Alabama Department of Environmental Management

Ecological Reference Reach

Rivers and Streams Monitoring Program

2016 Monitoring Summary

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 2016 to provide high-quality reference reach data for comparison with streams throughout the Southwestern Appalachian (68) ecoregion.

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

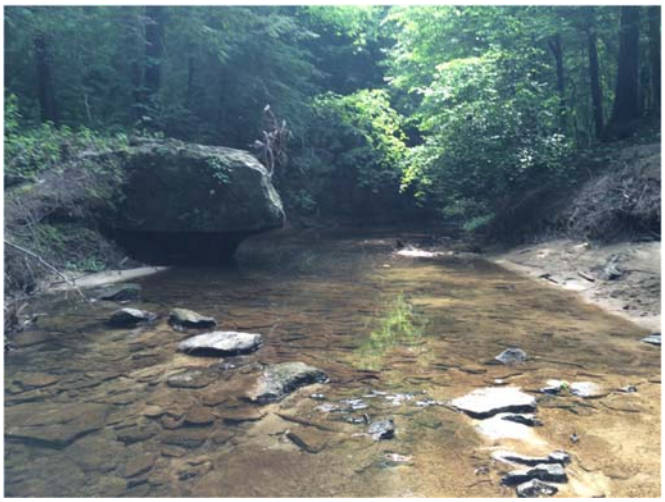

Figure 1. Brushy Creek at BRSL-3, May 10, 2016.

Table 1. Summary of general watershed characteristics: BRSL-3 (2016)

Watershed Characteristics	
Basin	Black Warrior
Drainage Area (mi²)	8.9
Ecoregion°	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

° 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 over 97% forested, with no permitted outfalls. It is sparsely populated, and contains 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 the Upper Sipsey Fork SHU, supporting several federally listed threatened and endangered aquatic species that are also of High or Highest Conservation Concern to the state of Alabama.

REACH CHARACTERISTICS

General observations (Figure 1, Table 2) and habitat surveys (Table 3) were completed to summarize conditions within the 100 m macroinvertebrate, and the 300 m fish sampling reaches. Results 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, with a mixture of habitat types and substrates. Overall habitat quality was categorized as *optimal* for supporting aquatic communities.

Table 2. Physical characteristics of Brushy Creek, within the 300 m IBI reach at BRSL-3, May 4, 2016.

Physical Characteristics	
Width (ft)	20
Canopy Cover	Shaded
Depth (ft)	
Riffle	0.4
Run	1.0
Pool	2.0
% of Reach	
Riffle	25
Run	35
Pool	40
% Substrate	
Boulder	15
Cobble	47
Gravel	15
Sand	15
Silt	3
Organic Matter	4
Mud/muck	1

BIOLOGICAL SURVEY 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 evaluate 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 in Brushy Creek at BRSL-3 was rated as *excellent-good*, identifying the reach as a level 2, or near natural, site. Taxa richness and diversity are excellent, with 94 total taxa and 43 pollution-sensitive taxa collected at the site. Nine 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). 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 *good* condition (Table 4b).

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Table 3. Results of the habitat assessment survey conducted on Brushy Creek, within the 300 m IBI reach at BRSL-3, May 4, 2016.

Habitat Survey	% Max Score	Rating
Instream Habitat Quality	86	Optimal (80-100)
Sediment Deposition	74	Sub-optimal (55-75)
Riffle Frequency	93	Optimal (80-100)
Bank Vegetative Stability	63	Sub-optimal (55-75)
Riparian Zone Measurements	90	Optimal (85-100)
Habitat Assessment Score	**161**	
% Maximum Score	**80**	**Optimal (>79)**

Table 4a. Results of the macroinvertebrate assessment conducted on Brushy Creek at BRSL-3, May 10, 2016.

Macroinvertebrate Assessment	Results
Taxonomic richness and diversity metrics	
Total # taxa	94
# rare and highly sensitive taxa	9
# sensitive taxa	43
# sensitive EPT taxa	14
Percent taxon metrics	
% sensitive EPT taxa	15
% sensitive taxa	46
% rare and highly sensitive taxa	10
% tolerant individuals	10
% tolerant taxa	9
Percent individual metrics	
% rare and highly sensitive individuals	11
% sensitive individuals	23
% sensitive EPT individuals	5
WMB-I Survey Score	**2.25**
WMB-I Survey Rating	**Excellent-good (2.10-2.25)**

Table 4b. Results of the fish assessment conducted on Brushy Creek at BRSL-3, May 4, 2016.

Fish Assessment	Results	Scores
Taxonomic richness and diversity metrics		
Total Native Species	16	3
Number Cyprinid species	5	3
Number of Sucker Species	2	3
Number Lepomis species	3	3
Number of darter+madtom species	5	5
Tolerance metrics		
Percent dominant species	23	5
Percent of tolerant species	23	3
Percent Lepomis	13	3
Trophic metrics		
Percent omnivores	5	5
Percent top carnivores	3	5
Abundance, condition, and reproductive metrics		
Percent DELT+hybrids		5
Percent simple lithophils	20	1
IBI Survey Score		**44**
IBI Survey Rating		**Good (41-49)**

WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. In situ measurements and water samples were collected monthly and semi-monthly (metals), from March through October, 2016, to help characterize the reach. In situ parameters were well within ranges to protect "*fishable/swimmable*" uses. Water temperatures ranged from 9.9 to 24.7 degrees Celsius. Turbidity was low, with an average of 5.8 NTU. The maximum individual *E. coli* count was <126 colonies/100 mL of sample. Median sediment, nutrient, and metals concentrations were also low. The median concentration of total iron (0.664 mg/L) was higher than expected, based on the 90th percentile of data collected in reference reaches within ecoregion 68e (0.056 mg/L).

Table 5. Summary of water quality data collected March-October, 2016. 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.

Parameter	N	Min	Max	Med	Avg	SD
Physical						
Temperature (°C)	9	9.9	24.7	17.6	18.6	4.9
Turbidity (NTU)	10	2.4	25.3	3.6	5.8	6.9
Total Dissolved Solids (mg/L)	7	2.0	31.0	21.0	18.7	11.1
Total Suspended Solids (mg/L)	7	< 1.0	34.0	2.0	7.8	12.3
Specific Conductance (µmhos/cm)	9	17.1	50.1	25.5	29.6	11.2
Hardness (mg/L)	4	5.5	18.0	12.0 G	11.9	5.8
Alkalinity (mg/L)	7	3.2	17.2	9.6	9.6	5.5
Monthly Stream Flow (cfs)	11	0.0	19.9	2.4	5.4	7.6
Measured Stream Flow (cfs)	8	0.4	19.9	2.7	7.5	8.2
Chemical						
Dissolved Oxygen (mg/L)	9	6.2	11.3	9.0	8.7	1.5
pH (SU)	9	6.7	7.3	7.0	7.0	0.2
Ammonia Nitrogen (mg/L)	6	< 0.007	< 0.007	0.004	0.004	0.000
J Nitrate+Nitrite Nitrogen (mg/L)	7	< 0.004	0.096	0.035	0.036	0.036
J Total Kjeldahl Nitrogen (mg/L)	6	< 0.050	0.710	0.121	0.240	0.262
J Dis Reactive Phosphorus (mg/L)	7	< 0.002	0.003	0.003	0.002	0.001
J Total Phosphorus (mg/L)	7	0.007	0.018	0.013	0.012	0.004
CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0
COD (mg/L)	7	< 2.9	7.4	6.4	5.3	2.2
J TOC (mg/L)	7	1.0	3.5	2.9	2.4	1.2
Chlorides (mg/L)	7	0.9	1.4	1.0	1.1	0.2
Sulfate (mg/L)	7	2.63	4.53	3.13	3.26	0.65
Total Metals						
J Aluminum (mg/L)	4	< 0.106	0.930	0.098	0.295	0.426
J Iron (mg/L)	4	0.135	2.330	0.664 M	0.948	0.993
J Manganese (mg/L)	4	< 0.004	0.566	0.050	0.167	0.270
Dissolved Metals						
Aluminum (mg/L)	4	< 0.106	< 0.106	0.053	0.053	0.000
Antimony (µg/L)	4	< 0.383	< 0.383	0.192	0.192	0.000
Arsenic (µg/L)	4	< 0.415	< 0.415	0.208	0.208	0.000
Cadmium (µg/L)	4	< 0.385	< 0.385	0.192	0.192	0.000
J Chromium (µg/L)	4	< 0.445	0.851	0.222	0.380	0.314
J Copper (µg/L)	4	< 0.454	0.785	0.227	0.366	0.279
J Iron (mg/L)	4	< 0.063	0.531	0.224	0.253	0.208
Lead (µg/L)	4	< 0.362	< 0.362	0.181	0.181	0.000
J Manganese (mg/L)	4	< 0.004	0.150	0.002	0.039	0.074
J Nickel (µg/L)	4	< 0.705	0.868	0.352	0.481	0.258
Selenium (µg/L)	4	< 0.505	< 0.505	0.252	0.252	0.000
Silver (µg/L)	4	< 0.478	< 0.478	0.239	0.239	0.000
Thallium (µg/L)	4	< 0.348	< 0.348	0.174	0.174	0.000
J Zinc (µg/L)	4	< 0.564	1.657	1.325	1.147	0.598
Biological						
Chlorophyll a (mg/m³)	7	< 0.10	26.70	0.41	4.06	9.98
J E. coli (MPN/DL)	7	28.8	122.3	54.8	70.0	38.5

G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68E; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68E; 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, being almost entirely forested and containing no permitted outfalls. Several recreational hiking trails run through the area. The reach is characterized by low water temperatures, and low concentrations of sediment, nutrients, and metals. The macroinvertebrate communities were rated *excellent-good* and the fish communities were rated *good* .

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