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Use of an Outdoor Lab in Teaching Botany

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Mean lengths (sexes combined) for all ages I through VI were 250, 350, 385, 407, 424, and 419 mm, respectively (Table 2). The oldest white bass (419 mm) collected were age VI, and only 15% of all fish collected were older than age IV. Growth of white bass in DeGray Lake was similar to that of other Arkansas reservoirs (Table 3). First-year growth was faster in DeGray Lake; however, age I fish were represented only by sexually mature males that had migrated to the spawning areas. As noted by most investigators, females grew faster than males. Mean length of females at each age was at least 21 mm greater than that of males.

Table 1. Year class composition (percent) of white bass collected in DeGray Lake each spring, 1975-79.

YEAR OF COLLECTION	NUMBER OF FISH	YEAR CLASS								
		1970	1971	1972	1973	1974	1975	1976	1977	1978
1975	95	2.1	69.5	14.7	8.4	5.3				
1976	55		12.7	25.5	20.0	38.2	3.6			
1977	92			29.3	12.0	35.9	9.8	13.0		
1978	181			0.5	15.0	27.1	7.7	18.2	31.5	
1979	127				5.5	10.2	22.8	15.7	44.1	1.6

Table 3. Average total length of white bass from selected lakes in Arkansas.

WATER	TOTAL LENGTH (MM) AT END OF YEAR OF LIFE				REFERENCE
	I	II	III	IV	
DeGray Lake	250[1]	350	385	407	Present Study
Lake Catherine	224	305	333	368	Mulsey and Stevens, Proc. Ark. Acad. Sci. 12:17-30, 1958.
Bull Shoals Reservoir	190	332	382	420	Houser and Bryant, U. S. Fish and Wildl. Serv. Tech Paper No. 49, 11 pp., 1970.
Beaver Reservoir	216	295	355	385	Yelleyi, Ph. D. Dissertation Univ. of Ark., 193 pp., 1972.

1] Males only

Table 2. Average total length (mm, empirical data) of white bass from DeGray Lake, 1975-79.

	AGE AND SEX										
	I[1]	II		III		IV		V		VI
YEAR CLASS	M	M	F	M	F	M	F	M	F	M
1978	246									
1977	251	334	357							
1976	243	330	350	357	365					
1975	259	345	366	369	393	390	400			
1974	251	339	351	374	399	384	416	401	435	
1973		343	380	375	408	396	415	417	428	419
1972				392	415	405	427	420	438	
1971						403	427	415	433	
1970									438	
Unweighted Average Length										
By Sex	250	338	361	373	396	396	417	413	434	419
Sexes Combined	250	350		385		407		424		419

1] Only one female yearling was collected during the study.

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USE OF AN OUTDOOR LAB IN TEACHING BOTANY

Those of us who teach botany with an ecological emphasis often have difficulty in locating areas for field experiences for our classes. At the University of Central Arkansas, however, the Outdoor Lab is an ideal setting for such exercises. This Outdoor Lab is situated on the southwestern part of the campus and consists of these habitats: a wooded area, an old field or pasture (perhaps a "prairie remnant"), shrubby successional stages, and a stream. This Outdoor Lab is considered part of the UCA Campus Arboretum (Moore, 1974).

At the present time four laboratory-field exercises have been developed and are being regularly used with my General Botany classes.

The first field experience is for consciousness-raising and is primarily set up to develop an awareness of the natural plant community. The class assembles at a circle of benches set up in the midst of the wooded area. A brief introduction to the area is given—the history of its development and its function on campus. Members of the class are then given suggestions for "experiencing an ecosystem." No communication with peers or instructor is permitted. Each student is instructed to wander in the area at will or sit to listen to sounds, to see what can be seen, to smell, to feel textures of rock or bark or leaf—letting thoughts come and go at will, recording in sketches or words, or not recording, as it pleases the student. At a signal from the instructor, the group gathers back at the benches to share reactions from this experience (if they wish to do so). Discussion follows and leads into consideration of the types of organisms seen in the area; some concepts of the ecological relationships are introduced to the group. These relationships deal with the basic ecological classification of organisms into decomposer, producer, and consumer categories. Listing of those seen by members of the class (perhaps pointing out some of these, if unnoticed by the group) tends to focus thoughts on some of the ecological concepts which will later be discussed in their text.

A second lab experience deals with the decomposers—a group of organisms which tends to be under-studied in most field experiences dealing with plant communities. Near the wooded area is a place where the maintenance crew dumps leaves and other biodegradable materials from campus clean-ups. Examination of what is happening in this large "compost pile" leads naturally into discussions of cycling of materials and energy in ecosystems. Discussions dealing with organisms involved, processes of metabolism, end-results, availability of materials and energy, and related questions can become quite lively and productive. Questions dealing with decomposition of organic materials, or composting, include: Does the decomposition of certain kinds of leaves (oak, pine, maple, elm) change the pH of the soil? How long does decomposition take? Is the process speeded by use of commercially available preparations? Can chemical fertilizers be used? Are aerobic or anaerobic conditions "better"? Students can usually add many questions, and they contribute to designing experiments by which some of these questions can be tentatively answered. The fact that these experiments usually use containers which are being recycled (such as half-gallon milk cartons) adds to the development of the concept of recycling. Setting up these experiments which they have designed has enabled these students to apply the scientific method of investigation to a problem in which they are interested, and recycling materials and energy has been emphasized. If the group can be encouraged to see the value of recycling other materials such as aluminum cans and see some glimpse of the relationship of such recycling to plants and plant communities, then more of the total material-energy picture can be included in discussions.

The third Outdoor Lab experience deals with the traditional sampling methods by which plant communities can be described. The botany students have had some experience in keying out trees on other parts of the campus arboretum, using Moore (1972); hence, they are able to identify the trees within the wooded area of the Outdoor Lab rather quickly. During the laboratory period, the modified point-quarter method (Smith, 1980) is used in sampling of the trees. The plant community is named in terms of the importance values assigned to the trees, a value based on the percentages of dominance, frequency, and density of the trees. Discussion of other sampling possibilities enables the students to form some concepts dealing with the techniques of quantifying other aspects of the ecosystem.

During the fourth session, the emphasis is on the time-space relationships of this plant community with others. Succession is observed in the various seral stages present in a proposed Nature Reserve, an area extending beyond, yet included in the Outdoor Lab area. Back at the bench circle, a discussion of relationships in time and space of these examples of plant communities with the worldwide view is usually quite rewarding. This discussion includes looking at a sheet dealing with activities relating to lifestyle, including hobbies and work, as these activities relate to the environment (in terms of polluting or maintaining it), to the economy and energy (in terms of cost and use of materials and energy), and to each student. Hopefully, the discussion which follows will spark some questions dealing with each student's relationship to the whole and thoughts concerning the student's reactions to these basic problems. Is the grassy community really "a prairie remnant"? If so, does that make it more valuable as part of a Nature Reserve or Outdoor Lab for the UCA campus? How can it be preserved and yet used to best advantage? Should students be concerned about the environment? about plant communities? about recycling materials? about energy shortages and alternative sources? These questions, hopefully, change to the more valuable and life-long questions for each student: What concerns do I have about these things? and what can I do about these concerns?

Having the Outdoor Lab on the UCA campus has been a most valuable asset for teaching these ecological concepts to various classes. With the increased emphasis on environmental education in our state and the development of outdoor-lab facilities in the various public school systems in Arkansas, it becomes even more important that the colleges and universities develop such on-site facilities for students. Students in general, not just the botany students, need to receive training in environmental awareness, to develop a knowledge of some of the relationships and dependencies on our "Spaceship Earth", in order to become part of the solution to problems and not part of the problems.

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AN INVESTIGATION OF THE STREAMBED OXYGEN DEMAND OF FOURCHE CREEK, PULASKI COUNTY, ARKANSAS

In recent years Fourche Creek has been the site of numerous investigations (ADPC&E, 1974a,b; Bryant and Terry, 1979; U.S. Army CoE, 1972). The stream has a history of consistently low D.O. values. Previous five-day BOD's collected indicated that neither the carbonaceous nor nitrogenous demand, nor a combination of the two, was sufficient to account for the low D.O. concentrations measured (ADPC&E, 1974a).

In a modeling report by Bryant and Terry (1979), it was hypothesized that the benthic deposits exerted a significant demand on the oxygen in the overlying water. The primary purposes of this study were to compare S.O.D. values derived experimentally with those derived from the model and, if possible, define the effects on the stream's ecosystem.

Fourche Creek extends 30 miles (48.6 km) from its sources in northeastern Saline County, Arkansas, to its confluence with the Arkansas River in Pulaski County. The sources lie in the eastern edge of the Ouachita Mountains at an elevation approximately 600 feet above mean sea level (Fig. 1). Figure 2 is a schematic diagram of the Fourche drainage showing locations of tributaries and major municipal and industrial effluents relative to its confluence with the Arkansas River. The main stem also receives runoff from springs, timberland, pastureland and residential areas (USACE Environmental Assessment Report, 1972). Table 1 contains data regarding the sampling sites.

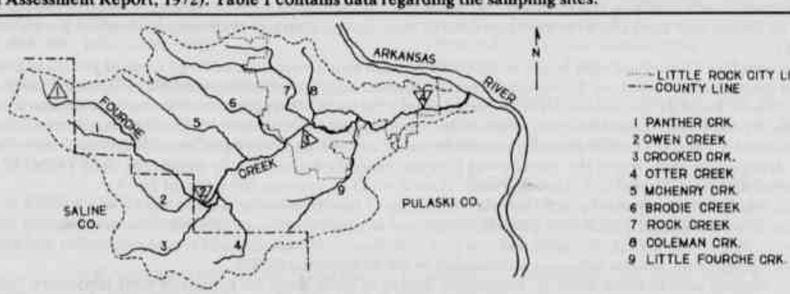

Figure 1. Map of Fourche Creek drainage showing sampling sites and major tributaries.

