

2005 Monitoring Summary



Crooked Creek at Clay County Pine Road (33.27708/-85.67016)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Crooked Creek watershed for biological and water quality monitoring as part of the 2005 Assessment of the Alabama, Coosa, and Tallapoosa (ACT) River Basins. The objectives of the ACT Basin Assessments was to fully assess the biological integrity of each monitoring site and to estimate overall water quality within the ACT basin group.

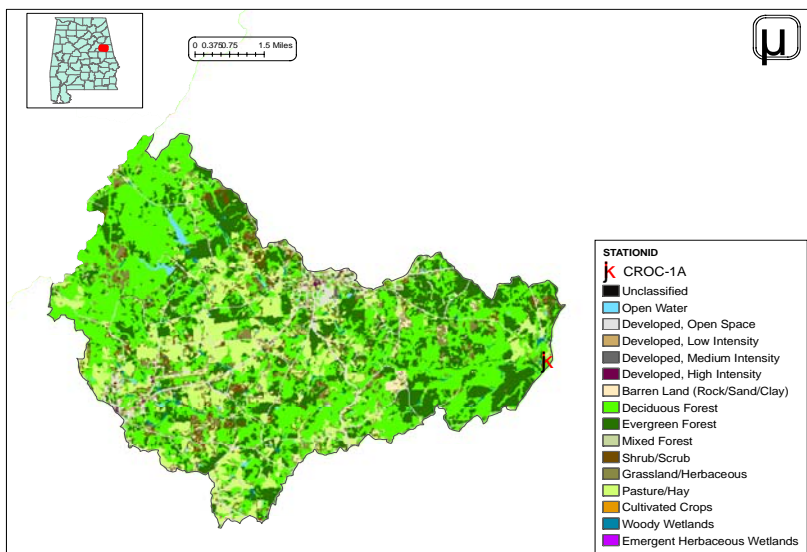


Figure 1. Sampling location and landuse within the Crooked Creek watershed at CROC-1A.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Crooked Creek is a small Fish & Wildlife (F&W) stream located near the city of Berwick (Fig. 1). Landuse within the watershed is primarily forest (66%) with pasture/hay. The presence of forest and pasture areas are characteristic of streams in the Southern Inner Piedmont (Table 1).

REACH CHARACTERISTICS

General observations (Table 2) and habitat assessments (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. Crooked Creek at CROC-1A is a high-gradient, boulder-bottomed stream in the Southern Inner Piedmont. Overall habitat quality was categorized as *optimal* macroinvertebrate community habitat.

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale. The final score is an average of the score for each metric. Metric results indicated the macroinvertebrate community to be characterized by pollution-tolerant taxa groups, indicating *poor* community condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics	
Drainage Area (mi ²)	51
Ecoregion ^a	45a
% Landuse	
Open water	1
Wetland	Woody 1
Forest	Deciduous 43
	Evergreen 23
	Mixed 1
Shrub/scrub	3
Grassland/herbaceous	7
Pasture/hay	15
Cultivated crops	
Development	Open space 5
	Low intensity <1
	Moderate intensity <1
	High intensity <1
Barren	1
Population/km ^{2b}	13
# NPDES Permits ^c	TOTAL 20
	Construction Stormwater 10
	Mining General Permit (old) 4
	Municipal Individual 3
	Underground Injection Control 3

a. Southern Inner Piedmont

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, 9 Jun 2008

Table 2. Physical characteristics at CROC-1A, May 9, 2005.

Physical Characteristics	
Width (ft)	60
Canopy cover	Mostly Open
Depth (ft)	
	Riffle 1
	Run 1.5
	Pool 2.5
% of Reach	
	Riffle 5
	Run 85
	Pool 10
% Substrate	
	Bedrock 40
	Boulder 30
	Cobble 5
	Gravel 5
	Sand 10
	Silt 6
	Organic Matter 4

Table 3. Results of the habitat assessment conducted May 9, 2005.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	80	Optimal (> 70)
Sediment deposition	79	Optimal (> 70)
Sinuosity	78	Sub-optimal (65-84)
Bank and vegetative stability	83	Optimal (≥75)
Riparian buffer	93	Optimal (>90)
Habitat assessment score	202	
% Maximum score	84	Optimal (> 70)

Table 4. Results of the macroinvertebrate bioassessment conducted May 9, 2005.

Macroinvertebrate Assessment Results			
	Results Scores		Rating
	(0-100)		
Taxa richness measures			
# Ephemeroptera (mayfly) genera	84	25	Poor (23-46)
# Plecoptera (stonefly) genera	2	33	Fair (32-49)
# Trichoptera (caddisfly) genera	2	17	Very Poor (<22)
Taxonomic composition measures			
% Non-insect taxa	8	68	Fair (49.4-74.1)
% Non-insect organisms	2	95	Good (93.9-97.0)
% Plecoptera	0	1	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	4	14	Very Poor (<20.2)
WMB-I Assessment Score	---	36	Poor (24-48)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during March through October of 2005 to help identify any stressors to the biological communities. Median values of nitrate+nitrite-nitrogen, total nitrogen, dissolved reactive phosphorus, and total phosphorous concentrations were above values expected in ecoregion 45a.

CONCLUSIONS

Bioassessment results indicated the macroinvertebrate community to be in *poor* condition. Intensive water sampling and habitat assessment results suggested nutrient enrichment to be a potential cause of the degraded biological condition.

FOR MORE INFORMATION, CONTACT:

Tonya Mayberry, ADEM Aquatic Assessment Unit
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2759 tmayberry@adem.state.al.us

Table 5. Summary of water quality data collected March-October, 2005. 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. Metals results were compared to ADEM's chronic aquatic life use criteria adjusted for hardness.

Parameter	N	Min	Max	Median	Avg	SD
Physical						
Temperature (°C)	7	13.0	25.0	21.1	20.5	4.2
Turbidity (NTU)	7	4.4	27.3	7.7	10.3	7.8
Total dissolved solids (mg/L)	7	17.0	66.0	34.0	38.9	16.2
Total suspended solids (mg/L)	7	3.0	23.0	7.0	9.7	6.9
Specific conductance (µmhos)	7	36.1	54.8	39.5	43.3	7.5
Hardness (mg/L)	4	9.0	11.6	10.0	10.1	1.1
Alkalinity (mg/L)	7	7.9	12.9	10.2	9.8	1.8
Stream Flow (cfs)	1	37.6	37.6	37.6	37.6	---
Chemical						
Dissolved oxygen (mg/L)	7	7.3	9.9	8.9	8.9	0.9
pH (su)	7	6.8	7.45	7.2	7.2	0.2
Ammonia Nitrogen (mg/L)	7	< 0.015	< 0.015	0.008	0.011	0.004
Nitrate+Nitrite Nitrogen (mg/L)	7	0.366	1.087	0.536 ^M	0.625	0.241
Total Kjeldahl Nitrogen (mg/L)	7	< 0.150	0.314	0.075	0.161	0.109
Total nitrogen (mg/L)	7	0.441	1.363	0.814 ^M	0.829	0.268
Dissolved reactive phosphorus (mg/L)	7	0.054	0.185	0.091 ^M	0.110	0.047
Total phosphorus (mg/L)	7	< 0.004	0.207	0.134 ^M	0.125	0.065
CBOD-5 (mg/L)	7	< 1.0	5.2	1.5	2.1	1.7
Chlorides (mg/L)	7	4.1	7.5	5.1	5.2	1.1
Atrazine (µg/L)	2	0.05	0.05	0.03	0.03	0.00
Total Metals						
Aluminum (mg/L)	4	0.038	0.287	0.112	0.137	0.1
Iron (mg/L)	4	0.452	0.887	0.64	0.655	0.2
Manganese (mg/L)	4	0.005	0.023	0.0063	0.010	0.0
Dissolved Metals						
Aluminum (mg/L)	4	0.012	0.169	0.0098	0.049	0.1
Antimony (µg/L)	4	< 2	< 2	1	1	0.0
Arsenic (µg/L)	4	< 10	< 10	5	5	0.0
Cadmium (mg/L)	4	< 0.005	< 0.005	0.0025	0.0025	0.0
Chromium (mg/L)	4	< 0.004	< 0.004	0.002	0.002	0.0
Copper (mg/L)	4	< 0.005	< 0.005	0.0025	0.003	0.0
Iron (mg/L)	4	0.138	0.285	0.176	0.1938	0.1
Lead (µg/L)	4	< 2	< 2	1	1	0.0
Manganese (mg/L)	4	< 0.005	0.016	0.0025	0.004	0.0
Mercury (µg/L)	4	< 0.3	< 0.3	0.15	0.15	0.0
Nickel (mg/L)	4	< 0.006	< 0.006	0.003	0.003	0.0
Selenium (µg/L)	4	< 10	< 10	5	5	0.0
Silver (mg/L)	4	< 0.003	< 0.003	0.0015	0.0015	0.0
Thallium (µg/L)	4	< 1	< 1	0.5	0.500	0.0
Zinc (mg/L)	4	< 0.006	< 0.006	0.003	0.003	0.0
Biological						
^J Chlorophyll a (µg/L)	7	0.53	11.21	1.07	2.74	3.9
^J Fecal Coliform (col/100 mL)	7	35	620	130	182	202

^J=estimate; N=# samples; M=value > 90th percentile of all data collected within ecoregion 45a