							
	Isonychia	9	1	5		69		56
	Leptophlebiidae							
	Habrophlebia							
	Paraleptophlebia	4						

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***HCR 1***	MMLT 1 a	MMLT 1 c	CHWT 1	CHWT 3	ROBT 1	NAST 1
Leptophlebiidae UNID dif							
Leptophlebiidae UNID							
Tricorythidae							
Tricorythodes							1
PLECOPTERA							
Chloroperlidae							
Haploperla							
Chloroperlidae UNID dif							
Leuctridae							
Leuctra	44						
Nemouridae							
Amphinemura							1
Peltoperlidae							
Tallaperla	11						
Perlidae							
Acroneuria	5					6	6
Agnetina							
Attaneuria							
Beloneuria							
Neoperla							
Paragnetina							
Perlesta	12	6		2	13	35	5
Perlidae Unid							
Perlodidae							
Isoperla							7
Pteronarcyidae							
Pteronarcys	2						
TRICHOPTERA							
Brachycentridae							
Brachycentrus							
Micrasema							
Calamoceratidae							
Anisocentropus							
Glossosomatidae							
Glossosoma							
Hydropsychidae							
Ceratopsyche	7						
Cheumatopsyche	12	21	30	7	189	21	81
Diplectrona							

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***HCR 1***	MMLT 1 a	MMLT 1 c	CHWT 1	CHWT 3	ROBT 1	NAST 1
Hydropsyche				14		2	14
Potamyia							
Hydropsychidae UNID dif							
Hydropsychidae UNID		1					
Hydroptilidae							
Hydroptila				2			1
Hydroptilidae UNID							
Lepidostomatidae							
Lepidostoma							
Leptoceridae							
Oecetis						1	
Mystacides							
Nectopsyche							1
Limnephilidae							
Pycnopsyche	2						
Limnephilidae UNID dif							
Molannidae							
Molanna							
Odontoceridae							
Psilotreta							
Philopotamidae							
Chimarra					12	4	92
Dolophilodes	5						
Philopotamidae UNID dif							
Polycentropodidae							
Cernotina							
Cyrnellus							1
Neureclipsis							
Polycentropus							1
Psychomyiidae							
Lype							
Psychomyia							
Rhyacophilidae							
Rhyacophila	1						

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

	State Park	***Reference***	***Reference***	Claude D. Kelley			***Reference***	Oak Mountain	
	Station	***BRE 1***	***HLB 1***	LTLM 2	LTLE 2	CHTE 1	***WGFC 1***	DRYS 1	PEAS 1
	Date	***98-05-28***	***98-05-27***	98-05-27	98-05-27	98-05-27	***98-05-14***	98-05-14	98-05-14
	EPT Taxa Richness	***10***	***8***	18	17	14	***17***	18	16
	EPHEMEROPTERA								
	Baetidae								
	Heterocloeon								
	Baetidae UNID dif			6	17	5	15		10
	Baetidae UNID							11	
	Baetiscidae								
	Baetisca	1							
	Caenidae								
	Caenis			15	11		1	1	
	Brachycercus								
	Caenidae UNID								
	Ephemerellidae								
	Attenella				2			3	
	Drunella								
	Ephemerella				10		18	6	
	Eurylophella	4				4		1	
	Serratella								
66	Ephemerellidae UNID dif								
	Ephemerellidae UNID								
	Ephemeridae								
	Hexagenia			4					
	Heptageniidae								
	Epeorus								
	Heptagenia						6		
	Leucrocuta							7	
	Rhithrogena						102		
	Stenacron						1	1	
	Stenonema	7		31	153	13	17	27	12
	Heptageniidae UNID							25	
	Isonychidae								
	Isonychia			1	5	1	69		
	Leptophlebiidae								
	Habrophlebia								
	Paraleptophlebia			2					4

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***BRE 1***	***HLB 1***	LTLM 2	LTLE 2	CHTE 1	***WGFC 1***	DRYS 1	PEAS 1
Leptophlebiidae UNID dif					1			
Leptophlebiidae UNID			1				6	
Tricorythidae								
Tricorythodes			2					
PLECOPTERA								
Chloroperlidae								
Haploperla								
Chloroperlidae UNID dif								
Leuctridae								
Leuctra	16	24	15	10	36			44
Nemouridae								
Amphinemura								1
Peltoperlidae								
Tallaperla					5	5		107
Perlidae								
Acroneuria	5	1	7	48	3	6		12
Agnetina		2						
Attaneuria				1				
Beloneuria		3						
Neoperla			10	5		1	54	
Paragnetina								
Perlesta	10	45	8	47	6	21	66	
Perlidae Unid							13	
Perlodidae								
Isoperla								
Pteronarcyidae								
Pteronarcys								
TRICHOPTERA								
Brachycentridae								
Brachycentrus	4					3		
Micrasema							6	
Calamoceratidae								
Anisocentropus					1			3
Glossosomatidae								
Glossosoma								
Hydropsychidae								
Ceratopsyche	4	1		51			28	
Cheumatopsyche			3	2		38	55	
Diplectrona					91			

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***BRE***	***1***	***HLB***	***1***	LTLM	2	LTLE	2	CHTE	1	***WGFC***	***1***	DRYS	1	PEAS	1
Hydropsyche			6		11						1		6		23	
Potamyia																
Hydropsychidae UNID dif																
Hydropsychidae UNID													6			
Hydroptilidae																
Hydroptila					2		9		1				3			
Hydroptilidae UNID																
Lepidostomatidae																
Lepidostoma															13	
Leptoceridae																
Oecetis					3		22		1		1				2	
Mystacides																
Nectopsyche					1											
Limnephilidae																
Pycnopsyche											2				2	
Limnephilidae UNID dif																
Molannidae																
Molanna																
Odontoceridae																
Psilotreta															1	
Philopotamidae																
Chimarra	32												43			
Dolophilodes															1	
Philopotamidae UNID dif									1							
Polycentropodidae																
Cernotina													1			
Cyrnellus	1						6									
Neureclipsis																
Polycentropus			1		3		5						1		1	
Psychomyiidae																
Lype					1											
Psychomyia													1		1	
Rhyacophilidae																
Rhyacophila																

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

State Park	***Reference***	***Reference***	Paul M. Grist		***Reference***	Wheeler		***Reference***	Cheaha	
Station	***SSB 1***	***SWFC 1***	VLYD 1	ULVD 1	***INCL 1***	FIRW 1	NLYW 1	***TCT 5***	CHE 1	CHEC 3
Date	***98-05-06***	***98-05-06***	98-05-06	98-05-06	***98-06-03***	98-06-03	98-06-03	***98-05-12***	98-05-12	98-05-12
EPT Taxa Richness	***13***	***14***	8	6	***23***	10	6	***23***	21	20
EPHEMEROPTERA										
Baetidae										
Heterocloeon									6	
Baetidae UNID dif	4	15	16	2	9	212	15	214	73	76
Baetidae UNID										
Baetiscidae										
Baetisca										
Caenidae										
Caenis	2	7	2		57					
Brachycercus			3		2					
Caenidae UNID					3					
Ephemerellidae										
Attenella										
Drunella					4					
Ephemerella		1			2			14	24	
Eurylophella	1				2			46	31	10
Serratella								30	13	12
Ephemerellidae UNID dif										
Ephemerellidae UNID					1					
Ephemeridae										
Hexagenia										
Heptageniidae										
Epeorus					12				6	38
Heptagenia								34		
Leucrocuta										4
Rhithrogena										
Stenacron			4		6			11		
Stenonema		10		2	24	29		154	50	114
Heptageniidae UNID			4		3				15	
Isonychidae										
Isonychia		30			4	3		88	24	
Leptophlebiidae										
Habrophlebia										3
Paraleptophlebia	3	5				1				5

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***SSB 1***	***SWFC 1***	VLYD 1	ULVD 1	***INCL 1***	FIRW 1	NLYW 1	***TCT 5***	CHE 1	CHEC 3
Leptophlebiidae UNID dif										
Leptophlebiidae UNID										
Tricorythidae										
Tricorythodes										
PLECOPTERA										
Chloroperlidae										
Haploperla										1
Chloroperlidae UNID dif								1		
Leuctridae										
Leuctra	16	15		1	21			1	13	88
Nemouridae										
Amphinemura										
Peltoperlidae										
Tallaperla	2							18	38	74
Perlidae										
Acroneuria	1	1			1			4	216	78
Agnetina										
Attaneuria										
Beloneuria										
Neoperla								54		
Paragnetina								3		
Perlesta	23	66		16				158	36	
Perlidae Unid										
Perlodidae										
Isoperla									6	1
Pteronarcyidae										
Pteronarcys	5		5							
TRICHOPTERA										
Brachycentridae										
Brachycentrus	3	11						165		
Micrasema										
Calamoceratidae										
Anisocentropus										
Glossosomatidae										
Glossosoma					8		1		10	38
Hydropsychidae										
Ceratopsyche					5	87				
Cheumatopsyche		54	3	14	27	558	1	135	42	
Diplectrona										

Appendix B. Taxa list of Ephemeroptera, Plecoptera and Trichoptera collected during the State Parks Study.

Station	***SSB 1***	***SWFC 1***	VLYD 1	ULVD 1	***INCL 1***	FIRW 1	NLYW 1	***TCT 5***	CHE 1	CHEC 3
Hydropsyche	8						174	71	32	39
Potamyia					10					
Hydropsychidae UNID dif			2							
Hydropsychidae UNID					2					13
Hydroptilidae										
Hydroptila						12	18		1	
Hydroptilidae UNID	1									
Lepidostomatidae										
Lepidostoma									6	1
Leptoceridae										
Oecetis	5	1			2			7		
Mystacides		2			2					
Nectopsyche										
Limnephilidae										
Pycnopsyche	1	2				1				
Limnephilidae UNID dif										1
Molannidae										
Molanna										
Odontoceridae										
Psilotreta										
Philopotamidae										
Chimarra					2	16	6	6		
Dolophilodes			1		1	12			36	301
Philopotamidae UNID dif										
Polycentropodidae										
Cernotina										
Cyrnellus				4				1	11	
Neureclipsis					1					
Polycentropus								3	21	49
Psychomyiidae										
Lype					3					2
Psychomyia					4					
Rhyacophilidae										
Rhyacophila								18		

Appendix C. Number and weight (grams) of fish by taxa collected at each station in the State Parks Study.

	Stations								
Species	CHEC-3	CHE-1	DRYS-1	WGFC-1	VLYD-1	SSB-1	CHWT-1	CHWT-3	MMLT-1a
Cyprinidae									
Campostoma oligolepis		8 (13.9)	5 (8.8)				23 (197.8)	1 (0.4)	8 (53)
Cyprinella callistia		15 (26.1)		14 (14)					
Cyprinella galactura									
Cyprinella gibbsi									
Cyprinella trichroistia		28 (101.6)		74 (90)					
Cyprinella venusta					1 (5.2)		9 (60.6)		
Ericymba buccata									19 (60.9)
Hybopsis lineapunctata				10 (12.5)					
Hybopsis winchelli						2 (3.5)			
Luxilus chrysocephalus					6 (99.7)	9 (40)		11 (214.7)	4 (13.8)
Luxilus zonistius									
Lythrurus bellus					14 (17.1)		4 (8.0)	12 (20.4)	
Nocomis leptocephalus					5 (2.7)	1 (0.9)		3 (25.2)	11 (153.7)
Notemigonus crysoleucas				1					
Notropis ammophilus					13 (12.1)	1 (1)			
Notropis asperifrons		10 (27)							
Notropis baileyi					66 (110.7)	76(113)		8 (17.1)	84 (148.4)
Notropis stilbius				16 (20.4)		1 (0.4)			
Notropis texanus						1 (1)			
Notropis volucellus							1 (0.5)		
Notropis xaenocephalus									
Pimephales vigilax									
Rhinichthys atratulus	65 (119.6)								
Semotilus atromaculatus	89 (547.7)	1 (0.6)	22 (179.2)	3 (14.6)					
Semotilus thoreauianus						1 (13.8)			

Appendix C. Number and weight (grams) of fish by taxa collected at each station in the State Parks Study.

	Stations								
Species	CHEC-3	CHE-1	DRYS-1	WGFC-1	VLYD-1	SSB-1	CHWT-1	CHWT-3	MMLT-1a
Catostomidae									
Erimyzon oblongus						1 (7.1)			
Hypentelium etowanum		3 (42.5)	3 (72.1)	7 (74.5)	2 (62.3)	2 (24.9)	2 (44.9)	3 (58.3)	9 (183.1)
Moxostoma duquesnei									
Moxostoma erythrurum							1 (37.1)		
Moxostoma poecilurum					7 (217.5)	1		2 (116.8)	
Ictaluridae									
Ameiurus natalis		1 (14)	1 (5.1)						
Ameiurus nebulosus								1 (51.9)	
Ictalurus punctulatus							2 (57.2)		
Noturus leptacanthus				3 (5.0)					
Fundulidae									
Fundulus olivaceus			9 (20.8)		1 (0.7)	4 (11.1)			1 (2.3)
Cottidae									
Cottus carolinae			5 (10.3)				17 (28.2)	1 (5.5)	
Centrarchidae									
Lepomis auritus									
Lepomis cyanellus		3 (131.1)	10 (84.8)	8 (105.1)					
Lepomis cyanellus x L. macrochirus				1 (7.5)					
Lepomis cyanellus x L. megalotis									
Lepomis gulosus						3 (43.5)	1 (16.7)		
Lepomis macrochirus			12 (115.5)		5 (20.2)	1 (0.8)		6 (17.2)	1 (36.0)
Lepomis megalotis	14 (136.6)	2 (38.3)	17 (114.3)	11 (154.4)	4 (60.1)	1 (55.6)	1 (5.5)	14 (115.0)	
Micropterus coosae		2(42)							
Micropterus punctulatus					1 (0.7)		1 (13.5)		1 (0.7)
Micropterus salmoides			1 (5.8)			1 (98.7)	1 (17.5)		1 (0.8)
Micropterus sp. (observed)									
Pomoxis annularis									1 (0.4)

Appendix C. Number and weight (grams) of fish by taxa collected at each station in the State Parks Study.

	Stations								
Species	CHEC-3	CHE-1	DRYS-1	WGFC-1	VLYD-1	SSB-1	CHWT-1	CHWT-3	MMLT-1a
Percidae									
Etheostoma coosae		11 (15.1)							
Etheostoma chuckwachatte									
Etheostoma jordani		13 (23.6)							
Etheostoma lachneri						1 (0.8)			
Etheostoma ramseyi			8 (12.7)		4 (2.3)				
Etheostoma rupestre							1 (2.2)		
Etheostoma stigmaeum				13 (10.1)					
Etheostoma tallapoosae									
Etheostoma whipplei			1 (2.1)					1 (5.5)	
Percina nigrofasciata				10 (18.7)	3 (1.7)	1 (0.4)	4 (15.3)	3 (14.2)	3 (10.7)
Percina palmaris									
Total species	3	12	12	12	14	18	14	13	12
Total individuals (wt-grams)	168 (803.9)	97 (475.8)	94 (631.5)	170 (526.8)	132 (613)	108 (416.5)	68 (505)	66 (662.2)	143 (663.8)

	Stations								
Species	KIRD-1	SSCD-1	STGD-1	STND-1	BYJT-1	MMLT-1c	ROBT-1	NAST-1	HCR-1
Cyprinidae									
Campostoma oligolepis	15 (182.9)	10 (149.4)	32 (244.2)			25 (14.5)	2 (18.7)	5 (24.8)	2 (13.2)
Cyprinella callistia									
Cyprinella galactura		4 (15.0)	6 (25.4)						
Cyprinella gibbsi									59 (101.8)
Cyprinella trichroistia									
Cyprinella venusta						9 (47.1)			
Ericymba buccata						179 (223.5)			
Hybopsis lineapunctata								2 (4.4)	4 (5.3)
Hybopsis winchelli									
Luxilus chrysocephalus							10 (147.5)	16 (159.1)	4
Luxilus zonistius									3 (18.6)

Appendix C. Number and weight (grams) of fish by taxa collected at each station in the State Parks Study.

	Stations								
Species	KIRD-1	SSCD-1	STGD-1	STND-1	BYJT-1	MMLT-1c	ROBT-1	NAST-1	HCR-1
Lythrurus bellus						15 (21.1)		1 (1.0)	
Nocomis leptocephalus							9 (67.6)	7 (41.7)	2 (41.9)
Notemigonus crysoleucas									
Notropis ammophilus							6 (5.9)		
Notropis asperifrons									
Notropis baileyi						23 (40.2)	206 (559.4)	17 (42.7)	20 (24)
Notropis stilbius									
Notropis texanus									
Notropis volucellus									
Notropis xaenocephalus									3 (4.3)
Pimephales vigilax								25 (67.8)	
Rhinichthys atratulus									
Semotilus atromaculatus			3 (54.8)	37 (28.6)					
Semotilus thoreauianus								3 (28.4)	
Catostomidae									
Erimyzon oblongus									
Hypentelium etowanum						17 (16.9)	3 (31.4)	5 (49.0)	1 (8.7)
Moxostoma duquesnei									1 (61.5)
Moxostoma erythrurum									
Moxostoma poecilurum									
Ictaluridae									
Ameiurus natalis	6 (426.3)	2 (31.4)	2 (57.4)	3 (112.1)	1 (0.2)			2 (221.7)	
Ameiurus nebulosus									
Ictalurus punctulatus						1 (0.2)			
Noturus leptacanthus							1 (2.4)		
Fundulidae									
Fundulus olivaceus						5 (8.7)			
Cottidae									
Cottus carolinae							13 (75.1)		30 (103.1)

Appendix C. Number and weight (grams) of fish by taxa collected at each station in the State Parks Study.

	Stations								
Species	KIRD-1	SSCD-1	STGD-1	STND-1	BYJT-1	MMLT-1c	ROBT-1	NAST-1	HCR-1
Centrarchidae									

Lepomis auritus	3 (189.9)				1 (47.2)	6 (345.9)	11 (239.8)	24 (516.8)	19 (131.9)
Lepomis cyanellus	9 (172.4)		1 (2.6)	8 (78.4)		2 (29.6)	1 (2.8)	26 (350.5)	7 (228.3)
Lepomis cyanellus x L. macrochirus									
Lepomis cyanellus x L. megalotis				1 (28.8)					
Lepomis gulosus	1 (6.9)	1 (8.0)	1 (16.3)						
Lepomis macrochirus	9 (267.8)	36 (165.3)	3 (3.8)	10 (31.7)	1 (16)	8 (131.4)	5 (55.5)	5 (53.7)	6 (28.8)
Lepomis megalotis		1 (2.9)	2 (13.7)	2 (11.4)					
Micropterus coosae									
Micropterus punctulatus									
Micropterus salmoides		6 (3.4)	1 (18.3)	2 (1.1)				2 (3.3)	5 (3.0)
Micropterus sp. (observed)						1			
Pomoxis annularis									
Percidae									
Etheostoma coosae									
Etheostoma chuckwachatte									15 (24.1)
Etheostoma jordani									
Etheostoma lachneri									
Etheostoma ramseyi									
Etheostoma rupestre									
Etheostoma stigmaeum							2 (2.0)		
Etheostoma tallapoosae									6 (5.1)
Etheostoma whipplei									
Percina nigrofasciata						3 (8.4)	2 (5.4)	3 (7.6)	
Percina palmaris									5 (17.3)
Total species	6	6	8	6	5	13	15	15	16
Total individuals (wt-grams)	38 (1,116.1)	33 (493.9)	100 (1,306)	77 (532.7)	23 (637.2)	321 (559.9)	262 (970.1)	108 (799.6)	157 (492.1)