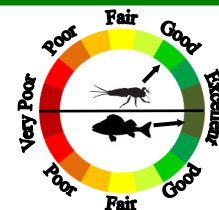


2019 Monitoring Summary

Ecological Reference Reach



Brushy Creek at Lawrence County Road 73 (34.33070/-87.28620)

BACKGROUND

Brushy Creek is among the least-disturbed watersheds within the Dissected Plateau ecoregion, based on landuse, road density, and population density. Since 1997, it has been monitored by the Alabama Department of Environmental Management (ADEM) as a “high quality” reference watershed for comparison with other streams within the ecoregion. Data from reference watersheds are used to characterize natural or background conditions expected in different ecoregions throughout the state. Brushy Creek was sampled in 2019 to provide high-quality reference reach data for Dissected Plateau streams.

Brushy Creek is within one of 50 Strategic Habitat Units (SHU) by the U.S. Fish and Wildlife Service (USFWS) and the Alabama Rivers & Streams Network (ARSN). SHUs are recognized as high quality habitats occupied by federally listed and state imperiled species.



Figure 1. Brushy Creek at BRSL-3, June 19, 2019.

Table 1. Summary of general watershed characteristics: BRSL-3

Watershed Characteristics	
Basin	Black Warrior
Drainage Area (mi²)	8.9
Ecoregion^a	68E
Assessment Unit	AL03160110-0203-103
Use Class	F&W
AU Category	1
12-digit Hydrologic Unit Code (HUC)	031601100201
Conservation Status	
Strategic Habitat Unit †	22 Upper Sipsey Fork
Landuse Categories (2011 National Land Cover Dataset)	
Wetland, Total (%)	0.5
Wetlands, Woody (%)	0.5
Forested, Total (%)	97.3
Forested, Deciduous (%)	55.5
Forested, Evergreen (%)	22.6
Forested, Mixed (%)	19.1
Shrub/Scrub (%)	0.4
Grassland/Herbaceous (%)	0.2
Pasture/Hay (%)	0.6
Developed, Total (%)	1.0
Developed, Open Space (%)	1.0
Population/km² (2010 US Census)	1
Roads	
Road Density	0.3

^a Dissected Plateau

† 12-digit HUC located in a Strategic Habitat Unit.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Brushy Creek is a *Fish and Wildlife (F&W)* stream located within the Bankhead National Forest. According to the 2011 National Land Cover Dataset, the watershed is 97% forested with no permitted outfalls. It is sparsely populated with few roads. A forest service road provides access to several recreational hiking trails and horseback riding trails in and near the watershed. It is located within a Strategic Habitat Unit that supports eight federally listed threatened or endangered aquatic species and five other aquatic species listed to be of the *Highest* or *High Conservation Concern* by the state of Alabama.

REACH CHARACTERISTICS

General observations (Figure 1, Table 2) and a habitat survey (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Like other streams in ecoregion 68e, Brushy Creek at BRSL-3 is a medium-high gradient stream characterized predominantly by a boulder and cobble substrate. Overall habitat quality was categorized as *sub-optimal* for supporting the biological communities in this stream type.

BIOASSESSMENT RESULTS

The benthic macroinvertebrate community was sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). Measures of taxonomic richness, community composition and pollution tolerance were used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in north Alabama streams and rivers. Each site is placed in one of six levels ranging from 1, or *natural*, to 6, or *highly altered*. The condition of the macroinvertebrate community has been rated as *good*, identifying Brushy Creek at BRSL-3 as a level 2 site or near natural site. Taxa richness and diversity are excellent, with 57 total taxa and 27 pollution-sensitive taxa collected at the site. Ten of the taxa are only found in the most pristine streams throughout Alabama and the southeast (Table 4a).

The fish community in Brushy Creek at BRSL-3 was sampled using Alabama's Fish Community Index of Biotic Integrity (AL-IBI), developed through a multi-agency (GSA, ADCNR, ADEM) project to establish a comprehensive fish community bioassessment tool for wadeable streams and rivers across the state. The data collected during this survey were to score the overall health of the fish community, based on conditions expected for wadeable streams and rivers in the Plateau Ichthyoregion. The AL-IBI uses twelve measures of species richness and diversity, tolerance/intolerance, and abundance, condition, and reproduction to assess the overall health of the fish community. The final IBI score is the sum of all individual metrics on a 60 point scale. The IBI score for Brushy Creek at BRSL-3 was 44, indicating the fish community to be in *excellent* condition (Table 4b).

Table 2. Physical characteristics of Brushy Creek at BRSL-3, June 19, 2019.

Physical Characteristics	
Width (ft)	20
Canopy Cover	Shaded
Depth (ft)	
Riffle	0.3
Run	0.8
Pool	1.0
% of Reach	
Riffle	5
Run	60
Pool	35
% Substrate	
Boulder	38
Cobble	50
Gravel	2
Sand	5
Silt	2
Organic Matter	3

Table 3. Results of the habitat assessment survey conducted on Brushy Creek at BRSL-3, June 19, 2019.

Habitat Survey	% Max Score	Rating
Instream Habitat Quality	57	Sub-optimal (55-74.999)
Sediment Deposition	64	Sub-optimal (55-74.999)
Riffle Frequency	70	Sub-optimal (55-74.999)
Bank Vegetative Stability	61	Sub-optimal (55-74.999)
Riparian Zone Measurements	91	Optimal (80-100)
Habitat Assessment Score	135	
% Maximum Score	67	Sub-optimal (55-69.999)

Table 4a. Results of the Macroinvertebrate survey conducted on Brushy Creek at BRSL-3, June 19, 2019.

Macroinvertebrate Assessment	Scores
Taxonomic richness and diversity metrics	
Taxa Count	57
# rare and highly sensitive taxa	10
# sensitive taxa	27
# sensitive EPT taxa	8
Percent taxon metrics	
% rare and highly sensitive taxa	18
% sensitive taxa	47
% sensitive EPT taxa	14
% highly tolerant taxa	11
Percent individual metrics	
% rare and highly sensitive individuals	17
% sensitive individuals	23
% sensitive EPT individuals	3
% tolerant individuals	10
WMB-I Survey Score	3.1
WMB-I Survey Rating	Good (2.85-3.149)

Table 4b. Results of the Fish survey conducted on Brushy Creek at BRSL-3, April 23, 2019.

Fish Assessment	Results	Scores
Taxonomic richness and diversity metrics		
Total Native Species	21	5
Number Cyprinid species	5	3
Number of Sucker Species	2	3
Number Lepomis species	4	5
Number of darter+madtom species	5	5
Tolerance metrics		
Percent dominant species	16	5
Percent of tolerant species	18	3
Percent Lepomis	9	5
Trophic metrics		
Percent omnivores	7	5
Percent top carnivores	2	3
Abundance, condition, and reproductive metrics		
Percent DELT+hybrids		5
Percent simple lithophils	29	3
IBI Survey Score		50
IBI Survey Rating		Excellent

WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. In situ measurements and water samples were collected in April, June, August and October 2019 to help characterize the reach. In situ parameters were well within ranges to protect “fishable/swimmable” uses. Individual *E. coli* counts exceeded the criterion for the *F&W* use classification during one sampling event. Individual pH values were slightly higher and lower than expected based off of data collected at reference reaches within the Dissected Plateau ecoregion (68e).

Table 5. Summary of water quality data collected April, June, August and October of 2019. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

BRSL-3 AL03160110-0201-100	N	Min	Max	Med	Avg	SD	E	10thP	90thP
Physical									
Temperature (°C)	6	10.1	22.7	17.1	17.2	5.0		10.1	22.7
Turbidity (NTU)	6	2.1	7.7	3.4	3.9	2.0		2.1	7.7
Total Dissolved Solids (mg/L)	4	25.0	45.0	35.0	35.0	8.3		25.0	45.0
Total Suspended Solids (mg/L)	4	<1.0	11.0	2.0	3.9	4.9		0.5	11.0
Specific Conductance (µmhos/cm)	6	15.1	48.0	28.1	28.7	12.1		15.1	48.0
Hardness (mg/L)	4	5.5	16.5	9.1	10.0	4.9		5.5	16.5
Alkalinity (mg/L)	4	3.6	14.8	8.2	8.7	4.8		3.6	14.8
Measured Stream Flow (cfs)	6	0.4	29.3	1.1	6.6	11.4		0.4	29.3
Chemical									
Dissolved Oxygen (mg/L)	6	7.8	11.4	8.6	9.2	1.3		7.8	11.4
pH (SU)	6	6.1 ^D	8.0 ^D	6.8	6.8	0.6		6.1	8.0
Ammonia Nitrogen (mg/L)	4	<0.004	0.016	0.008	0.006	0.003		0.002	0.008
Nitrate+Nitrite Nitrogen (mg/L)	4	<0.003	0.046	0.021	0.022	0.024		0.002	0.046
Total Kjeldahl Nitrogen (mg/L)	4	<0.200	1.640	0.154	0.512	0.754		0.100	1.640
Total Nitrogen (mg/L)	4	<0.140	1.642	0.178	0.534	0.739		0.140	1.642
Dis Reactive Phosphorus (mg/L)	4	<0.005	<0.005	0.002	0.002	0.000		0.002	0.002
Total Phosphorus (mg/L)	4	<0.004	0.012	0.009	0.008	0.004		0.002	0.012
TOC (mg/L)	4	1.2	4.4	2.4	2.6	1.4		1.2	4.4
CBOD-5 (mg/L)	4	<2.0	<2.0	1.0	1.0	0.0		1.0	1.0
COD (mg/L)	4	4.7	13.5	10.9	10.0	4.2		4.7	13.5
Chlorides (mg/L)	4	0.9	1.2	1.0	1.0	0.1		0.9	1.2
Sulfate (mg/L)	4	2.61	5.22	2.98	3.44	1.21		2.61	5.22
Total Metals									
Aluminum (T) (mg/L)	4	0.068	0.132	0.092	0.096	0.031		0.068	0.132
Iron (T) (mg/L)	4	0.133	0.899	0.602	0.559	0.321		0.133	0.899
Manganese (T) (mg/L)	4	<0.004	<0.004	0.002	0.002	0.000		0.002	0.002
Dissolved Metals									
Aluminum (mg/L)	4	0.031	0.076	0.040	0.047	0.020		0.031	0.076
Antimony (µg/L)	4	<1.480	<1.480	0.740	0.740	0.000		0.740	0.740
Arsenic (µg/L)	4	<0.689	<0.689	0.344	0.344	0.000		0.344	0.344
Cadmium (µg/L)	4	<0.726	<0.726	0.363	0.363	0.000		0.363	0.363
Chromium (µg/L)	4	<0.793	<0.793	0.396	0.396	0.000		0.396	0.396
Copper (µg/L)	4	<1.190	<1.190	0.595	0.595	0.000		0.595	0.595
Iron (mg/L)	4	<0.063	0.625	0.357	0.343	0.250		0.032	0.625
Lead (µg/L)	4	<0.697	<0.697	0.348	0.348	0.000		0.348	0.348
Manganese (mg/L)	4	<0.004	<0.004	0.002	0.002	0.000		0.002	0.002
Nickel (µg/L)	4	<1.960	<1.960	0.980	0.980	0.000		0.980	0.980
Selenium (µg/L)	4	<1.900	<1.900	0.950	0.950	0.000		0.950	0.950
Silver (µg/L)	4	<1.350	<1.350	0.675	0.675	0.000		0.675	0.675
Thallium (µg/L)	4	<0.641	<0.641	0.320	0.320	0.000		0.320	0.320
Zinc (µg/L)	4	<2.340	<2.340	1.170	1.170	0.000		1.170	1.170
Biological									
Chlorophyll a (mg/m²)	4	1.00	1.07	0.78	0.78	0.33		0.50	1.07
E. coli (MPN/DL)	4	39.3	579.4 ^H	125.9	217.6	252.3	1	39.3	579.4

D=an individual value >90% of all verified ecoregional reference reach data collected in the ecoregion 68E; E=# samples that exceeded criteria; H=F&W human health criterion exceeded; J=estimate; N=# samples.

SUMMARY

The ADEM monitors Brushy Creek at BRSL-3 as a “high-quality” reference reach for comparison with other Dissected Plateau streams. Brushy Creek at BRSL-3 is typical of streams in the region, characterized by moderate to high gradient riffles with boulder and bedrock substrates. Located within the Bankhead National Forest and a SHU, the watershed is of exceptional quality, containing no permitted outfalls and almost entirely forested. Several recreational hiking trails run through the area. Water quality conditions are very high, exhibiting low water temperatures, and low concentrations of sediment, nutrients, and metals. Macroinvertebrate diversity and taxa richness are *good* and the fish community was found to be in *excellent* condition.

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