Effects of Clear Cut Logging on Benthic Assemblages in Southeastern Oklahoma

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Logging impacts streams by a) introducing sediment and logging debris, b) altering flow and temperature, c) increasing nutrient concentrations, d) altering the form and amount of organic detritus, and e) changing the rates of aquatic primary production (1). These changes are often followed by changes in the populations of benthic macroinvertebrates (2 - 4). Logging occurs on over 40,414 acres (of 4.3 million forested acres) annually in southeast Oklahoma (5). Most logging is restricted to Choctaw, LeFlore, McCurtain, and Pushmataha counties, which produce about 98% of the state's timber.

Single benthic samples were taken from 41 sites in the Little River system between 20 July and 11 August 1982 to test the hypothesis that benthic assemblages were different in areas downstream from clearcuts than from those in uncut areas. Benthic organisms were collected in riffles using a Circular Depletion Sampler with three 1-min subsamples at each site (6). Organisms captured were preserved in 10% formalin, then separated and identified to family.

The percent shredders (those that feed on particles > 10^3 μm), collectors (those that feed on particles < 10^3 μm), and predators were determined for each site. Logging activity (age 1 - 2 clearcuts) versus absence of these clearcuts was considered the treatment. Shannon Weaver benthic diversity was also correlated with the presence or absence of age 1 clearcuts upstream.

Several families, Amphipoda, Lumbriculidae, Siphlonuridae, Isopoda, Sialidae, Turbellaria, Hydroptilidae, Philopotomidae, Baetiscidae, and Tricorythidae, were prevalent in sites below age 1 clearcuts whereas Coenagrionidae, Coryduligastridae, Helicopsychidae, Hydropsychidae and Polycentropodidae were most abundant in sites that were not below age 1 clearcuts. Two mayfly families, Baetistidae and Tricorythidae, were collected exclusively at sites below age 1 clearcuts. Collectors dominated the assemblage in sites with no age 1 and/or age 2 clearcuts upstream but made up a relatively smaller proportion of the assemblage in sites below age 1 clearcuts (Figure 1). There were significant differences in number of individuals but no such significant differences in benthic familial diversity in sites below age 1 clearcuts and those without such clearcuts. Webster et al. (7), O'Neil et al. (8), and Webster and Patten (9) have suggested that benthic communities in headwater streams of forested regions are resilient. Resilience might be especially advantageous to the benthic community in our study area because of the high probability of seasonal catastrophes such as flash floods and droughts.

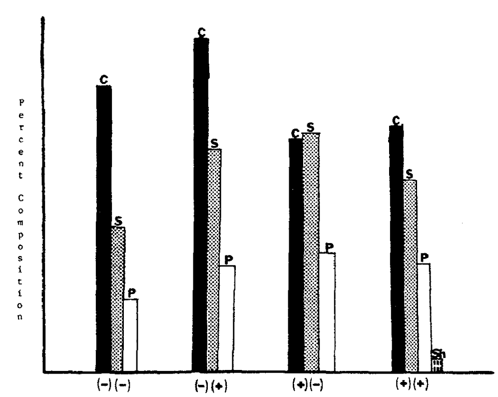

FIGURE 1. Trophic composition of downstream communities from logged and unlogged upstream sites. C = collectors, S = scrapers, P = predators and Sh = shredders. First sign shown under bars indicates presence (+) or absence (−) of an upstream clearcut of age 1; second sign indicates presence (+) or absence (−) of an upstream clearcut of age 2.

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TABLE 1. T-test comparisons of physical and biological characteristics between sites having upstream clearcuts (CC1 > 0) and sites with no upstream clearcuts (CC1 = 0) sites.

Factor	CC1 = 0 N = 15	CC1 > 0 N = 24	Significance Level
Diversity	3.16	3.34	0.200
No. of individuals	1700.67	2882.17	< 0.0005

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