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STUDIES OF THE CONTENT AND PROCESS OF ENVIRONMENTAL EDUCATION

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By

VICKIE LYNN WOLFE
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STUDIES OF THE CONTENT AND PROCESS OF
ENVIRONMENTAL EDUCATION

A Dissertation APPROVED FOR THE
SCHOOL OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE

BY

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Preface

In a keynote address delivered in January 2000, author Daniel Quinn told the 2000 Houston Youth Environmental Leadership Conference,

> Here is Quinn's Second Law: What people think is what they do. And its corollary: To change what people do, change what they think. At the present time, there are six billion people on this planet pursuing a vision that is devouring the earth. That's our problem . . . Our problem is a world-devouring vision that six billion people are pursuing.
>
> Now what can we do about this vision? We can't legislate it away or vote it away or organize it or even shoot it away. We can only teach it away. If the world is saved, it will be saved by people with changed minds, people with a new vision. . . . That's our path of hope for the future.

It is my contention that environmental education should be on an equal footing with universally accepted components of the educational process, such as writing. This dissertation is focused on two fundamental components of environmental education: 1) content, i.e., what is taught, and 2) process, i.e., the activities through which the content is learned.

I have focused primarily on environmental education at the college level because most the people who have the greatest potential for influencing the future health of the planet are college graduates: executives in business and industry, politicians, and teachers, for example. It is not, however, my contention that environmental education at the college level is more important than it is at the K-12 level.

Prior to this research, there had been no examination of the extent to which environmental and sustainability issues are, or may be, a part of the education of students in non-"environmental" majors at colleges and universities in the U.S., nor of the various mechanisms by which college students in non-"environmental" majors may be educated about these issues. In addition, to my knowledge there has been no prior attempt to examine the various ways in which higher education institutions reach out to K-12 students in the area of environmental education, nor to examine the various issues relevant to such outreach.

Chapter One examines two questions: "To what extent are environmental and sustainability issues a part of the education of students in non-'environmental' majors at baccalaureate-granting institutions in the U.S.?" and "By what *mechanisms* are these students educated about the environment?" It seemed that the best avenue for finding answers to these questions was to survey institutions' Chief Academic Officers—i.e., their Provosts or Academic Vice Presidents. I therefore developed a questionnaire which was sent to the Chief Academic Officers at 1172 baccalaureate-granting institutions in the U.S. Responses were received from 492 institutions.

A few respondents to the survey that forms the basis for Chapter 1 related efforts by their institutions to enhance environmental education at the K-12 level; this prompted me to explore this area further. In Chapter Two, I examine the possibilities for and impediments to the enhancement of K-12 environmental education by higher education institutions. Information for this study was obtained from programs' websites, from the profiles and syllabi posted on www.secondnature.org, and through correspondence with representatives of the various programs. This chapter has implications for both content and process. Higher education institutions can enhance K-12 environmental education by including environmental and sustainability issues in the education of teachers, as well as through various types of direct outreach to K-12 students.

Chapter Three is focused primarily on content: I surveyed people in six professions in an attempt to gain insight into the level of "technical" knowledge needed to understand the environmental issues relevant to those professions. The professions were journalists, elementary school teachers, legislators, engineers, geologists and managers in petroleum-related firms. Results of this study are relevant to general as well as environmental education.

In Chapter 4 I make recommendations for actions that could be taken by colleges and universities in order to help ensure that their graduates are adequately educated about environmental and sustainability issues. The final chapter is a recommended research plan for evaluating the effects of particular learning activities on students' attitudes toward the environment and knowledge of environmental issues.

Studies of the Content and Process of Environmental Education

Chapter 1

Environmental Education of Students in Nonenvironmental Majors at Four-Year Institutions in the U.S.

Abstract

In order to examine the extent to which four-year institutions in the U.S. provide for the environmental education of students in nonenvironmental majors, and to identify various approaches to increasing environmental literacy at the college level, chief academic officers at these institutions were surveyed electronically. Of the 496 responding institutions (representing a 42.3 percent response rate), 11.6 percent indicated that an "environmental literacy" course was required of all students, and 55.0 percent reported that such a course was available and countable toward the institution's general education requirements. At least one "environmental" minor (e.g. Environmental Science, Environmental Studies) was offered at 33.7 percent of the institutions. Thirty-nine percent reported the existence of an "environmental" academic program that offered a course appropriate for non-majors.

Various approaches to achieving environmental literacy at the college level are discussed, as are statistical differences in survey responses 1) among Carnegie classifications, from Research to Baccalaureate; 2) between public and private institutions; and 3) among geographical regions. Generally, proportions of positive responses were greater among Research institutions than among the other Carnegie categories, and among public than private institutions. In regional comparisons,

proportions of positive responses were significantly lower in the Central/South Central region than in the Northeast, North Central and Western regions.

Introduction

If we subscribe to the premise that a major purpose of education should be to provide people with the knowledge and skills to allow them to function as responsible citizens, it is obvious that environmental education is an essential component. Current problems are of a magnitude that has not been faced previously, e.g.

- Global warming, caused by greenhouse gases, has the potential to alter life on earth for centuries to come in terms of climate, sea level, and possibly a number of indirect ways which have not yet been conceived;
- A billion people are being added to the earth's population approximately every 12 years; and
- People in developed countries are consuming the earth's resources at a rate that is far beyond that which is sustainable: for instance, scientists at the University of British Columbia have estimated that four additional planets would be required if every person on earth consumed at the same rate as the average American (Taylor, 1999, as cited in Braus, 1999).

Roth (1992) offers several definitions of "environmental literacy" (EL), including "The environmentally literate have a knowledge of issues, knowledge of action strategies, a strong internal center for their locus of control, positive attitudes and a strong sense of responsibility" (Hungerford, Peyton and Wilke, 1981, as cited in Roth, 1992, p. 9). In the same monograph, Roth (1992) says,

> Much of the environmental degradation that has occurred in the past, and continues today, is the result of the failure of our society and its

> educational systems to provide citizens with the basic understandings and skills needed to make informed choices about people/environmental interactions and interrelationships. Environmental degradation is often the result of thoughtless activity of most economic systems operative today (p. 1).

A 1998 survey conducted by Roper for the National Environmental Education and Training Foundation validated this assertion in that it revealed persistent misconceptions in the U.S. with respect to the environment. For example, only 27 percent of Americans know that most electricity in the U.S. (70 percent of total production) is produced by burning coal and other flammable materials; rather, a majority believes that energy is produced in ways that produce no air pollution, mostly by hydroelectric generation, which in fact provides only about ten percent. Further, 47 percent think the most common form of surface water pollution is waste dumped by factories, and another 15 percent of Americans think garbage dumping by cities is the primary cause of water pollution. Only 22 percent know that run-off is the most common form of surface water pollution (National Environmental Education and Training Foundation/Roper Starch, 1998).

In a 1994 essay, David Orr suggested that the "ignorant and uneducated" are not primarily to blame for the environmental crisis. Rather, he said, it is the work of degree-holding individuals who have been indoctrinated with the notion that domination of nature is the rightful destiny of humans. He contended that solutions to ecological challenges would require reconsideration of the "substance, process, and purposes of education at all levels" (p. 44). Brough (1994) warned that, without continued changes within higher education, most college students will graduate "with only a shallow knowledge of the planet that sustains them" (p. 37).

The 1998 edition of Peterson's Guide to Four-Year Colleges lists more than 983 programs in institutions offering majors in environmental science, environmental studies, or related subjects. However, the extent to which colleges and universities educate students in other majors about the environment is unknown. Coppola (1999) points out that specialized environmental programs reach only a minority of undergraduates, and contends that "Students who do not major in environmental sciences or studies or who do not elect an environmental course will miss an opportunity for developing responsible behavior toward human and nature relationships" (p. 39).

Nickerson (1994) stated that universities had

> come to realize that all students, not only those interested in science-based environmental studies, must become environmentally literate, in the same way that all students must understand math and science even if they don't major in, or even enjoy, these subjects . . . all have a need to be sufficiently acquainted with science to discharge their obligations as citizens by making rational, environmentally sound decisions (pp. 49-50).

Prior to this research there had been no attempt to comprehensively examine the extent to which students in non-environmental majors at four-year colleges and universities in the U.S. are required to, or given opportunities to, learn about the environment. The objectives of this research were 1) to examine the extent to which students in non-environmental majors at four-year colleges and universities in the U.S. are a) being required to learn about the environment, or b) being given opportunities to do so; 2) to examine the methods by which students in non-environmental majors are educated about the environment; and 3) to determine whether differences exist among various categories of institutions (public vs. private; Carnegie classifications; and geographical regions) with respect to environmental education of students in non-environmental majors, and if so whether these differences were meaningful.

Methods

It was assumed that an institution's Chief Academic Officer (CAO), or someone on his/her staff, would be the person most knowledgeable about the institution's curriculum. CAOs at 1172 of the approximately 1400 institutions in the Carnegie classifications defined in Table 1 were therefore asked to complete a questionnaire pertaining to the environmental education of students in non-"environmental" majors at their institutions. The questionnaire was sent by electronic mail to all CAOs whose e-mail addresses were listed on a mailing list purchased from Higher Education Publications, Inc., Falls Church, VA. A small number of questionnaires were sent via surface mail; in all, the questionnaire was sent to 1172 institutions. In many cases the questionnaire was forwarded by the CAO to another person for completion.

Table 1. Definitions of Carnegie Classifications

Classification	Definition (average enrollment)
Research	Award at least 50 doctoral degrees annually; receive at least $15.5 million annually in federal support. (18,565)
Doctoral	Award at least ten doctoral degrees annually in three or more disciplines, or 20 or more in one or more disciplines. (11,926)
Master's	Award 20 or more master's degrees annually in one or more disciplines. (5524)
Baccalaureate	Award fewer than 20 master's degrees annually. (957)

Note. In this study no differentiation was made between level I and level II of each Carnegie classification; for more detailed definitions of these classifications please refer to www.carnegiefoundation.org.

Development of the Questionnaire

"Environmental literacy" (EL) was defined in the cover letter as "a basic understanding of the concepts and knowledge of the issues and information relevant to the health and sustainability of the environment, as well as environmental issues related to human health." The questionnaire is shown in Appendix A. Since the most common mechanisms by which college students become educated about subjects outside their majors are a) general education courses, b) elective courses in other departments, and c) minors, the most relevant questions for determining the extent to which institutions attempt to increase students' EL, or at least make available opportunities for increasing students' EL, seemed to be 1) "Is an EL course part of the institution's general education curriculum?" and 2) "What environment-related curricular offerings are available?" With respect to the former, the questionnaire asked a) whether an EL course was a requirement in the institution's core curriculum, and b) whether such a course was an option in the core curriculum. Respondents who answered "yes" to either of these questions were asked the name of the course(s) and the name of the department(s) offering them.

Since it seemed that environmental academic programs (e.g. environmental studies, environmental science) were the most likely place in the curriculum for environment-related "electives" available to non-majors, the questionnaire asked what, if any, "environmental" academic programs existed at the institution, and whether the program(s) offered courses a) appropriate or b) designed for non-majors. Additionally, respondents were asked whether an "environmental" minor was offered. The final question asked respondents to relate anything related to their institutions' approach to EL that had not been covered in prior questions.

Nominal-level questions (i.e., those which were answered simply "yes" or "no") asked whether the institution's general education curriculum included an EL course as a requirement or an option, and whether an "environmental" minor was offered. Respondents were also asked whether an "environmental" academic program (e.g. environmental science, environmental studies, etc.) existed, and if so whether it offered a course a) appropriate, or b) designed for non-majors. All such questions were phrased positively, e.g. "As part of this institution's core curriculum, all students are required to take one or more courses specifically intended to increase their "environmental literacy."

Further explanation may be in order regarding inclusion of the question regarding the existence of an environmental department which offered a course "designed" for non-majors. Two assumptions led to this question's inclusion in the survey. The first was that an "introductory" course or courses designed to provide a foundation for students majoring in that particular discipline may not be the ideal vehicle for providing some "literacy" in that discipline to students majoring in other fields. For example, Chinnici and Hiley (1998) report recognition of this reality by science faculty at Virginia Commonwealth University; the solution was the development of a selection of science courses designed specifically for the general education curriculum. Further, the Carnegie Foundation (1977) writes,

> Breadth or distribution requirements are too often . . . met by the introductory course intended for persons who plan to major in the field . . . We suggest special courses for nonmajors . . . (p. 12)
>
> One way to improve that part of general education that is drawn from the subject fields is to develop for each one an introductory course for nonmajors . . . In making this suggestion, we are aware that there is

widespread criticism of what are often called "survey courses." It is true that when they are badly handled introductory courses deteriorate into superficial 'appreciation' courses. We do not believe, on the other hand, that the flaw is in the concept. The flaw is in execution, which, in turn, is subject to college control (pp. 12, 170).

The second premise that led to inclusion of this question in the survey was that academic units (i.e., departments, schools, etc.) should take seriously the need to impart, at a minimum, "conversational" knowledge of their disciplines to students in other majors who enroll in their courses either as electives or to satisfy general education requirements; indeed, that the education of such students should be a primary goal of academic units and that outreach to the student body at large should be a part of the unit's agenda.

Data Analysis

Responses to nominal-level questions were analyzed for statistically significant differences at the $\alpha = 0.05$ level between public and private institutions; among Carnegie classifications; and among geographical regions. Geographical regions are shown in Figure 1. The regions were selected after survey responses were received and were arranged so as to 1) include states that were contiguous, and 2) include a statistically significant number of responses (i.e., approximately 30) from both public and private institutions.

The statistical methods used were those outlined in Mendenhall and Sincich (1995) for determining a confidence interval for a binomial proportion, and for testing the difference between two binomial proportions. The methods assume an approximately normal sampling distribution, which was satisfied by the data reported herein. Statistical methods are shown in detail in Appendix B. PC-SAS was used to analyze for statistically significant differences in responses by Carnegie classification across geographical regions by a two-way non-parametric ANOVA (analysis of variance) on the Wilcoxon rank sums. Wilcoxon rank sums are obtained by sequentially ranking parameter measurements of two combined samples, then re-separating the samples and summing each one's rank scores. ANOVA is a statistical procedure for determining the source(s) of variation in a data set.

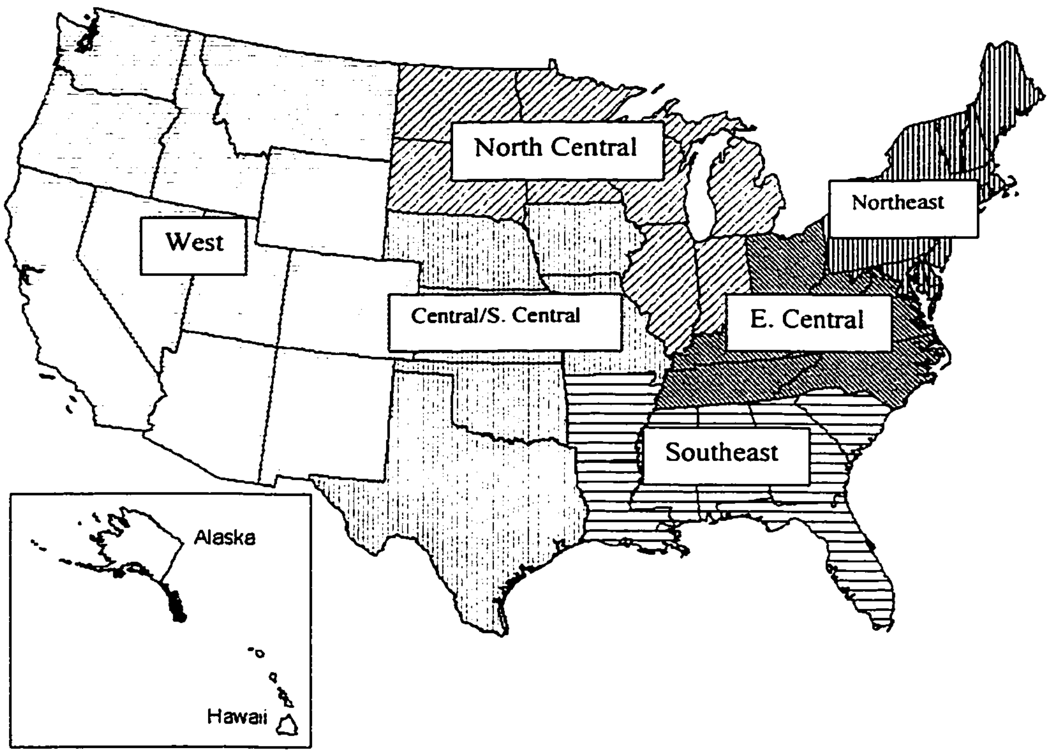

Figure 1. Geographical regions used for data summarization and analysis.

Results and Discussion

Four hundred ninety-six of the 1172 institutions responded, representing a response rate of 42.3 percent. Response rates broken down between public and private institutions, among Carnegie classifications and among geographical regions are shown in Table 2. Table 3 shows response rates by Carnegie classifications within regions. Collated responses to open-ended questions are located in Appendix C. The sections that

Table 2. Survey Response Rate, by Carnegie Classification and Region

Classification/ Region	Public			Private			Total		
	Sent	Rec'd	%	Sent	Rec'd	%	Sent	Rec'd	%
Carnegie Classification									
Research	84	44	52.4	40	20	50.0	124	64	51.6
Doctoral	64	25	39.1	41	18	43.9	105	43	41.0
Master's	240	92	38.3	194	69	35.6	434	161	37.1
Baccalaureate	82	39	47.6	427	189	44.3	509	228	44.8
Total	470	200	42.6	702	296	42.2	1172	496	42.3
Region									
Northeast	101	32	31.7	209	94	45.0	310	126	40.6
East Central	72	34	47.2	126	51	40.5	198	85	42.9
Southeast	77	30	39.0	74	33	44.6	151	63	41.7
Central/S. Central	68	27	39.7	98	37	37.8	166	64	38.6
North Central	70	40	57.1	109	50	45.9	179	90	50.3
West	82	37	45.1	77	29	37.7	159	66	41.5
Total	470	200	42.6	693*	294*	42.4*	1163*	494*	42.5*

*Puerto Rican institutions were not included in the regional figures.

Table 3. Survey Response Rate, by Carnegie Classification within Regions

Region	Research			Doctoral			Master's			Baccalaureate		
	Sent	Rec'd	%	Sent	Rec'd	%	Sent	Rec'd	%	Sent	Rec'd	%
Northeast	35	14	40.0	27	13	48.2	117	40	34.0	130	59	40.8
East Central	15	8	53.3	16	7	43.8	53	21	40.0	114	49	43.0
Southeast	16	9	56.3	13	5	38.5	59	22	37.0	63	27	42.9
North Central	14	8	57.1	16	8	50.0	71	30	42.0	78	44	56.4
Central/South Central	13	9	69.2	14	2	14.3	67	23	41.2	72	30	38.6
West	29	15	51.7	19	8	42.1	66	25	38.0	45	18	41.5

follow discuss responses to questions about an EL course(s) in institutions' general education curricula; "environmental" academic programs offering course(s) appropriate for or designed for non-majors; the existence of "environmental" minors; and other approaches to EL. Core requirements are discussed first.

Core Requirement

Survey respondents were asked to indicate whether or not the following statement applied to their institutions: "As part of this institution's core curriculum, all students are REQUIRED to take one or more courses specifically intended to increase their "environmental literacy." Figure 2 shows proportions of positive responses between public and private institutions, among Carnegie classifications, and among geographical regions. In all graphs, error bars represent a 95 percent confidence interval.

A total of 11.6 percent of responding institutions indicated this statement was true of their institutions. The small proportion of respondents reporting such a requirement is not surprising, in light of a 1989 study of graduation requirements which concluded that over 90 percent of the nation's colleges and universities allow students to fulfill general education requirements by selecting from lists of courses rather than by taking prescribed courses (Toombs et al., 1989). Overall, the proportion of private institutions responding positively (14.5 ± 6.8 percent) was more than double the proportion of public institutions that did so (7.0 ± 4.4 percent); the difference between public and private institutions was statistically significant at the $\alpha = 0.05$ level ($z = 2.578$). This might be simply a function of a greater affinity generally among private institutions for core curricula over distribution requirements; this is speculation, however.

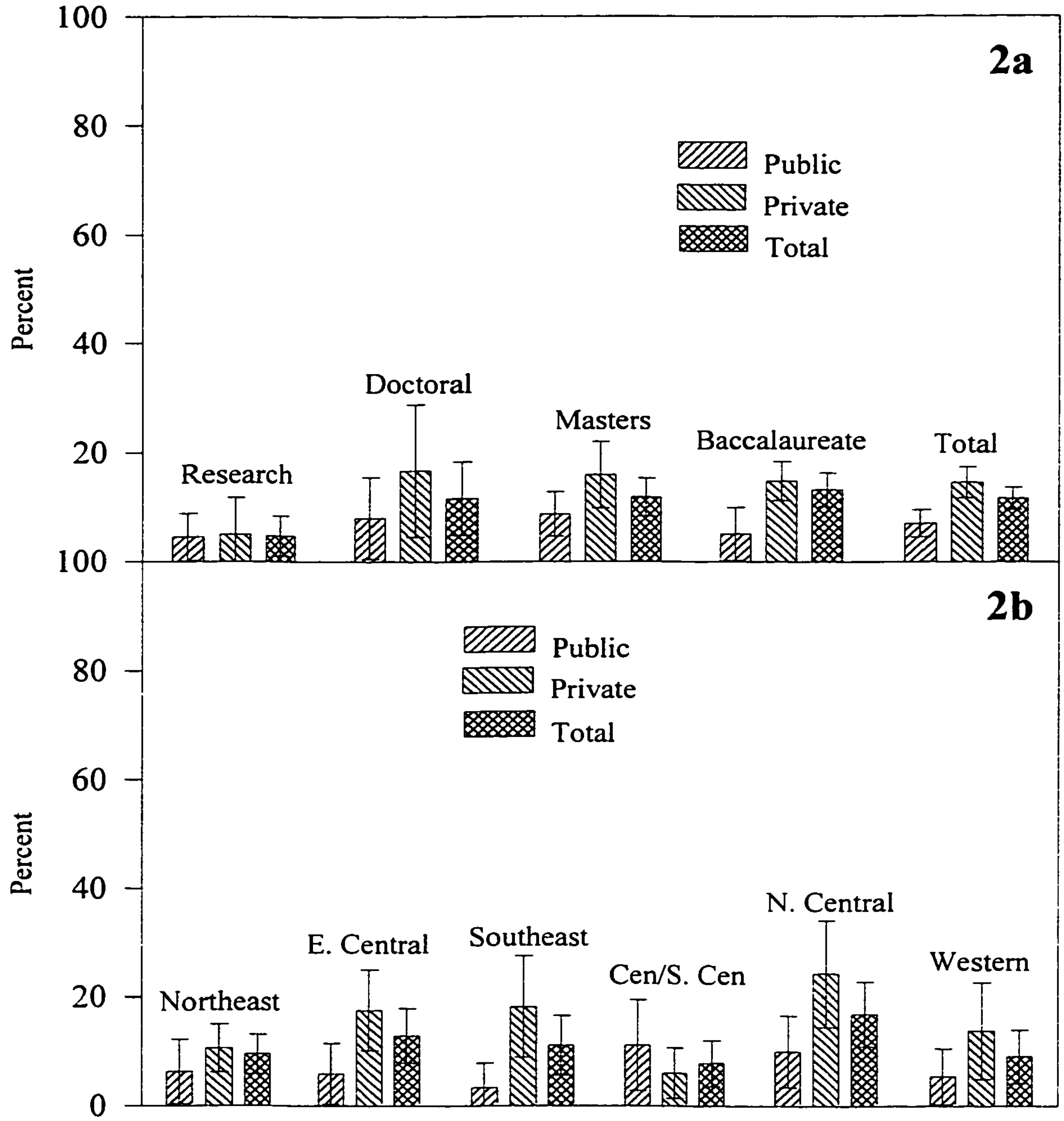

Figure 2a and 2b. Proportions of institutions indicating an "environmental literacy" core requirement, by Carnegie classification (a) and region (b). Error bars represent a 95 percent confidence interval.

Coppola (1999) suggests that EL can be achieved for all graduates only by a general education requirement; and Collett and Karakashian (1996a) write, "It is our conviction that within the next decade a graduation requirement in environmental literacy, championed by student activists, will be common in higher education, along with full majors in environmental studies" (p. 3). In another essay (1996b), the same authors contend that a "general-education requirement in environmental literacy . . . is the best way to make sure that all students become educated about the biosphere" (pp. B1-B2).

Two respondents whose institutions' general education requirements do include an EL course indicated that this approach has been successful; the first was a public Doctoral institution, the second a private Master's institution:

> Under a grant from the Environmental Protection Agency, we developed the course Society, Technology, and Environment as part of our core required curriculum. A textbook--Environmental Protection--has been published and is widely available, and our experiences with the curriculum have been published in peer-reviewed journals. I believe that our approach has been very, very successful for our students (N. Elliot, personal communication, November 23, 1999).

> When our evening program was developed in 1991 the science requirement was limited to the Ecology and Environment course. This course is described in the catalog as follows:
> "Ecology and the Environment: Crises and Conflicts (3 units). Investigation of ecological principles involved in human relations to and interaction with the environment. Emphasis is given to political and economic aspects involved in the solution of environmental problems. A number of laboratory/field problems are studied."
> This has been a very popular course and students have indicated that their lifestyles have been positively impacted by this environmental study. (D. Lucy, personal communication, November 16, 1999)

Two other respondents expressed the opposite opinion of this approach, however:

> We feel that the best way to promote env. literacy is to offer compelling courses oriented toward environmental issues. Students are

> drawn to these because of interest and reputation, **NOT** because the courses are required! Requiring students to take courses results in a disinterested student audience and lowered quality of interactions in the classroom. (G. Ellmore, personal communication, October 26, 1999)
>
> We feel that requiring environmental literacy courses is a heavyhanded strategy likely to backfire. Instead, we offer a rich program that students can sample and sponsor many on-campus events to raise the general level of environmental understanding. (E. C. Everbach, personal communication, November 8, 1999)

Finally, one respondent from a Research university in the south central U.S. raised the issue of resource availability in such curricular decisions:

> We have a course but to expand it into the realm of being required would require new resources to have enough faculty to teach this course to all of the new students that matriculate yearly. (J. D. Vitek, personal communication, October 30, 1999)

The validity of the points made in the last three quotes is not questioned. Suppose, however, that the concept of an EL course among an institution's general education requirements is compared with most institutions' requirement that all students complete one or more writing courses. The importance of college graduates' ability to write well is so universally accepted that it is doubtful that anyone would contend that requiring students to take writing courses is "a heavyhanded strategy likely to backfire," or that lack of resources precludes such a requirement. Is it any less important for students to understand the gravity of current environmental problems than it is for them to be able to write? Since future generations' quality of life on this planet, and the ability of many species to even survive on this planet, hangs in the balance, I would argue that the answer is "no." The provision of adequate resources for a general education requirement in EL should be as high a priority as the provision of adequate resources for a writing requirement.

General Education Option

As noted earlier, at most institutions students are allowed to fulfill general education requirements through courses chosen from a menu rather than through courses designated as requirements. Figure 3 depicts proportions of responding institutions indicating the statement, "All students are NOT required to take an 'environmental literacy' course as part of this institution's core requirements; however, such a course is AVAILABLE and may be counted toward the fulfillment of general education requirements" was true of their institutions. In this case, a statistically significant difference was seen at the $\alpha = 0.05$ level between public (75.0 ± 9.0%) and private (50.0 ± 15.5%) Research institutions ($z = 1.974$). In addition, there was a statistically significant difference between the proportion of public Research institutions responding positively and the proportion of either public Master's (57.6 ± 7.1%; $z = 1.968$) or public Baccalaureate (41.0 ± 10.9%; $z = 3.14$) institutions that did so. This could be simply a function of more diverse curricula at larger institutions.

Regionally, a statistically significant difference at the $\alpha = 0.05$ level was seen between the total proportion of positive responses in the Central/South Central region (42.9 ± 7.8%) and that in both the Northeast (61.1 ± 6.0%; $z = 2.53$) and North Central (61.0 ± 7.7%; $z = 2.26$) regions. The proportion of positive responses among public institutions in the Western region (70.3 ± 10.4%;) was also greater than that in the Central/South Central region (44.4 ± 13.3%) by a statistically significant margin ($z = 2.08$). This is part of a trend that will be discussed in the summary: generally speaking, there were lower proportions of positive responses in the Central/South Central region than in any other. Finally, there was a statistically significant difference between the

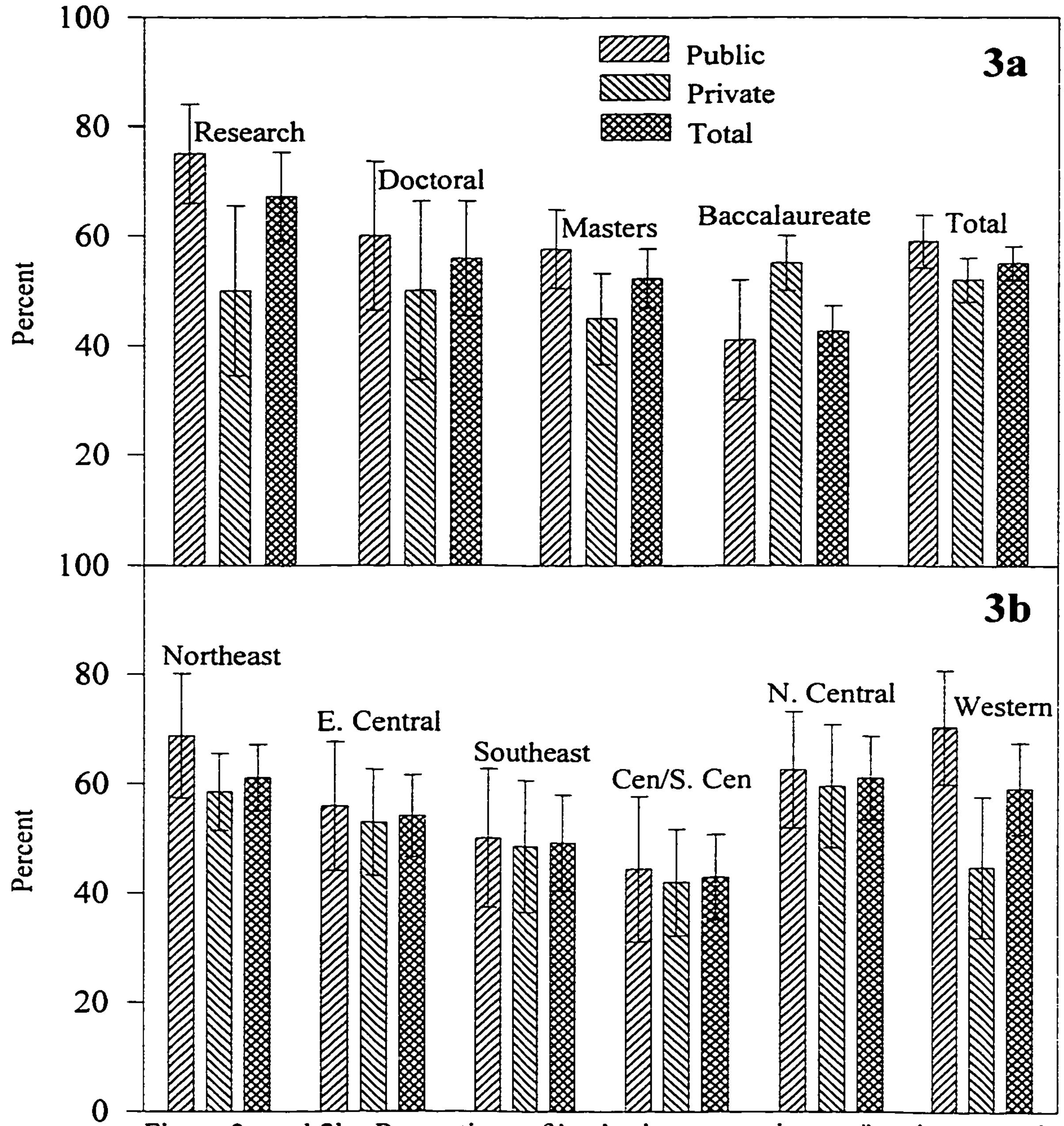

Figure 3a and 3b. Proportions of institutions reporting an "environmental literacy" core option by Carnegie classification (a) and region (b). Error bars represent a 95 percent confidence interval.

proportion of positive responses in public (70.3 ± 10.4%) vs. private (44.8 ± 12.8%) institutions in the Western region ($z = 2.09$).

Course "Appropriate" or "Designed" for Increasing EL

As stated in the Methods section, because it seemed that environmental academic programs (e.g. environmental studies, environmental science) were the most likely place in the curriculum for environment-related "electives" available to non-majors, respondents were asked what, if any, "environmental" academic programs existed at their institutions, and whether the program(s) offered courses a) "appropriate" or b) "designed" for non-majors.

"Appropriate" Course. The proportions of institutions that indicated the existence of an academic program that offered a "course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose" are shown in Figure 4. Statistically significant differences at the $\alpha = 0.05$ level were seen between the total proportion of Research institutions (54.7 ± 8.6%) and the total proportion of Master's institutions (36.0 ± 5.2%) responding positively ($z = 2.57$), as well as the proportions of public Research (56.8 ± 10.3%) and public Baccalaureate institutions (25.6 ± 9.7%) that did so ($z = 2.87$). Again, these results could be simply a function of more diverse curricula at larger (i.e., Research) institutions, including a greater likelihood that "environmental" programs may exist at larger institutions.

Regionally, among public institutions, the proportion of institutions responding positively in the Southeast was less than that in each of the five other regions by a statistically significant margin ($z \geq 2.08$). Could these results be indicative of a lower level of environmental concern in the South? Perhaps so, when one also considers that,

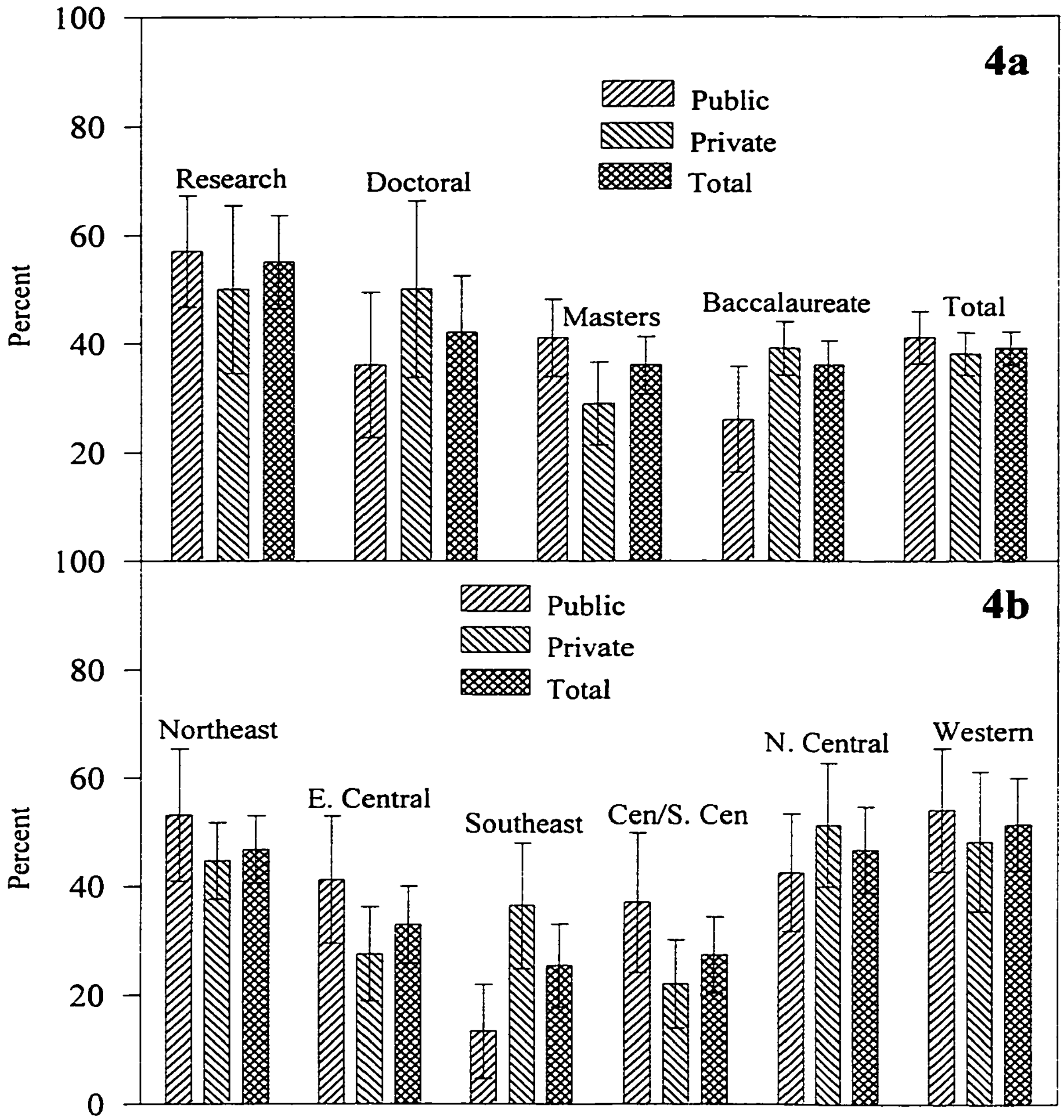

Figure 4a and 4b. Proportions of institutions indicating the existence of an "environmental" program offering a course "appropriate" for non-majors, by Carnegie classification (a) and region (b). Error bars represent a 95 percent confidence interval.

according to Segrest (1997), a group of southern states that includes all the states in the present study's "Southeast" Region except Mississippi is responsible for nearly half (47 percent) the United States' annual carbon dioxide emissions. Obviously, residents of southern states make greater use of air conditioning than the residents of many other states; yet per capita CO_2 production in Arkansas is greater than that in Florida (Segrest, 1997; Demographia, 2000), whose climate is warmer than that of Arkansas. This suggests that air conditioning use may not be the only relevant factor.

Among private institutions, the proportions responding positively in the Northeast (44.7 ± 7.1%) and North Central (51.4 ± 11.4%) regions were greater than those in the Central/South Central (22.0 ± 8.1%) and East Central (27.5 ± 8.7%) regions by margins that were statistically significant at the $\alpha = 0.05$ level ($z \geq 2.04$). As well, the proportion of positive responses in the West (48.5 ± 12.9%) was greater than that in the Central/South/Central region by a statistically significant margin ($z = 2.42$).

When regions were compared by Carnegie classification, the *p* value for Doctoral institutions approximated 0.05, indicating a significant difference among the regions as a group. The largest proportion of positive responses for Doctoral institutions was seen in the Northeast; the smallest was seen in the Central/South Central region. The *p* value among regions for Research institutions also approximated 0.05, indicating a significant difference among the regions as a group. The largest proportion of positive responses for Research institutions was seen in the West; the smallest in the Southeast.

"Designed" Course. Proportions of institutions indicating the existence of an academic program that offered a "course DESIGNED to increase the environmental literacy of non-environmental majors" are shown in Figure 5.

As indicated in the Methods section, this question was included in the survey on the assumption that one role of an "environmental"—or, for that matter, nearly any academic department—should be to impart fundamental knowledge of their discipline to students in other majors. One respondent indicated that educating the larger campus community is a goal of his institution's Environmental Studies department:

> By creating a department of Environmental Studies in 1998, Emory College and Emory University made a statement that environmental literacy should be a component of undergraduate education. Developing that literacy of the Emory community is a programmatic goal of the Department of Environmental Studies. (L. Gunderson, personal communication, December 14, 1999)

A statistically significant difference was seen between the proportion of total Research institutions responding positively to this question (46.9 ± 8.6%) and that of total Doctoral institutions that responded positively (27.9 ± 9.5%; $z = 1.97$). Among public institutions, the proportion of Research institutions responding positively (50.0 ± 10.4%) was greater than the proportion of both Master's (26.1 ± 6.3%; $z = 2.76$) and Baccalaureate (20.5 ± 9.0%; $z = 2.79$) institutions that did so by a statistically significant margin.

Regionally, the total proportion of positive responses in the Central/South Central region (16.9 ± 5.9%) was less than that in the North Central (40.0 ± 10.7%; $z = 3.37$) and Western (40.5 ± 8.4%; $z = 2.24$) regions by a statistically significant margin. The proportion of private institutions reporting the existence of such a course in the Central/South Central region (18.0 ± 7.5%) was less than that in the Northeast (34.0 ± 6.8%; $z = 2.03$) and Western (44.8 ± 12.8%; $z = 2.56$) regions by margin that was statistically significant.

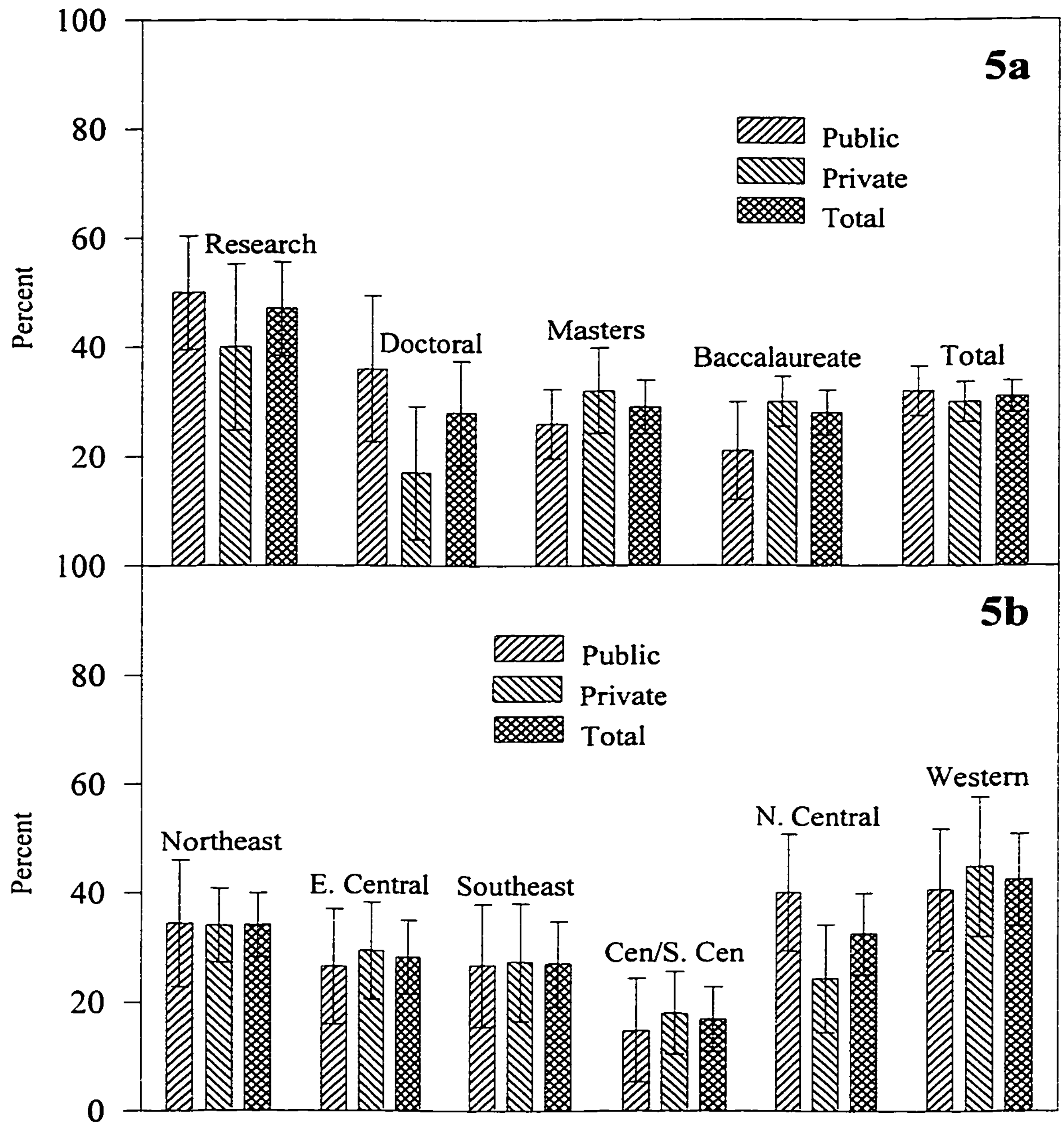

Figure 5a and 5b. Proportions of institutions indicating existence of an of an "environmental" program offering a course designed for non-majors, by Carnegie classification (a) and region (b). Error bars represent a 95 percent confidence interval.

When public institutions were compared across regions, the p value was 0.2144, indicating no significant difference among the regions as a group. However, confidence intervals indicated that the proportion of positive responses for public institutions in the Central/South Central region (14.8 ± 9.5%) was less than the mean for all groups by a margin that was statistically significant. As well, no significant differences were seen when regions were compared by Carnegie category; for Master's institutions, the p value for this interaction was 0.2715. However, confidence intervals indicated that the proportion of positive responses for Master's institutions in the Northeast (34.4 ± 11.6%) was significantly greater than the mean for all groups.

Overlap Between General Education Requirements/Options and Courses Offered by "Environmental" Departments

Of the institutions reporting an EL course in their core "requirements," 59.7 percent reported the existence of an "environmental" academic program, such as environmental science, environmental studies, etc. Forty two percent of the institutions with an EL core requirement said the environmental program offered a course "appropriate" for non-majors; 43.9 percent said a course "designed" for non-majors was offered.

Of the institutions reporting an EL course as a core "option," 60.5 percent reported the existence of an "environmental" program. A course "appropriate" for non-majors was offered by 41.3 percent of the institutions at which an EL course was a core option, while a course "designed" for non-majors was offered at 38.7 percent.

Interestingly, then, at 18.6 percent of the institutions at which an EL course is either a core "requirement" or a core "option," an environmental academic program exists that offers no course appropriate for non-majors. One might conclude that educating the larger campus community about environmental issues is not a goal of these programs.

Does a Single Course Make a Difference?

Thus far the discussion has focused on individual courses: a core required course in EL; one or more EL courses as general education options; or a course "appropriate" or "designed" for non-majors offered by an environmental academic program. It is therefore appropriate at this point to consider whether completion of such a course results in changes in students' knowledge of, attitude toward, and/or behavior with respect to the environment; Research by others indicates the answer is "yes." For example, Smith-Sebasto (1995) reported a statistically significant difference in measures of environmentally responsible behavior (ERB)[1] among students who completed an environmental studies course, in comparison with a control group of students who completed a history course. Students who completed the environmental studies course displayed a more internally oriented locus of control of reinforcement for ERB[2], a higher perception of their knowledge of and skill in using categories of ERB, and a higher degree of self-report of participation in ERB than did the control group of students. As well, Benton (1993) found that MBA students who had completed a 10-week environmental management course were more environmentally knowledgeable, expressed greater concern about the environment, and were more action oriented than was true before the course.

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[1] Smith-Sebasto (1992) cites Sivek and Hungerford's (1989/90) definition of environmentally responsible behavior: "Any action, individual or group, directed toward the remediation of environmental issues/problems."

[2] Internal locus of control of reinforcement is defined as "the perception by an individual that a reinforcement is contingent upon her/his own behavior or her/his own relatively permanent characteristics (Rotter, 1966 as cited in Smith-Sebasto, 1992).

"Environmental" Minor

Since a minor typically consists of 15 credit hours, it represents the most in-depth EL option short of a major; its primary disadvantage is the relatively small number of students who choose to pursue such a minor. Proportions of institutions reporting the existence of an "environmental" minor are shown in Figure 6. The proportion of public Baccalaureate institutions reporting the existence of such a minor (23.1 ± 9.4%) was less than the proportion of Research (54.5 ± 10.4%; $z = 2.92$) or Doctoral (56.0 ± 13.8%; $z = 2.68$) institutions that did so by a statistically significant margin. It is interesting that the smallest proportion of private institutions reporting such a minor was among Research institutions; the difference between public (54.5 ± 10.4%) and private (20.0 ± 12.4%) Research institutions was statistically significant ($z = 2.58$).

Regionally, the proportion of private institutions reporting such a minor in the Northeast (39.4 ± 7.0%), North Central (43.2 ± 12.9%) and Western (48.3 ± 12.9%) regions was significantly greater than the proportion that did so in the Central/South Central (20 ± 7.8%) and the East Central (21.6 ± 8.0%) regions ($z \geq 2.17$). In addition, in the East Central region the proportion of public institutions reporting such a minor (44.1 ± 11.8%) was greater than the proportion of private institutions that did so by a statistically significant margin ($z = 2.21$).

Other Approaches to EL

Responses to some open-ended survey questions revealed some approaches to EL on college campuses that were not addressed by direct survey questions. A discussion of four such approaches follows.

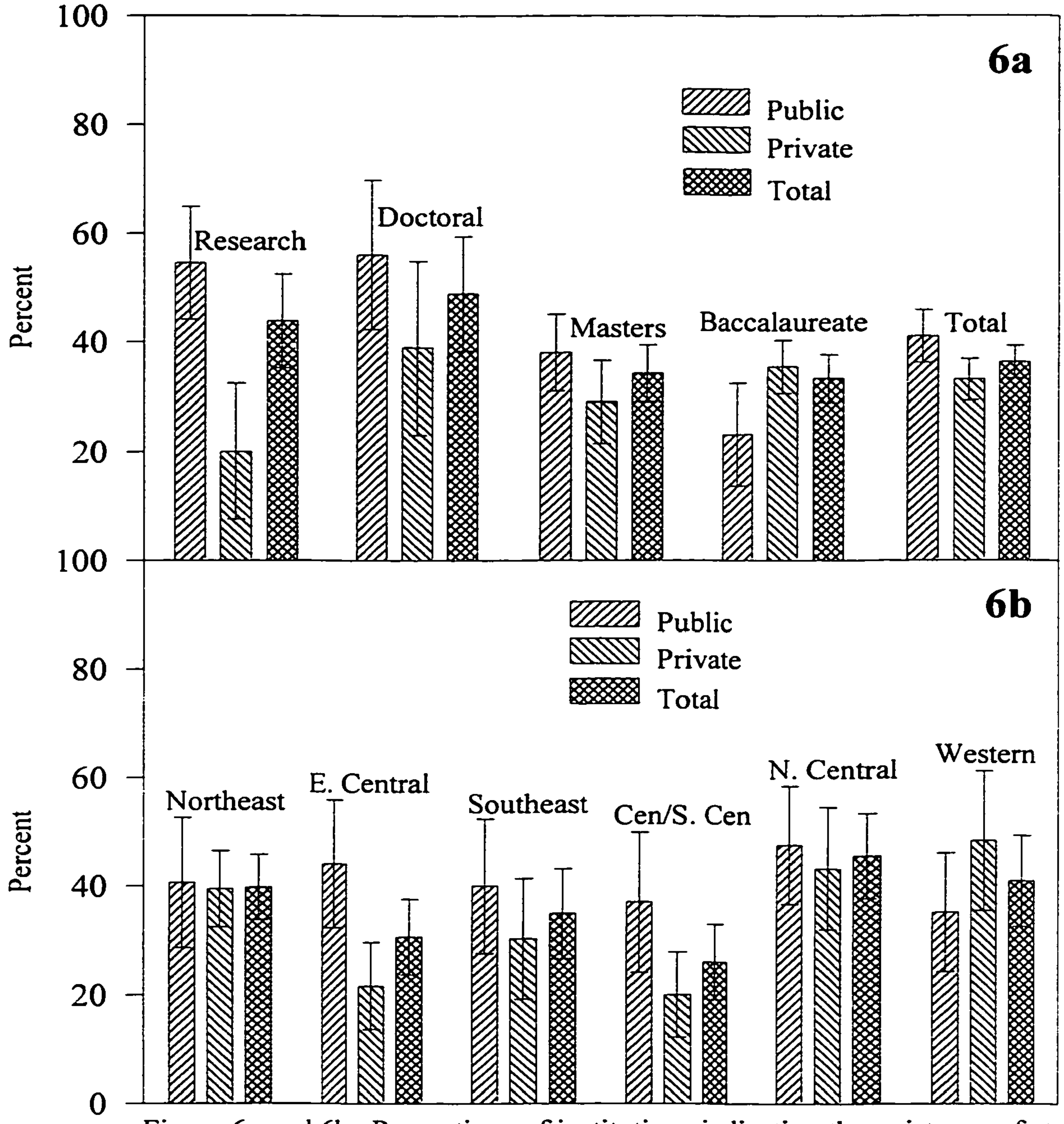

Figure 6a and 6b. Proportions of institutions indicating the existence of at least one "environmental" minor, by Carnegie classification (a) and region (b). Error bars represent a 95 percent confidence interval.

1) "Infusing" Sustainability and Environmental Issues Across the Curriculum. Some institutions attempt to integrate environmental themes into courses across the curriculum. For example:

> Another route that has proven successful in enhancing env. literacy at Tufts has been to invest in faculty development programs, offering workshops to help faculty design and incorporate environmental units or perspectives in their already-established courses. These workshops have gone a long way in 'seeding' dozens of courses with environmental perspectives across the curriculum ranging from engineering to drama. (G. Ellmore, personal communication, October 26, 1999)

Reaching non-environmental majors through non-environmental classes affirms that environmental concerns are not marginal; reaches more students; and does not depend upon a small number of faculty (Strauss, 1996). This approach might be compared to the "Writing Across the Curriculum" movement of the 1970s and 1980s, whose effectiveness is evidenced in a 1995 study by Cash. Six hundred fifty-six graduates from an institution that had incorporated writing-across-the-curriculum in the 1970s were surveyed regarding the types of writing being utilized in their present roles, and the effectiveness of their writing curriculum in preparing them for these roles. The sample was drawn from eight graduating classes and a wide variety of majors. Nearly half (47.9%) indicated that their writing ability had been a factor in obtaining their present jobs; more than a fourth had authored or co-authored a publication; on average, respondents spent 2.43 hours per week writing for pleasure; and 70.8 percent reported that friends and family solicit their help in writing tasks because these people considered the respondent a "good writer." Notably, the experience cited most often for preparing respondents for writing in the workplace and writing in school were the papers written for classes in their majors. This result could be used to argue for inclusion of other types of learning within major classes—such as incorporating whatever environmental and sustainability issues are relevant to the subject matter.

In summarizing the curriculum reform movement of the 1980s, Gaff (1991) suggested that students benefit most from particular kinds of general education curricula, including mandated study across the curriculum of such subjects as writing, critical thinking, and ethics or values. His opinion is supported by Wiggins (1992), who interviewed library personnel at nine large universities in order to identify common problems related to information literacy. He writes that

> A team approach to developing an effective information literacy program is essential between faculty and librarians, between faculty and academic administrators, and between academic administrators and librarians. Instructional programs begin with a few faculty and librarians who see the benefits of working together.
>
> Success across the campus depends in part on the level of centralization of university services and curriculum offerings. Information literacy can be integrated across the curriculum if it is clear who the key people are and if deans and administrators share common goals for the university. Common goals are a necessary prerequisite for developing cooperation across the campus (pp. 75-76).

These assertions can be extended to environmental literacy: i.e., if a group exists who want to incorporate EL across the curriculum, obviously other faculty must be brought "on board." It could begin with faculty from an environmental program working with a few faculty from other disciplines. Presidents could demonstrate that EL is an institutional priority by signing onto the Talloires declaration. Composed in 1990 at an international conference in Talloires, France, this declaration is the first official statement made by university administrators of a commitment to environmental sustainability in higher education. It is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities. The Talloires declaration has been signed by over 275 university presidents and chancellors in over 40 countries (Second Nature, Inc., 2001) and is shown in its entirety in Appendix D.

2) EL as an Educational "Outcome." A current trend in higher education is that of focusing on learning outcomes rather than content inputs in designing curricula. For example, students at Alverno College in Milwaukee, WI must demonstrate competence in eight "abilities" in order to graduate; one of the abilities is "taking responsibility for the global environment" (Levine and Nidiffer, 1997). As well, the 2001-2002 criteria of the Accreditation Board for Engineering and Technology, Inc. (ABET) includes a "Program Outcomes and Assessment" criterion which specifies 11 "outcomes" that must be demonstrated by a program's graduates; one of these is "the broad education necessary to understand the impact of engineering solutions in a global and societal context" (Engineering Accreditation Commission, 2000, p. 1).

The trend toward educational outcomes is reflected in Iowa State University's response to the survey:

> Through our curriculum process, we are looking at re-defining our core set of expected outcomes for students. Among those being considered is environmental literacy.
>
> We have seven undergraduate colleges, and few general education requirements for all students at Iowa State. Our focus on core student outcomes is the way in which we achieve common curricular goals without requiring all curricula to accomplish those outcomes in the same way (namely, with the same course requirements). We believe that this approach is consistent with current trends in higher education focusing on student learning outcomes rather than curricular inputs. (H. Shapiro, personal communication, December 5, 1999)

To this end, accrediting agencies could adopt EL as a criterion for outcome assessment, as some accrediting agencies have done in the area of information literacy:

The Middle States Association of Colleges and Schools (1990, as cited in Rader, 1995), a regional accrediting association, prepared criteria for outcome assessment in higher education that include a section on information literacy. The intent of the criteria is to measure the extent to which students have mastered the ability to retrieve and use information, particularly in the general education program. As well, in 2000 the Association of College and Research Libraries (ACRL) published "Information Literacy Competency Standards for Higher Education" which, along with relevant performance indicators and outcomes, were developed by an ACRL task force working with the academic library community, teaching faculty, academic officers in higher education, and chief officers of the regional accrediting associations. A comparable set of "Environmental Literacy Competency Standards for Higher Education" could be adopted by higher education accrediting agencies. Roth (1992) defines three levels of EL—nominal, functional and operational—on a continuum. Accrediting agencies could begin by adopting his "nominal" level, which is defined as follows:

> Nominal environmental literacy indicates a person able to recognize many of the basic terms used in communicating about the environment and able to provide rough, if unsophisticated, working definitions of their meanings. Persons at the nominal level are developing an awareness and sensitivity towards the environment along with an attitude of respect for natural systems and concern for the nature and magnitude of human impacts on them. They also have a very rudimentary knowledge of how natural systems work and how human social systems interact with them (p. 18).

Then perhaps at a future time, a more stringent EL competency standard could be adopted, such as Roth's "functional" and eventually his "operational" level, which are defined as follows:

> Functional environmental literacy indicates a person with a broader knowledge and understanding of the nature of and interactions between

> human social systems and other natural systems. They are aware and concerned about the negative interactions between these systems in terms of at least one or more issues and have developed the skills to analyze, synthesize, and evaluate information about them using primary and secondary sources. They evaluate a selected problem/issue on the basis of sound evidence and personal values and ethics. They communicate their findings and feelings to others. On issues of particular concern to them, they evidence a personal investment and motivation to work toward remediation using their knowledge of basic strategies for initiating and implementing social or technological change.
>
> Operational literacy indicates a person who has moved beyond functional literacy in both the breadth and depth of understandings and skills who routinely evaluates the impacts and consequences of actions; gathering and synthesizing pertinent information, choosing among alternatives, and advocating action positions and taking actions that work to sustain or enhance a healthy environment. Such people demonstrate a strong, ongoing sense of investment in and responsibility for preventing or remediating environmental degradation both personally and collectively, and are likely to be acting at several levels from local to global in so doing. The characteristic habits of mind of the environmentally literate are well ingrained. They are routinely engaged in dealing with the world at large.

3) The Case for Interdisciplinarity. A number of respondents mentioned the existence of some type of interdisciplinary environmental program, e.g. an interdisciplinary minor. One respondent from a public Master's level university makes a persuasive case for a team-taught introductory course for an interdisciplinary minor:

> Salisbury State University currently has an interdisciplinary environmental minor program. As a steering committee member, I have been involved in planning the new curriculum for the minor. A new interdisciplinary course in environmental studies that involves faculty from ecology, philosophy, and economics has recently been developed in order to provide unity to the minor. This course is currently being taught in the fall 1999 semester and has been very successful thus far.
>
> I think that providing the students with this interdisciplinary approach to the environment can greatly improve the program in many ways. First, the course introduces students to the different ways of approaching environmental issues. This knowledge could increase students' interest in environmental courses that they never would have taken prior to the interdisciplinary course. Second, the course provides the students with a framework for the interdisciplinary minor. Because the

> minor has courses from many departments the students may feel that the minor is disjointed. A course such as this - that is required of the minor - could help to avoid this feeling. And lastly, the course mimics the real world. Environmental studies are interdisciplinary by nature - and should be addressed this way in the classroom. (J. L. Caviglia, personal communication, November 1, 1999)

The University of Oklahoma offers an interdisciplinary, 15-hour minor called Interdisciplinary Perspectives on the Environment (IPE); its two "core" courses, an introductory course and a senior practicum, are team taught by faculty from diverse disciplines. According to Gowda et al. (1997), the team-teaching, case-study, small group learning model of interdisciplinary instruction employed in the introductory course has proven to be both successful and popular among students. Students responding to an evaluative survey indicated that the introductory course succeeded strongly in introducing them to the interdisciplinary nature of environmental problems and that such a goal could not have been accomplished in a course taught by a single instructor. In another evaluative survey of seniors who graduated with an IPE minor, 100 percent of those surveyed indicated that team-teaching in both the introductory course and senior practicum enhanced the quality of their learning experience and that such courses could not be taught as effectively by only one instructor. Further, all the students agreed that the IPE program's central goal of providing students with a course of study that teaches them to integrate different intellectual perspectives from the humanities, social science and sciences had been met (Gowda et al., 1997). Finally, in 1996 the minor was reviewed by an Arts and Sciences dean from another campus, who cited its interdisciplinarity as its main strength (Bell, 1997).

4) Faculty Hiring Practices. The response of a private Master's institution indicated that environmental expertise is considered when new faculty are hired:

> . . . we offer a number of courses in different departments (e.g., History, Economics, Government, Philosophy, Religious Studies) that deal with environmental issues as primary themes. These courses contribute to the environmental literacy of our students. We have hired faculty in a number of these departments with special emphasis on competence and interest in environmental education.
>
> (This) approach to faculty hiring . . . has been quite successful. We have been intentional in advising departments that they will increase the likelihood of having a faculty position request approved if that position would bring someone to campus who would assist with the Environmental Studies Program. The latter is cross-disciplinary (as are most environmental stuidies programs) and depends on courses from faculty all across the curriculum. We have strengthened our environmental studies program itself and our curricular offerings in this area through this hiring process (Philip Glotzbach, personal communication, October 29, 1999).

Summary

Table 4 summarizes the approaches for increasing the EL of students in non-"environmental" majors that are discussed in this study, and some positive and negative aspects of each.

Three general "trends" were observed among responses to nominal-level survey questions. One trend pertained to Carnegie classifications; a second to public vs. private institutions; and the third to regional comparisons.

The first trend was that the proportions of positive responses to most survey questions were greater among Research institutions than among the other Carnegie classifications. Perhaps this is simply a reflection of more diverse curricula among these largest institutions. Comments of the Carnegie Foundation for the Advancement of Teaching (1977) may be relevant:

> Private liberal arts colleges are often disadvantaged in . . . competition because they lack financial and other resources needed to expand their curricula.
>
> In terms of comprehensiveness, the community colleges and liberal arts colleges have the fewest offerings, and the research universities have

Table 4. Advantages and Disadvantages of Various Approaches to Increasing College Students' "Environmental Literacy"

Method	**Positive aspects**	**Negative aspects/potential obstacles**	**% of institutions using**
Core requirement	• Ensures that all students are reached • Allows for more depth than some other options • Demonstrates importance institution places on environmental and sustainability issues	• Resources required (e.g. faculty time) • Student resentment	11.6*
General education option	• General education credit encourages students to enroll in course they might not choose otherwise • Allows for more depth than some other options	• Resources required (e.g. faculty time) • Not all students will enroll	55.0*
Elective course	• Allows for more depth than some other options	• Not all students will enroll	
"Designed" course	• Allows for more depth than some other options	• Time required in designing a special course • Not all students will enroll unless required	31*
Minor	• Greater depth than any other option	• Small number of students who choose	36.3*
Infusion across the curriculum	• Reaches majority of students • Does not depend upon a small number of faculty • Reinforces importance of environmental issues • Demonstrates connection of environment and sustainability to all aspects of life	• Less depth than some other approaches • Possible lack of interest/resistance on the part of some faculty	
EL as an educational "outcome"	• Can result in a higher level of learning, if 1) achievement of the outcome must be demonstrated, and 2) proper assessment techniques are used	• Resources required for 1) assessing whether the outcome has been achieved, and 2) designing the necessary learning activities	

Table 4. Advantages and Disadvantages of Various Approaches to Increasing College Students' "Environmental Literacy" (cont.)

Method	Positive aspects	Negative aspects/potential obstacles	% of institutions using
Interdisciplinary approach (e.g. course, minor)	• Best for fostering an appreciation of the multifaceted nature of environmental and sustainability issues • Interdisciplinary courses may be team-taught, so less time is required of individual faculty	• Requires participation of faculty from multiple disciplines; often interdisciplinary work is not rewarded comparably with work in a faculty member's own discipline • Allocation of FTEs must be determined	
"Green" campus practices	• Environmental benefits—it is the "right thing to do" • Sets a positive example for students • Demonstrates importance institution places on sustainability and environmental stewardship • Can save money (see NWF, 1998) • Enhances institution's image	• Can be expensive monetarily, e.g. installation of solar panels; "environmentally-friendly" products are often more costly than their alternatives • Time and resources required	
Publicizing environment-related courses	• Increases enrollment in these courses	• Time and resources required	
Criterion in faculty hiring decisions	• Increases extent to which environmental and sustainability issues are included in curriculum	• May narrow field of candidates	
Lectures and seminars	• Can be a vehicle for educating the surrounding community as well as the campus community • Enhances institution's image	• Time required in preparing, delivering (if given by on-site person), scheduling; cost of bringing "outside" person to campus	
"Environmental" newsletter	• Demonstrates importance institution places on sustainability and environmental stewardship	• Time and resources required	

Table 4. Advantages and Disadvantages of Various Approaches to Increasing College Students' "Environmental Literacy" (cont.)

Method	**Positive aspects**	**Negative aspects/potential obstacles**	**% of institutions using**
Column in campus publication(s) (e.g. newspaper)	• Reaches a substantial number of students, faculty and staff	• Time required in writing and/or soliciting	

*Percentages are based on responses to nominal-level survey questions. Percentages of institutions using the other methods listed in this table cannot be estimated from this study as the questionnaire included no nominal-level question that would allow such an estimate.

> the largest number. This characteristic is influenced by size and also by function and history. Institutions that were established with responsibilities for teacher education or with the responsibilities for agricultural and technical education under terms of the Land-Grant College Act tend to be more comprehensive than liberal arts colleges (pp. 60-61, 140, 149).

According to Ratcliff (1997), however, there may be reason to hope that smaller institutions will follow suit:

> The research university leads the academic procession . . .The other forms of higher education—the community colleges, liberal arts colleges, comprehensive institutions, and doctoral granting universities—have drifted toward the ideals of the research university or followed innovations produced by them like the tail of a snake following its head (p. 144).

The second general trend was that of greater proportions of positive responses among public than among private institutions. One notable exception to this trend was that more than twice as many private than public institutions reported requiring an EL course in their core curricula (Figure 2a); perhaps this merely indicates a greater preference among private institutions for core curricula over distribution requirements, however. Further, the April 6, 2001 issue of The Chronicle of Higher Education, contains an article in which Noel Perrin briefly profiles 11 institutions he calls "greenest;" eight are private, three public. Perrin calls Dartmouth College "a striking example of what I shall modestly call Perrin's Law: No college or university can move far toward sustainability without the active support of at least two senior administrators" (p. B9). He goes on to say that Dartmouth formerly had two such committed senior administrators, but attributes the college's having "lost ground" in terms of sustainability to the fact that it now has none. Perrin also quotes an Emory University official who, in commenting on the University's "green" practices, said, "It's easy to do when your president wants you to." As well, Middlebury College is identified as an institution at which senior administrators "strongly back environmentalism."

Tulane was also on Perrin's list. Its campus Environmental Coordinator, who responded to my survey, related that

> As a result of student activism and research, Tulane recently created an Office of Environmental Affairs to promote campus greening efforts. Proposals for a "Sustainable Campus Design" section of the Campus Master Plan, and the implementation of an environmental management system are now being made to top administration.

Perrin calls Oberlin College "an exception to Perrin's Law" in that its "greening" has occurred without the active support of any senior administrators. Oberlin's Adam Joseph Lewis Environmental Studies Center, one of the most environmentally benign college buildings in the world, was built with funds raised through the efforts of Oberlin's Environmental Studies Department chairman, David Orr.

All five of the above are private institutions. In contrast, "greening" at the University of New Hampshire, one of the three public institutions included in the article, is attributed partly to a $12.8 million special endowment for the campus sustainability office. Perrin's article does seem to suggest that, while a "green" campus agenda can be moved forward via a number of mechanisms, support of senior administration is a significant factor. However, a sample of 11 campuses is too small to support assumptions about whether such support is more likely to occur at private vs. public institutions. In sum, the reasons for the larger proportion of positive responses among public institutions are unclear and represent a possible avenue for exploration in further research.

The third general trend was that, in regional comparisons, proportions of positive responses were significantly lower in the Central/South Central region than in the Northeast, North Central and Western regions. Could this trend indicate a lower level of environmental concern in the Central/South Central region, which is comprised of Texas, Oklahoma, Kansas, Nebraska, Iowa and Missouri? These data are, of course, insufficient to answer that question definitively; however, it is interesting to note the following information that seems to support such a conception. I have focused primarily on Texas, since 1) more than one third (34.4 %) of that region's survey responses came from Texas, and 2) more than half (56.2 %) that region's population resides in Texas (Demographia, 2000).

A 1995 state-by-state ranking of the performance of oil refineries from "worst" to "best" showed Kansas and Texas to be second and third "worst," respectively, while New Jersey, which is in the Northeast region and which has more extensive toxic chemical reporting requirements, ranked among the best (Environmental Defense Fund, 1995). According to Texans for Public Justice (2000), Texas ranks fourth among the states in per capita energy consumption. It produces nearly twice as much carbon dioxide annually as California, which has 1.6 times its population (Demographia, 2000). If Texas were a country, it would be seventh in the world in CO_2 emissions. Texas also exceeds California in tons of hazardous air pollutants released annually. In 1996, Texas ranked 49th among the states in per capita expenditures on water quality and resources. Although Texas has the second highest number of people living in areas with unhealthy air, its per capita spending on air quality programs is 18th among the 50 states. Nebraska, Missouri and Kansas, which are also in the Central/South Central region, rank 46th, 47th and 50th, respectively. Twenty-eight percent of water-quality permit holders in Texas violate their permits, ranking it 19th among the 50 states for this statistic; Nebraska is ranked fifth, with 45 percent of its permit holders violating their permits. In 1998 Texas and Kansas ranked 49th and 50th, respectively, in per capita spending on parks, although Texas ranks 24th in per capita acres of park land. In 1997, Texas ranked 45th in per capita visits to parks, and in 1999 was ranked 46th in protection of open spaces (Texans for Public Justice, 2000).

When one considers the above statistics in combination with the facts that 1) proportions of positive responses among institutions in the Central/South Central region were lower in almost cases than those for the other five regions and 2) in three cases these differences were statistically significant, it appears safe to infer that the overall level of concern about the environment in this region may be lower than is true in other parts of the U.S.

Since there was, generally, a larger proportion of positive responses among Research institutions than among the other Carnegie institutions, linear regression analysis was performed to determine whether a correlation existed between the proportion of positive responses to each question in each region and the proportion of total responding institutions that was comprised of Research institutions in each region. The graphs appear in Appendix E; no such correlation was observed.

Recommendations

This chapter has reported on a number of approaches being employed at colleges and universities across the U.S. for fostering EL among college students. Are there recommendations that can be made as to the most effective means of fostering EL at the college level, based upon 1) the information gathered in this study, 2) pedagogical principles, and 3) potential for providing the greatest amount of environmental education to the maximum number of students?

I would first suggest employment of Wiggins' "backward design" process (1998, as cited in Fink [in press]):

1) Designation of desired "outcomes" (i.e., attributes, abilities, types of knowledge). Environmental Literacy: Its Roots, Evolution and Directions in the 1990s by Roth (1992) may be helpful in this regard as it defines three levels of EL—nominal, functional and operational—on a continuum.
2) Development of methods for assessing whether the designated outcomes have been achieved; and
3) Design of appropriate learning activities, both curricular and noncurricular. Examples of the latter might include "greening" of campus operations or scheduling speakers who will discuss environmental topics. Since "active" learning is generally known to be far superior to "passive" learning, "active" learning techniques should be employed wherever possible. Possibilities include attendance at environment-related public hearings, participation in environment-related community-service projects, or visits to wastewater treatment plants, landfills, recycling and composting facilities, and facilities that employ renewable energy technologies.

The particular learning activities will depend, at least in part, upon the institution's particular culture. Institutions whose general education curricula are comprised of core requirements should include an environmental course in those requirements. On the other hand, those who allow students to select general education courses from a "menu" (i.e., distribution requirements) should include an interesting selection of environment-related courses and require students to choose one or more. Such courses could include sufficient science to satisfy general education science requirements for non-science majors. Particularly if effective teaching methods (e.g., active learning) are employed, this appears to be the most effective option for fostering in-depth learning about the environmental and sustainability issues among the greatest number of students.

Whether or not an institution's core or distribution requirements include courses offered by an "environmental" department or program, such programs can reach out to the broader campus community in a variety of ways, such as designing courses specifically for non-majors, and publicizing environmental courses appropriate for non-majors. Other avenues for outreach include a weekly column in the campus newspaper, and special lectures and seminars appropriate for general audiences. For example, the University of Oklahoma's Interdisciplinary Perspectives on the Environment minor received a grant from the College of Arts and Sciences to fund a series of lectures which included Interior Secretary Bruce Babbitt, historian Carolyn Merchant, philosopher Mark Sagoff, and ecologist George Cox (Heiser et al., 1996).

Other approaches that can be employed alone or in combination with any of the above include incorporation of environmental and sustainability issues across the curriculum. To maximize the effectiveness of such efforts, faculty can avail themselves of such resources as Second Nature, Inc. <http://www.secondnature.org> or Collett and Karakashian's Greening the College Curriculum. Infusion of environmental and sustainability issues into the curriculum can be augmented by inclusion of environmental interest and expertise in the criteria considered when new faculty are hired, as reported earlier by one institution.

Institutions might also consider publication of a catalog of environmental courses; two survey respondents reported annual publication of such a catalog at their institutions. Bruce and Candy (1994, as cited in Bruce, 1995) propose a set of criteria for evaluating courses' contribution to information literacy; a similar set of criteria could be developed for evaluating courses' contribution to EL, and applied when considering courses for inclusion in catalogs of environmental courses.

Finally, the importance of "green" campus operations cannot be overemphasized. The reader is referred to Bloom's (1982) discussion of the "latent curriculum"—i.e., the lessons educators and institutions teach via their day-to-day practices and operations. Bloom contends that the latent curriculum may actually be more effective than the manifest curriculum; that learning is most powerful when the manifest and latent curricula reinforce each other; and that when the two curricula are in conflict, the latent curriculum is likely to dominate. Keniry's Ecodemia (1995) is an excellent guide for greening campus operations from purchasing to groundskeeping, from energy conservation to printing services. As well, the book cites examples of the use of "green" campus practices as pedagogical vehicles: for instance, student interns at Stetson University researched opportunities for reducing energy use through improved building and classroom scheduling; and Texas Southern University has an "Adopt-a-Plot" program in which the grounds manager provides assistance and tools to students and faculty who volunteer to develop their own sites (Keniry, 1995).

Studies of the Content and Process of Environmental Education

Chapter 2

Enhancement of K-12 Environmental Education by Higher Education Institutions: Possibilities and Impediments

Abstract

In this chapter I explore ways in which higher education institutions can enhance environmental education at the K-12 level, as well as some of the obstacles to such efforts. Brief overviews are provided of several higher education institutions' activities in the area of K-12 environmental education, either in the form of direct outreach to K-12 students, teacher training (pre-service or in-service), or both. Methods used by some of the programs to assess their success are discussed briefly, as are impediments to higher education institutions' enhancement of K-12 environmental education. Prominent among these impediments are funding and the traditional higher education faculty rewards system. Factors relevant to the latter are addressed; they include the extent to which the institution's mission recognizes a commitment to collaboration with the public schools; the recency of the institution's emphasis on K-12 collaboration; the institution's organizational and governance structure; and the size of the institution.

Introduction

Some might contend that environmental education (EE) is even more important at the K-12 level than at the college level; according to Shamos (1995), only about 20 percent of the U.S. population obtains a college degree. In addition, research by Hess and Torney (1967, as cited by Stapp, 1974) indicated that childhood is a critical time in the development of a sense of citizen responsibility, and that it is during the formative years that persons acquire the attitudes, values and skills that will enable them to make sound decisions. Roth (1992) stated that the development of "useful levels of environmental literacy . . . requires regular and continuous development throughout the school years and beyond, and should be part of the basic core program of schools across the nation" (p. 2).

Five of the respondents to the survey that formed the basis for Chapter 1 mentioned some type of activity directed toward K-12 EE; this prompted me to explore this area further. As the title suggests, the primary questions I seek to answer in this chapter are 1) what are some ways in which higher education institutions can enhance environmental education at the K-12 level, and 2) what are some of the obstacles to these efforts. I am aware of no previous work addressing these questions specifically for EE.

My first objective is to provide brief overviews of several institutions' activities in the area of K-12 EE, in the hope that additional institutions might use these ideas to initiate or augment their own efforts directed toward the enhancement of K-12 EE. Nearly all the endeavors described herein fall into one or both of two categories: a) some form of direct outreach to K-12 students, and/or b) inclusion of environmental components in pre-service or in-service training of K-12 teachers. Direct outreach is defined here as direct engagement of K-12 students in environmental education activities initiated by college or university faculty and/or students. I also asked the programs' representatives how their programs' success is assessed, and in a later section have included the information they provided.

My second objective is to address some of the impediments to K-12 outreach by higher education institutions. Prominent among these are funding and the higher education faculty rewards system.

Typically, funding for such programs is largely external. In some cases, external funding sources are quite secure and dependable; in others, this is not the case. While none of the programs in this study indicated concern that their programs might be discontinued if external funding ended, funding uncertainty was a limiting factor in some cases. The higher education faculty rewards system, which typically places twice as much emphasis on research and teaching as it does on "service," can be seen as another obstacle to K-12 outreach by higher education institutions.

Methods

Programs were identified through the responses to the survey that formed the basis for Chapter 1, and through the profiles and syllabi posted on www.secondnature.org. It is not known what proportion of K-12 EE outreach activities are included in Second Nature's database; to my knowledge, however, it is the best source of information on this subject. Additional information was obtained from the various institutions' websites, and through correspondence with representatives of the programs.

Observations

Direct Outreach Activities

Examples of "direct outreach" activities include conduction of EE programs in schools; development of electronic EE materials for K-12 students, such as websites or a CD-ROM; and a variety of "active learning" activities, such as visits to the institution's nature center, field trips, and involvement of students in research, restoration or development projects. Only two programs are described in this section, as these were the only two that consisted of only direct outreach; most of the direct outreach activities were conducted in conjunction with teacher training programs, and are described in a later section called "Both Direct Outreach and Teacher Training."

Long Term Ecological Research. The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1100 scientists and students investigating ecological processes over long temporal and broad spatial scales. The Network was established in 1980 by the National Science Foundation (NSF) to support research on long-term ecological phenomena in the U.S. The 24 LTER sites represent diverse ecosystems and research emphases. The Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs (White, 2001).

Education is integral to the LTER mission. Thirteen of the 24 sites are "Schoolyard LTER" sites, which provide a vehicle through which faculty and students in higher education collaborate with K-12 students and teachers on ecological research and educational projects (LTER Network, 2001). For example, the North Temperate Lakes LTER site brings together scientists from the University of Wisconsin at Madison and other universities with K-12 students in southern Wisconsin to study biological, ecological, chemical and physical attributes of lakes (University of Wisconsin, 1999). At the Sevilleta LTER site, student activities in coordination with the Department of Biology at the University of New Mexico include monitoring of key processes and populations of the Middle Rio Grande riparian forest ecosystem in Central New Mexico (University of New Mexico, 1999).

__**University of New Hampshire**__. Researchers at the University of New Hampshire's (UNH) Complex Systems Research Center initiated the "Forest Watch" program to involve K-12 students in the collection and processing of data relating to air pollution damage in forest stands. Participating schools select a permanent sampling plot in a pine stand and conduct several measurements as specified by UNH. Among the program's stated educational objectives are the engagement of K-12 students in authentic science through participation in a student-scientist partnership; the provision of hands-on measurement activities using scientific and technological tools, in order to contribute meaningful data to researchers; the enhancement of higher-order thinking skills by introducing students to local, regional and global science issues; and the development of data analysis and communication skills. The program is described as "highly successful" in its profile on the Second Nature website; more than 100 K-12 schools and study plots across New England currently are part of Forest Watch, enabling UNH to conduct a regional analysis of white pine health (University of New Hampshire, 2001; Second Nature, Inc., 2000c).

Teacher Training

Ideally, teacher training in the content and pedagogy of EE should occur in the undergraduate years (i.e., pre-service). Whether or not EE training occurs at the undergraduate level, however, in-service EE training (i.e., of working teachers) is also very valuable, as was seen in the results of a survey of 900 randomly selected teachers conducted by the Wisconsin Center for Environmental Education. When asked what would influence them to teach about the environment, in-service training was the response selected by 33 percent of the teachers. Further, in a regression analysis performed to determine whether particular aspects of teachers' backgrounds accounted for the variability in the amount of class time spent on EE, participation in EE in-service education accounted for 37 percent of the variability, and number of in-service courses taken in EE accounted for 24 percent of the variability (Champeau, 1997). This section and the one that follows include examples of both pre-service and in-service teacher training.

The National Research Council's Center for Science, Mathematics and Engineering Education (1996) has said that

> Through the education they provide to future K-12 teachers, colleges and universities have a heavily leveraged influence on American education. An elementary school teacher will influence hundreds of students over the course of a career; a secondary school teacher, thousands. Providing K-12 teachers with the training, resources, and support they need . . . is a powerful means by which to improve the scientific and technical literacy and numeracy of the American public (p. 17).

A committee of the Advisory Committee to the National Science Foundation's (NSF) Education and Human Resources Directorate conducted an intensive review of the state of undergraduate education in science, mathematics, engineering and technology (SME&T) in the United States. Their (1998) report states "the SME&T education community is coming to recognize what should have been clear all along—that the teachers of the students coming out of the K-12 system were prepared primarily *at the undergraduate level* for their school careers" (p. 6). The Committee recommends that SME&T departments "work collaboratively with departments of education, the K-12 sector and the business world to improve the preparation of K-12 teachers (and principals)" (p. iv).

The same advice should apply to environmental departments. Stapp (1974, p. 52) named "a severe shortage of classroom teachers prepared to effectively integrate environmental education into instructional programs" as one of the major constraints confronting EE. Twenty years later, a survey of Wisconsin teachers' perceived competencies in, attitudes toward, and class time devoted to teaching about the environment suggested that lack of training in EE is a major reason teachers do not infuse these concepts (Lane et al., 1994). More recently, a study by McKeown-Ice (2000) showed that in fact most institutions of teacher education have few requirements related to environmental education, and that environmental education is not institutionalized in the majority of these schools. Further, in the Spring of 2000 the North American Association for Environmental Education (NAAEE) and the Environmental Literacy Council (ELC), in partnership with the National Environmental Education and Training Foundation (NEETF), sponsored a nationwide survey of teachers to gather information about how EE is conducted in K-12 classrooms. The survey found that only 10.4 percent of the teachers who teach environmental topics[1] had taken courses in environmental teaching methods, while 28.9 percent had received such training after having begun teaching. A larger proportion of the teachers who teach environmental topics had had courses in environmental science/ecology or environmental studies: 27 percent had had such courses in their pre-service training, while 36 percent had received such training after becoming teachers (University of Maryland College Park, Survey Research Center, 2000).

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[1] The percentages of teachers teaching environmental topics were 83 percent in grades K-4; 59 percent in grades 5-8; and 45 percent in grades 9-12.

Results of the NAAEE/ELC/NEETF study that are, perhaps, even more disturbing are that only 38 percent of the teachers who teach environmental topics include global warming, and only 33 percent include population growth. The most popular EE topic was recycling, 87 percent of the teachers included, followed by endangered species at 77 percent. Further, the most frequently cited reason for not teaching environmental topics was irrelevancy to curricula (University of Maryland College Park, Survey Research Center, 2000). These findings suggest that 1) teachers that do teach environmental topics are inadequately trained with respect to the relative importance of various environmental issues, and 2) teachers are inadequately educated as to the overall importance of environmental issues.

Below I cite two examples from the survey that forms the basis for Chapter 1 of institutions that are trying to incorporate EE into the education of future teachers. Following these examples, I describe the potential of Second Nature, Inc. to provide ideas to colleges and departments of education for including EE in teacher training.

EE Course Requirements for Teachers. Requiring that education majors complete one or more environmental courses is one means by which higher education institutions can enhance EE at the K-12 level. A small proportion of institutions are doing so. In McKeown-Ice's study, 14 percent of institutions (n = 424) required their elementary education majors to complete an EE course, and 13 percent (n = 417) required such a course of their secondary education majors. One respondent to the survey that formed the basis for Chapter 1 expressed that his institution is

> trying to increase the Scientific Literacy of our students through our required courses in the Core Curriculum. Many of the instructors use environmental issues as vehicles to help students learn about the applications and principles of science. **We especially want to reach our**

> **elementary education majors with environmental issues to be used as examples in science instructor [sic] for their future classrooms.** (bold added) (W. A. Shergalis, personal communication, November 3, 1999)

Another respondent to that survey reported that all elementary education majors at his institution are required to take a course in science methods which is heavily oriented toward EE and the local flora and fauna (R. D. Brauhn, personal communication, November 16, 1999).

Second Nature, Inc. Second Nature, Inc. is "a nonprofit organization that helps colleges and universities make environmentally sustainable and just action a foundation of learning and practice." (Second Nature, Inc., 2000a). Its online "Resource Center" (http://www.secondnature.org/resource_center/resource_center.html) includes an abundance of course syllabi and institutional profiles submitted by individuals across higher education; these serve as examples of environmentally sustainable activities at colleges and universities. A search of these programs and syllabi reveals a number of institutions offering undergraduate and graduate environmental education courses directed largely toward pre-service and in-service K-12 teachers. Examples include an undergraduate course that surveys the field of environmental education; courses on materials, methods and program design; and a "best practices" course.

Both Direct Outreach and Teacher Training

Most of the programs in this study include both direct outreach to K-12 students and teacher training. In some cases, the two activities are independent of each other; in others, they are integrated, e.g. the inclusion of actual K-12 outreach in EE courses. In the case of the latter, students in education curricula may, for example, design EE lesson plans or programs, develop an EE website, or take students on nature trail walks or field trips.

One such example is a course called "Interpreting the History, Geology and Ecology of Monterey Bay" at California State University at Monterey Bay. The course is part of an effort to develop an interactive educational website intended to help school children learn about Monterey Bay. Requirements included 50 hours of service in the schools (Second Nature, Inc., 1999c). Another example course is "Theory and Practice in Environmental Education" offered by Pitzer College in Claremont, CA in which students design and implement an outdoor environmental education program; about 140 elementary students participate annually (Second Nature, Inc., 1999f; Paul Faulstich, personal communication, November 5, 2000). Following are more detailed descriptions of several other programs.

Manchester College. Manchester College in North Manchester, Indiana is engaged in a number of activities that, individually and collectively, appear to represent a significant potential for enhancing K-12 EE. Most of the activities involve the college's 100-acre nature center which includes a lake, restored prairie, wetland complex and woodlands, and for which a curriculum matrix recently was developed to provide lessons on many topics geared to education requirements in grades K-6. Local grants enable approximately 4,000 elementary students visit the nature center yearly.

Also through grant-funded programs, students at Manchester were involved in the development of a curriculum matrix in partnership with the county Solid Waste Management District. Programs on recycling are presented to nearly all elementary and middle school students in the county, as well as some high school students. Further, this program includes activities at the nature center for 600 students annually.

Field Biology is a course requirement in Manchester's Elementary Education major. As a component of the course, students are trained to take elementary students who visit the nature center on trail walks. It is estimated that 250 elementary students participate in this activity yearly.

The information about Manchester was obtained in personal communications with J. Y. Switzer on October 28, 1999, and B. J. Ehrhardt on October 4, 2000 and November 5, 2000.

Oberlin College. Oberlin College was selected by the Orion Society, a national organization that promotes environmental literacy and place-based nature education, as one of five sites in the country to pilot a "watershed education" partnership program. Students from Oberlin's Environmental Studies Program (ESP) work with county schools to implement place-based EE based on the Black River Watershed (Oberlin College, 2001).

In the initial phase, ten Oberlin students conducted separate studies on the Black River Watershed, which is about 450 square miles in size. The studies focused on such topics as wetlands, water quality monitoring, watershed education, oral histories and literature. Next, Oberlin students prepared sample watershed education lesson plans and then were paired with local teachers to begin testing the plans and activities in the classroom. Special projects were initiated with each school which included litter cleanup; monitoring impacts of sewage effluent; a survey of a local wetland; tree and plant identification; and wetland ecology (Second Nature, Inc., 1999a).

In the following year a $50,000 grant was received from the Ohio Environmental Education Fund (OEEF). In addition, Seventh Generation, a local environmental organization that was also a partner in the project, hired a coordinator to develop the watershed education partnership. To prepare college students for work with local schools in the watershed, a full-year course sequence was initiated, which included content on various aspects of the watershed, curriculum development, and testing and evaluation of watershed lesson plans in classrooms (Second Nature, Inc., 1999a). Currently, a graduate-level environmental education course is offered which uses the Watershed Project to introduce students to the principles of place-based environmental education (Oberlin College, 2001). It is estimated that approximately 250 K-12 students are reached annually through the Watershed Project (David Benzing, personal communication, April 4, 2001).

In addition to providing student teachers and sponsoring watershed research, the ESP participates in teacher training and maintains a watershed education resource library. Several other entities are also partners in the project. Common Ground is a non-profit retreat and conferencing center whose mission is to design programs that support community building and leadership through an understanding of the natural environment; it provides staff support and teacher training for the project. Other participants included the Oberlin College Center for Service and Learning, the Lorain County Center for Leadership in Education, Lorain County Schools, and the Black River Remedial Action Plan Coordinating Committee (Oberlin College, 2001).

Washington State University. Washington State University's Center for Environmental Education (CEE) operates as an outreach conduit, focusing WSU resources and educational activities on studying and addressing regional problems. Part of the Center's mission is to sponsor action-based teaching and research, and to use regional problems as concrete case studies in environmental education (Center for Environmental Education at Washington State University, 2000). Its K-12 programs provide support, training and resources for teachers and schools to improve environmental education. The Center integrates environmental education into the pre-service teacher education program at WSU and also provides in-service training to the region's teachers (Center for Environmental Education at Washington State University, 1999).

The CEE worked with the university's Community Service-Learning Center to develop an environmental service-learning program called the Environmental Project Program. This field-based environmental education program involves both K-12 and university students in stream, prairie and wetlands restoration projects as educational activities. Other CEE-sponsored activities have included student research on the environmental effects of styrofoam, and provision of resources for environmental educational activities related to watersheds (Second Nature, Inc., 2000b).

Goshen College. Merry Lea Environmental Learning Center of Goshen College (Goshen, IN) is an 1150 acre natural area and environmental education facility whose mission includes the provision of environmental education for people of all ages. Most of the ecosystem types found in northeastern Indiana, as well as some unique geological features, are present on Merry Lea, making the Center a unique environmental education resource. Activities at Merry Lea include programs in environmental science and nature study for classes from the elementary to college level. Examples are studies of aquatic ecosystems, vegetation, glacial geology and groundwater resources, and experiments in erosion control (Yoder, 2001). Each year, 6500 K-12 students participate in activities at Merry Lea. (Luke A. Gascho, personal communication, December 5, 2000).

An "outreach" program for middle school and high school students is under development; it will involve a mobile environmental laboratory that Merry Lea staff will drive to regional schools (Luke A. Gascho, personal communication, December 5, 2000). "Environmental Education for Teachers" is a graduate course offered in June and taught jointly by faculty from the Merry Lea facility and Goshen College's education department. The Center also receives support from The Nature Conservancy (Yoder, 2001).

University of Washington. A program called Health and Environmental Resources for Educators at the University of Washington (HERE@UW) was created to design educational materials on environmental health and toxicology for the K-12 classroom. It originated when UW faculty received a three-year grant from the National Institute of Environmental Health Sciences (NIEHS) to develop an environmental health sciences curriculum for the high school grade level. Additional funding was provided by the Boeing Company and Rohm & Haas. The project included a newsletter and a computer curriculum, and resulted in the production of a CD-ROM, "Essentials of Cell Biology," which features numerous examples of adverse effects that can result from interactions between xenobiotic chemicals and biological systems. A second NIEHS grant enabled the development and implementation of an Environmental Health Sciences Workshop for Educators. The HERE@UW listserv keeps workshop participants connected to each other and to the program, and is available to anyone interested in the program. Continued growth and expansion of HERE@UW has included development of a resource kit designed to inspire toxicologists to visit K-12 classrooms. In addition, the program has a website which includes EHS resources for educators, access to the program's newsletters, and access to "Greenskate," a computer curriculum (Second Nature, Inc., 1999b; Sharpe, 1999).

Duke University. The goal of Duke University's Center for Environmental Education is to improve knowledge and understanding of environmental processes in audiences beyond higher education. The Center serves as a bridge linking faculty, research and facilities at the Nicholas School of the Environment (NSOE) with the K-12 community. It has created partnerships with local elementary schools in order to expand the dissemination of environmental content to the traditional science curriculum. These outreach programs provide graduate students with opportunities to conduct environmental education within the local schools. In addition, student volunteers have participated in the revitalization or design and construction of such outdoor classroom settings as nature trails, a pond, gardens, and a composting system (Nicholas School of the Environment, 2001).

The goal of the Center's Teacher-Researcher Partnership (TRP) Program is to facilitate the transfer of NSOE research to the K-12 arena. In the Mahogany Mysteries TRP, for example, 12 local middle school teachers from various disciplines worked with a NSOE researcher and CEE staff for two years to become fully educated on conservation issues, specifically sustainable forestry. Ultimately the group spent a week in Belize, where the teachers participated in ecological research, met local Belizean teachers in a Creole village, and learned about Belizean history and culture. After returning, the teachers worked together to develop an integrated unit on the cultural, biological and historical facets of mahogany and its conservation (Nicholas School of the Environment, 2001).

Hamline University. The purpose of Hamline University's Center for Global Environmental Education is to foster environmental literacy and stewardship in citizens of all ages. Part of the University's Graduate School of Education, the Center's vision is realized through coursework and through service-oriented projects funded by foundations, corporations, government and private donors. The Center offers an Environmental Education Certificate in five program areas, as well as a Certificate in Inquiry-Based Teaching and Learning. Its K-12 educational programs are easy for teachers to incorporate into the classroom and include "Rivers of Life," in which students explore waterways; "A Thousand Friends of Frogs," which engages students as student scientists who collect data while learning about frogs; and "Self Expressing Earth," which teaches ecological literacy through the expressive arts (Hamline University, 2001).

It should be noted that Hamline is a member of Associated New American Colleges, whose members are characterized in part by a commitment to service in their surrounding regions (Associated New American Colleges, 2001).

Northern Arizona University. Northern Arizona University has an Environmental Education Resources Center whose community outreach programs include teacher training workshops; provision of environmental education materials to teachers and other environmental educators; participation in community functions that provide materials and activities for children; and the Wildlife After School Program which is staffed by undergraduate NAU students who organize after-school activities and field trips for children in grades 3-6 (Second Nature, Inc., 1999d). About 100 students annually are reached directly through the Center, and an additional 1000 through participating teachers (Paul Rowland, personal communication, November 5, 2000).

Columbus State University. In association with Columbus Water Works, the College of Science at Columbus State University in Columbus, GA sponsors Oxbow Meadows Environmental Learning Center as an outreach program. The Center uses nature as a classroom, focusing on the diversity of the 1600 acre riparian wetland habitat. It also demonstrates how damaged land can be reclaimed and maintained using environmentally sound practices: the site's history includes uses for agriculture, the mining of sand and clay for brick production, and a city landfill. The Center offers hands-on environmental education annually to about 12,000 K-12 students from Alabama and Georgia. Guided tours are offered to K-12 classes as well as other groups. Additional activities include summer camps and teacher training (Columbus State University, 2000; Becky Champion, personal communication, November 12, 2000).

Clark Atlanta University. Faculty at Atlanta's Clark Atlanta University conducted a simulated "trip to the rainforest" with students in a local elementary school by introducing the students to the critical importance of rainforest preservation, as well as the culture, food, language and history of Brazil. The experience also included computer-simulated adventures and a replication of an airline trip. Extra funding from EPA and the Department of Energy made it possible for the program to sponsor trips to actual Central and South American rainforests for public school teachers, enabling them to conduct workshops for their colleagues (Second Nature, Inc., 1999e).

Summary of Programs' Activities. The most common activity among the above programs was visits to K-12 classrooms by higher education students or faculty; this occurred in eight of the twelve programs. Other common elements included lesson or curriculum development, which was part of five programs, provision of materials, which was part of three programs, and in-service teacher training, which was offered by five institutions. Three of the institutions have an affiliated nature center that K-12 students may visit; four of the programs involve a local issue, e.g., solid waste, a local watershed, a local bay; and three programs involve students in a service project.

Degree and Methods of Program Self-Assessment

Assessment provides a means of measuring the success of a technique or program, and is useful in identifying possible avenues for improvement. In corresponding with representatives of the various programs described above, I inquired about methods of measuring programs' success. Several representatives reported that no assessment is performed. More than 90 percent of Merry Lea's school groups are "return" groups, which, together with "testimonials from teachers and students," are interpreted as indicators of "client satisfaction." Among the programs that do attempt to assess their success, methods mentioned included meetings of "grant teams" to discuss a program's strengths and weaknesses, and pre/post knowledge and attitude instruments along with written comments and surveys of parents. The two most detailed responses follow:

> We assess various programs differently depending on resources available, demands of the grant, etc. Materials are usually assessed as part of a development cycle (i.e. formative assessment) through surveys, focus groups, etc. Workshops are evaluated by similarly. Our largest current project, a seven year grant working with middle schools in WA and NM has an extensive assessment component built in that will track teacher and

> student performance, attitudes, behavior shifts, etc. That project has a dedicated team working on assessment issues alone (Jon Sharpe, personal communication, November 8, 2000).
>
> Assessment is done in a variety of ways. Student testimonials and exit interviews (from both the college students and the elementary school children) provide much helpful input. Also, elaborate portfolios documenting the achievements of the semester are produced by the college students, and pre- and post-program questionnaires are collected from the elementary students. All college students fill out a course evaluation at the end of the term. The elementary students also keep extensive field books, which are assessed by . . . teams (Paul Faulstich, personal communication, November 5, 2000).

In summary, the degree of assessment performed was quite varied, from "none" to "a dedicated team working on assessment issues alone." Implementation of some form of assessment by programs that currently use little or none would help to determine whether the programs' goals are being met, and to identify potential avenues for improvement. Using Wiggins' (1998, as cited in Fink, 2001) "backward design" process, the first step would be to identify the desired "outcomes" of a program's learning activities, e.g. changes in attitude. Next, methods would be developed for assessing whether the desired outcomes had been achieved, such as pre- and post- surveys. Analysis of the results would help to determine the effectiveness of various activities, and potential areas for improvement.

Possibilities and Impediments

I asked representatives what limited their ability to reach additional K-12 students and what, if any, obstacles stood in the way of the programs' reaching their full potential. Responses included funding, marketing of additional programs, personnel constraints, physical constraints of scheduling more group visits, etc., limited opportunities on the part of teachers to interact with a center, willingness on the part if the K-12 culture to adopt environmental education; and one respondent mentioned his own lack of background in teacher training.

Funding was discussed by nearly all respondents and is discussed in detail below. Representatives were also asked their views of the extent to which K-12 outreach is valued when faculty are evaluated for promotion and tenure. Those responses are discussed in detail as well.

Funding. As noted, many of these programs are supported by external funds. Merry Lea (of Goshen College) has a "Friends of Merry Lea" group that provides financial support, and Oxbow Meadows (of Columbus State) is developing a "Friends of Oxbow" group that, it is hoped, will help with local funding and support. One representative said, "We are scrambling to get more funding for this year . . ." If these efforts are unsuccessful, he said, the program would still continue but without stipends for the teachers, new equipment, etc. A representative from another program commented,

> Our projects are based on grants so funding is a major obstacle. If we had permanent funding we could pay regular staff to offer regular programs. . . . We operate on a year to year basis . . . It is unlikely that we could become a budget line since we are in the process of budget cuts at the institution. We would need to become "profit making" to become an integral part of the institution.

It should be noted, however, that many respondents considered their external funding sources to be quite secure, and none of the respondents expressed concern that their programs might be discontinued unless they became line items in the institutions' budgets. In summary, then, much of the programs' funding is external; the extent to which the respective institutions support the programs financially is quite varied; and nearly all representatives feel that more could be accomplished if more funding were available. However, while lack of funds may limit what can be accomplished, insufficient funds is not a threat to any program's continued existence.

The Higher Education Faculty Rewards System. The traditional higher education faculty rewards system represents another potential "impediment" to the enhancement of K-12 EE by higher education institutions. Representatives of many of the above programs were asked how they feel K-12 outreach fits—or, as the case may be, doesn't fit—into the traditional higher education faculty rewards system. For example, do faculty feel they would be better off career-wise doing something other than K-12 outreach? Is that even a concern? Does K-12 outreach somehow "fit" into the faculty rewards structure at the particular institution--e.g. into the "service" category or because community outreach is a priority at that institution? How supportive is the institution of this work, in comparison to other programs?

Three representative responses follow, which indicate that while K-12 outreach "counts" in terms of any grants received and as a "service" activity, faculty who are concerned about promotion would be well advised to focus most of their energies on "more scholarly research activities." Respondents' identities have been intentionally omitted; the responses are numbered for clarity.

> 1) There is significant support from (our president) for university faculty to get involved in k-12 Education . . .
>
> That said, faculty who ultimately vote on the promotion and tenure of their junior colleagues for the most part still do not 'value' participation in k-12 outreach activities as much as research or classroom teaching. It is considered a form of public service, and does count in that way. However, for a faculty member who was to commit a large part of his/her effort on k-12 outreach/education, including publishing education articles in 'scholarly' journals, promotion based on those accomplishments would be difficult. In other words, there still seems to be an attitude that participating in k-12 outreach is great, as long as it doesn't preclude more scholarly research activities.

I would say that there is a relatively large amount of enthusiasm among our faculty to participate in k-12 education. Among the various 'service' types of activities, it is deemed valuable and important. My advice, however, has been that assistant professors should not commit large amounts of time to such efforts if they expect to get promoted. That remains a reality, and probably won't change. However, with the increased opportunities to obtain federal funding for k-12 education outreach/curriculum development, it has become easier for people to gain professional recognition in this area.

2) Bringing in grants is a recognized important activity for faculty in our institution and is connected to pay raises and promotion. The encouragement for bringing in grants is generally from administrators such as the dean or some chairs. In so far as our outreach activities are entirely funded by grants (since we have to buy out our time from other activities to have time for outreach), some rewards result from outreach activities. Most senior faculty, however, i.e. those who vote on your tenure, do not think it is particularly important and the general feeling among young faculty is that it is discouraged or even seen as a distraction from research and publication. In general, outreach-oriented faculty are treated as second class faculty within the institution. I know several faculty, who after getting tenure, began to focus more aggressively on outreach to K-12, or outreach in general, and who have been bluntly told that this does not fit into the department's mission and that they are hurting their careers. There is no doubt, that spending a significant amount of time focused on outreach will hinder your career . . .

3) We have had about 5-8 folks who will help whenever we have a program and are excited to do so out of their own sense of responsibility to community outreach; however, because of many of the reasons you mentioned, we have had problems with continual involvement of faculty. Through my conversations with various faculty members, it seems the lack of recognition (i.e. teaching requirements) from the institution is the largest problem. One even told me that we could pay him a stipend and it would still not entice him because he has to balance his research and his teaching.

I really think it is this recognition as teaching (towards the teaching requirement) for faculty that would be the most successful way to really encourage faculty involvement with the community (especially K-12) at an institutional level.

All three of the above responses are from large institutions. A respondent from a smaller, liberal arts institution also reported that his institution's merit evaluations presently are "heavily biased toward traditional scholarship," although an initiative recently had been presented to the faculty which, if passed, would implement formal recognition of "service" activities. Generally, however, the preceding comments indicate that the faculty rewards system in higher education can be seen as an impediment to direct K-12 outreach, with the possible exception of outreach activities that are funded by grants.

This issue is addressed in the report, "Making a Place in the Faculty Rewards System for Work with K-12: A Project Report of Four Universities"[2] (Gips, 1998), part of a project that purported "to enhance the value that university rewards systems place on faculty work with K-12 schools and teachers, and ultimately to improve the quality of education delivered in K-12 and in colleges and universities." Gips reported that an institution's view of itself with respect to the community in which it is located appeared to affect the degree to which faculty recognize the work of the community as their work. More specifically, the extent to which the institution's mission recognizes a commitment to collaboration with the public schools, both in writing and in action, affects the degree to which this kind of work is emphasized in the rewards system. Other factors included

- The recency of the institution's emphasis on K-12 collaboration—i.e., the length of time K-12 work has been valued at the institution;
- The institution's organizational and governance structure: a centralized governance structure was seen to be more conducive to K-12 outreach by faculty than a structure in which a large amount of power lies within a faculty governance system; and
- Size of the institution, with greater likelihood of expeditious policy change among smaller institutions.

The author also contends that use of financial rewards to support departmental efforts with K-12 partners can lead to more-significant results than rewarding individuals for their singular efforts.

Conclusions

This chapter has examined a number of approaches for the enhancement of K-12 environmental education by institutions of higher education. Types of approaches include training of pre-service and in-service teachers in the content and pedagogy of EE; development of EE curricula by an institution's faculty or students; development of electronic EE materials for K-12 students, such as websites or a CD-ROM; conduction of EE programs in schools; and a variety of "active learning" activities, such as field trips, visits to the institution's nature center, and involvement of students in research, restoration or development projects. Table 5 summarizes the various approaches for enhancement of K-12 environmental education by higher education institutions that are discussed in this study, and some positive and negative aspects of each. It is encouraging that most of these programs include some form of "active" learning: educational psychologists tell us that humans retain only 10-20 percent of what we hear or read, vs. 80 percent of what we do (Cortese, 1999). It should be noted that in some cases the outreach activities emanate from the particular interests of individual faculty or departments, rather than adoption of K-12 outreach as an institutional goal.

One must, of course, use caution in generalizing based on a small sample. Having acknowledged this, this study indicates that, in terms of "direct outreach" activities, the potential for reaching the greatest number of K-12 students lies in nature centers that

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[2] There was no overlap between the four institutions in Gips' report and the institutions whose programs are described in this manuscript.

Table 5. Advantages and Disadvantages of Various Approaches for Enhancement of K-12 Environmental Education by Higher Education Institutions

Approach	**Positive aspects**	**Negative aspects/potential obstacles**
Pre-service teacher training in EE	• Potential for reaching a very large number of K-12 students	• Limited "space" in curriculum • Time and resources required to develop appropriate learning activities for pre-service teachers
In-service teacher training in EE	• Potential for reaching a very large number of K-12 students • Research shows a correlation between EE in-service education and amount of class time spent on EE	• Not all teachers will participate unless required • Time and resources required to develop appropriate learning activities for in-service teachers
Nature center	• Potential for reaching a large number of K-12 students • "Hands-on," "active" learning is superior to "passive" learning	• Many institutions have no land available • Resources required to staff and maintain such a center
Visits to K-12 classrooms	• If conducted by higher education students, can be a valuable "hands-on" learning experience for them • Exposure to EE that K-12 students might not otherwise receive	• Time required on the part of higher education faculty
Lesson or curriculum development	• Can be a valuable learning experience for college students, if conducted by students rather than faculty	• Time required on the part of higher education faculty
Studying a regional issue	• Makes learning more "relevant" to the students • Can be an avenue for "hands-on," "active" learning, which is superior to "passive" learning • Could result in positive change with respect to the issue in question	• Finding a local issue that would be appropriate to study • Higher education faculty member(s) with relevant expertise must be willing to participate • Funding
Service projects	• Can be an avenue for "hands-on," "active" learning, which is superior to "passive" learning • Benefits to the recipient or object of the service	• Finding appropriate environment-related service projects • Time required on the part of higher education faculty

Table 5. Advantages and Disadvantages of Various Approaches for Enhancement of K-12 Environmental Education by Higher Education Institutions (continued)

Approach	Positive aspects	Negative aspects/potential obstacles
Providing EE materials	• Affords K-12 students the use of materials to which they might not otherwise have access, due to budget constraints or other reasons • Can be a valuable learning experience for college students, if materials are developed by students rather than faculty.	• Time and resources required in preparing the materials

students may visit; on average, each of the three nature centers described here reaches about 7800 students annually. Further, nature centers represent an avenue for "hands-on," "active" learning, which is generally agreed to be superior to "passive" learning. However, institutions interested in K-12 outreach but which own no land suitable for nature centers could find inspiration in the Manchester College Solid Waste Management District Program, which reaches nearly all elementary and middle school students in the county, as well as some high school students. The two "key" ingredients in that program appear to be acquisition of external funding, and a local external entity (i.e., the Solid Waste Management District) that was willing to participate. It is also significant that this program involves a local issue, i.e., solid waste, as student learning is enhanced when it is made relevant to "real life." Other programs that involve students in the study of a local entity and thus could be used as models for other institutions in this respect are Oberlin's Watershed Education Project, and California State University at Monterey Bay's "Interpreting the History, Geology and Ecology of Monterey Bay." Further, three of the programs (Oberlin's Watershed Education Project, Washington State University's Center for Environmental Education, and Hamline University's Center for Global Environmental Education) involve students in service projects, which represent another "active learning" strategy.

With respect to the issue of funding, the National Science Foundation (NSF) may represent a potential source of "external" funds for enhancing K-12 EE, in view of NSF's increased emphasis on science, mathematics and technology (SMT) education at the K-12 level. For example, programs and funding opportunities offered under NSF's Division of Elementary, Secondary and Informal Education include

- "Teacher Enhancement" which supports projects that provide professional development opportunities to broaden and deepen the disciplinary knowledge and pedagogical skills of teachers;
- "Instructional Materials Development" which supports projects that create curricula, instructional materials and student assessments for enhancing students' understanding of SMT in grades preK-12; and
- "Informal Science Education" which supports activities that provide opportunities outside formal school settings for increasing understanding and appreciation of SMT among individuals of all ages, interests and backgrounds (NSF Directorate for Education and Human Resources, 2001).

Other NSF programs that might be considered are the Course, Curriculum, and Laboratory Improvement (CCLI) program (http://www.nsf.gov/pubs/2002/nsf02043/nsf02043.html), and NSF Graduate Teaching Fellows in K-12 Education (GK-12). In the latter, undergraduate and graduate students are trained by their institutions to serve in partner K-12 schools as resources knowledgeable about both the content and applications of SMT (NSF, 2002).

Unfortunately, it seems safe to say that the traditional higher education faculty rewards structure poses an impediment to K-12 outreach. In Gips' (1998) report, support of K-12 outreach by the institution's leadership, both formal and informal, appeared to be the most important factor with regard to inclusion of these activities in an institution's faculty rewards structure.

I would contend that the single thing colleges and universities could do that would result in the greatest enhancement to K-12 environmental education, at least in terms of number of students affected, is to include environmental and sustainability issues in pre-service and in-service teacher training. It seems that this could potentially raise the public's environmental consciousness significantly. In McKeown-Ice's (2000) study, survey respondents were asked to rank the barriers to EE at their institution at the pre-service level. Overwhelmingly, respondents ranked "limited course time, conflicts with mandated course content" as the most significant barrier. However, this problem could be circumvented by several of the strategies suggested in Chapter 1 for increasing environmental literacy among college students in general. If existing courses in the education curriculum have no "room" for inclusion of environmental and sustainability issues, students could be required to take a separate course in another department. When hiring new faculty, colleges of education could consider candidates' "environmental" interest and expertise. If "green campus" practices are not adopted campus-wide, they could be adopted by the College of Education; etc.

Finally, a 1996 survey of state EE coordinators showed that only two of the 43 states whose coordinators responded require an EE course or the equivalent for K-6 teacher certification, and only four of the 43 require such a course for 7-12 teachers (Holtz, 1996). In McKeown-Ice's study, state certification guidelines were one of the two most influential factors in determining the nature of the environmental education component of pre-service education programs (the other was faculty interest or knowledge). It appears safe to say, therefore, that state teacher certification requirements in EE would significantly increase the inclusion of EE in K-12 teacher training and thereby in K-12 education itself.

Studies of the Content and Process of Environmental Education

Chapter 3

Technical Knowledge Required for Understanding Environmental Issues Relevant to Selected Professions

Abstract

In an attempt to gain insight into the level of "technical" expertise required in order to understand the environmental issues relevant to selected professions, some individuals in those professions were surveyed. Professions surveyed included journalists, elementary school teachers, legislators, engineers, geologists and managers in petroleum-related firms. Whenever possible, I attempted to select individuals identified as relatively "environmentally astute." Areas of technical expertise included mathematics, physics, chemistry, earth sciences, life sciences and toxicology. Respondents rated required levels of competence in the various disciplines on a numerical scale which corresponded to descriptions of levels of competence for each discipline.

Among the study's interesting results was the opinion of legislators that the level of technical knowledge needed to understand the environmental issues relevant to their jobs was lower than that of all other groups in five of the six disciplines; in four of the disciplines, the differences were statistically significant. All groups but one (journalists, who chose mathematics) rated toxicology as the discipline about which they needed to be least knowledgeable.

The mean scores for all groups combined represented the approximate level of knowledge that would be acquired in an introductory-level college course in each

discipline. Specific levels of knowledge of each discipline for each group, represented by each group's mean score for that discipline, are discussed. Respondents were also asked the extent to which environmental education should be designed to impart "knowledge" vs. foster environmental ethics. Implications of this study for general education curricula are considered.

Introduction

Understanding environmental issues requires a degree of competence in such "technical" disciplines as mathematics, physics and chemistry. However, the level of technical competence required to deal responsibly with the environmental issues relevant to one's work varies from one profession to another, as does the potential for damaging or protecting the environment. Information pertaining to different professions' requisite level of knowledge of various technical disciplines could therefore be useful in designing general education curricula and/or curricula in those majors.

Much has been written about the appropriate level of "scientific literacy" that should be engendered by a college education. A committee of the Advisory Committee to the National Science Foundation's (NSF) Education and Human Resources Directorate conducted an intensive review of the state of undergraduate education in science, mathematics, engineering and technology (SME&T) in America. The review concluded that it was "imperative" that all of America's undergraduates attain a higher level of competence in science, mathematics, engineering, and technology:

> America's SME&T faculty must actively engage those students preparing to become K-12 teachers; technicians; professional scientists, mathematicians, or engineers; business or public leaders; and other types of "knowledge workers" and knowledgeable citizens. . . . It is important to assist them to learn not only science facts but . . . how to make informed judgments about technical matters (NSF Advisory Committee, 1998, p. ii).

The National Research Council's Center for Science, Mathematics and Engineering Education (1996) has said that the undergraduate years are the last opportunity for rigorous academic study of science, mathematics, engineering and technology

> by many of the future leaders of our society—the executives, government officers, lawyers, clergy, journalists, and others who will have to make momentous decisions that involve science and technology. Colleges and universities prepare the elementary and secondary teachers who impart lifelong knowledge and attitudes about science and technology to their students (p. 1).

And in a paper called "Teaching Relevant Science for Scientific Literacy," Hobson (2000) writes,

> Consider the elementary education students who will teach the next generation, the journalism students who will report the science news, the political science and law students who will go into government service, or the business students who will develop new technologies and hire scientists: All of these are nonscientists. We ignore them at our peril. Our attention, or inattention, to these students has a large future multiplier effect (p. 243).

According to Goodstein (1992), "approximately 95 percent of the American public is illiterate in science by any rational definition of what we mean by science literacy" (p. 150); and he expressed the opinion that science illiteracy is "a threat to our ideal of Jeffersonian democracy" (p. 149). Hobson (1999) reports that very few raise their hands when he begins speeches with the question, "Have you encountered, in any science course at any level, a significant discussion of any science-related social issue, such as population growth or environmental pollution?" Rutherford and Ahlgren (1990) contend that

> The life-enhancing potential of science and technology cannot be realized unless the public in general comes to understand science, mathematics, and technology and to acquire scientific habits of mind; without a

> scientifically literate population, the outlook for a better world is not promising (p. vii). . . . Scientific habits of mind can help people in every walk of life to deal sensibly with problems that often involve evidence, quantitative considerations, logical arguments, and uncertainty; without the ability to think critically and independently, citizens are easy prey to dogmatists, flimflam artists, and purveyors of simple solutions to complex problems. . . . The most serious problems that humans now face are global: . . . (p. vi)

The authors go on to list ten of these problems; five of the ten are environmental, or directly related thereto: unchecked population growth, acid rain, rainforest destruction, loss of other important sources of species diversity, and environmental pollution. Others, such as global warming related to carbon-based fuels, certainly could be added to this list. Roth (1992) asserts that "There is no doubt that environmental literacy draws upon many aspects of scientific literacy, particularly in terms of habits of mind" (p. 8), and points out that both "literacies" involve people in using critical and creative thinking; in seeking and organizing information; in being "healthily skeptical;" and in forethought.

Knowledge vs. Attitude

A number of studies in the literature on environmental education examine the effect of the relationship between the cognitive and affective domains, or of the affective domain alone, upon people's behavior with respect to the environment. For example, Ramsey and Rickson (1989) suggest that while it is unclear whether attitudes lead to increased knowledge or vice versa, there probably is a relationship between the two: that "elementary knowledge leads to attitudes which in turn motivate one to learn more and so on" (p. 11). Further, a longitudinal study of in-service teachers participating in a summer workshop designed, in part, to promote cognitive and affective growth related to environmental issues showed that growth in knowledge alone resulted in rather short-lived gains (i.e., less than two years). The authors correctly pointed out that "Even if this were not the case, the increasing rate at which knowledge is accumulating daily makes an education based essentially on information exchange rather short-lived and of questionable value anyway." Notably, however, the study also showed "that measurable and enduring change in a positive direction can be achieved by adults in attitude, values, and behavior—if appropriate strategies and methods are employed" (p. 232). In that study, the "strategies and methods" included field trips; development and presentation of environmental education lesson plans; panel debate/discussions; audiovisual materials; and engagement in extensive interactions with faculty and with each other (Edwards and Iozzi, 1983).

Finally, Swan (1974) wrote

> The traditional approach to conservation education has been to "teach the facts" and assume that if people "get the facts" about resource problems they will become concerned about the problems . . . This model is successful, however, only when two other conditions are present—the person must already have some concern or emotional feelings about the problem, and they must have the personal feeling that they can do something about resolving the problem (pp. 31-32).

One objective of this study therefore is to look at the extent to which environmental education should be designed to convey "knowledge" vs. develop an environmental ethic. Further, in the "knowledge" arena, it examines the types of "technical" knowledge (sciences, mathematics, etc.) that are needed by various professionals in order to understand, and properly respond to, the environmental issues that are relevant to their particular professions, and <u>how much</u> knowledge is needed in each of those "technical" disciplines.

Methods

Selected individuals in six professions were asked to complete a questionnaire that asked their opinion of the level of "technical" expertise required in order to understand the environmental issues relevant to those professions, and to the extent to which environmental education should be designed to convey "knowledge" vs. develop an environmental ethic. Professions included journalists, elementary school teachers, legislators, engineers, geologists and managers in petroleum-related firms.

Selection of Respondents and Distribution of Questionnaire

Respondents were not selected randomly. Since the survey's objective was to gain insight into the types and amounts of "technical knowledge" needed to understand the environmental issues relevant to the selected professions, it was assumed that more accurate responses would be obtained from persons of above average environmental knowledge and/or "environmental consciousness" than from a randomly selected sample. Wherever possible, therefore, an attempt was made to select for such persons, as described below.

Selection of Professions. It is recognized that many professions can potentially have a significant impact on the environment, and that some potentially may have an even greater effect than those selected for this study. For reasons of practicality, the study focused on a small number of professions; following is the rationale upon which selections were based.

Journalists were selected because of the importance of their role in accurately informing the public of environmental issues and events. The journalists who received the questionnaire were all members of the Society for Environmental Journalists (SEJ), a nonprofit group of nearly 1100 journalists and academics working in every type of news media.

Legislators were selected because of their potentially significant impact on the environment through the creation of environmental laws and policy. The legislators were selected by asking their colleagues in the Oklahoma State Legislature whom among their numbers they considered to be particularly environmentally conscious and/or knowledgeable.

Elementary teachers were selected because of their potential to educate young students about the environment. The particular teachers who were sent the questionnaire were selected by the Science Coordinator for the Norman, OK public school system after she was apprised of the survey's objectives.

Engineers were selected because potentially, they too can significantly impact the environment in the construction of roads, bridges, etc. Some engineers were selected in a similar way to that of legislators, i.e., by recommendations from their colleagues. Others completed the questionnaire at the International Petroleum Environmental Conference (IPEC), described below.

Managers in petroleum-related firms were selected because a) I wanted to include representatives of business and industry, as many of their decisions obviously have a potentially significant impact on the environment; and b) since the amount of technical knowledge needed to make environmentally sound decisions varies widely from industry to industry, it seemed appropriate to concentrate on one industry. Geologists were included as a matter of convenience. They were not actually selected as a profession to survey, but since several geologists completed the questionnaire at the IPEC conference, their responses are included.

Distribution of the Questionnaire. The questionnaire was distributed at the 2000 IPEC in Albuquerque, NM, where responses were obtained from engineers; managers in petroleum-related firms; and geologists. This conference is organized annually by a consortium of individuals and organizations from higher education as well as state and federal agencies. Its mission is to increase the competitiveness of the domestic petroleum industry through reducing the cost of compliance with U.S. environmental regulations. The conference is targeted at "anyone involved in developing and implementing new technology to address and resolve environmental problems in exploration, production, and refining, especially engineers and scientists;" as well as health, safety, environmental and operating professionals from all areas of the petroleum industry (University of Tulsa, 2001). The questionnaire was distributed at this conference on the assumption that the "environmental knowledge" of its attendees would be above average.

Questionnaires were distributed to journalists via the SEJ's listserv. All other questionnaires were sent and returned via surface mail, except for those distributed and collected at the IPEC conference.

Development of the Questionnaire

It could be argued that life sciences are the scientific disciplines most relevant to the environment, since they encompass such concepts as the flow of nutrients and energy through ecosystems, the importance of ecosystem balance and habitat, etc. However, understanding of biological processes necessitates some understanding of chemical processes; which in turn requires some understanding of the principles of physics; which in turn necessitates understanding of mathematics. This is the dogma which led to inclusion of these four disciplines in the questionnaire.

Earth sciences were included due to the prominence of fossil energy sources in environment-related debates (e.g. global warming, drilling for oil in ecologically sensitive areas) and also to the issue of groundwater contamination from human activities. Finally, toxicology was included as a result of my own opinion that nearly everyone would benefit from some knowledge of toxicology; otherwise, one is unable to know for certain (e.g.) the risks posed by particular concentrations of various xenobiotics, and must rely on information provided by others who conceivably might have an agenda to promote and therefore be less than truthful.

Respondents were asked to rate knowledge needed in the areas of mathematics, physics, chemistry, earth sciences, life sciences and toxicology on a Likert scale from one to five. Table 6 shows the descriptions of levels one, three and five for each discipline that were used on the instrument. Level one was intended to represent the approximate level of knowledge of the particular discipline that would be acquired in elementary school. Level three was intended to represent the approximate level of knowledge that might be acquired in an introductory-level college course, while level five was intended to represent the approximate level of knowledge that would be acquired in more advanced college courses. If respondents felt the level of knowledge fell "in between" those described, they were asked to use appropriate intermediate scores (i.e., two or four).

In addition, the questionnaire asked

- What proportion (0-100%) of the "environmental" education of persons entering your profession should deal with ethical issues as opposed to strictly knowledge?
- Did you take one or more courses that were environment-related in a significant way?
- Were you exposed to concepts of ethics with respect to the environment?

These questions were included because of the aforementioned evidence that education in both knowledge and attitude are important in fostering environmentally responsible behavior.

Data Analysis

It is, of course, desirable to examine research data quantitatively whenever possible. PC-SAS was used to analyze for statistically significant differences in scores among professions by a two-way non-parametric ANOVA (analysis of variance) on the Wilcoxon rank sums. Wilcoxon rank sums are obtained by sequentially ranking parameter measurements of two combined samples, then re-separating the samples and summing each one's rank scores. ANOVA is a statistical procedure for determining the source(s) of variation in a data set. This particular test was chosen because it is appropriate when a normal distribution cannot be assumed, as in the case of small sample sizes.

Error bars in Figures 7-9 represent two standard errors. Standard error was chosen over standard deviation because the former is a measure of the variance in sampling distributions, while the latter measures the level of dispersion of population measurements about their mean.

For questions on which respondents were required to specify a numerical score, standard errors were calculated using Microsoft® Excel's formula for standard deviation, and dividing by the square root of *n*. For nominal-level questions (i.e., those which were answered simply "yes" or "no"), standard errors were calculated using the formula shown in Appendix A.

Table 6. Descriptions of the Knowledge Levels for Each Discipline That Were Used on the Survey Instrument

Discipline	**Level 1**	**Level 3**	**Level 5**
Mathematics	Basic arithmetic computations learned in elementary school: addition/subtraction, multiplication, division, fractions.	Level 1 plus algebra, plane geometry, statistics	Level 3 plus trigonometry, differential and integral calculus
Physics	None	Fundamental understanding of laws of motion, gravitation, thermodynamics (including entropy), electrical and magnetic attraction, energy (e.g. kinetic, potential, conservation); nuclear reactions; radioactivity; i.e., concepts that would likely be learned in an introductory-level college physics course.	Level 3 plus such concepts as kinetic theory, magnetic fields, waves, optics, electronics, fluid mechanics, quantum theory.
Chemistry	None	Fundamental understanding of such concepts as scientific notation, atomic and molecular structure, nomenclature, pH and stoichiometry that would likely be learned in an introductory-level college chemistry course.	Level 3 plus knowledge of oxidation/reduction, organic chemistry, the carbonate cycle, precipitation/dissolution, complexation.

Table 6. Descriptions of the Knowledge Levels for Each Discipline That Were Used on the Survey Instrument (continued)

Discipline	Level 1	Level 3	Level 5
Earth Sciences (Geology, hydrology)	None	Geologic time, earth history, hydrologic cycle, groundwater, minerals, rock formations, fossil energy sources, surface processes, structure of the earth.	Level 3 plus Darcy's law, porosity, permeability, vadose zone hydraulics, well hydraulics, basin recharge, flood routing.
Life Sciences (e.g. botany, zoology, ecology)	None	Basic metabolic processes, metabolically important compounds, cell structure and function, elementary genetics, evolutionary processes, nutrient cycling, fundamentals of ecology, energy flow and ecosystem function; i.e., concepts that would likely be learned in an introductory-level college biology course.	Level 3 plus bio-chemistry, physi-ology, molecular biology, cell biology, biodegradation pro-cesses, ecology of particular biomes, habitat assessment and evaluation, ecosystem rehabili-tation and restoration, quantification methods for biodi-versity, productivity, population growth.
Toxicology	None	Types of toxic responses (e.g. carcinogenesis, mutagenesis, etc.), EPA methods for setting maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs), concepts of dose/response, bioaccumulation, bioconcentration.	Level 3 plus biotransformation pathways, toxicokinetics, immunotoxicology, acute and chronic toxicity testing.

Results/Discussion

Respondents included seven journalists; nine state legislators; ten elementary teachers; nine managers in petroleum-related firms; thirteen geologists; and six civil/environmental engineers. Each group's mean scores are shown in Figures 7, 8 and

9. Figures 7 and 8 depict the same data; Figure 7 is arranged by discipline, while Figure 8 is arranged by profession.

A statistically significant difference was in the level of mathematics respondents in the various professions thought was necessary; $p = 0.0007$. Specifically, engineers indicated they needed significantly more mathematics than was indicated by the other professions, and the level of mathematics knowledge journalists and legislators felt they needed was less than that of the other groups by a statistically significant margin.

In the case of physics, a statistically significant was also seen among the groups; $p = 0.0117$. Elementary school teachers felt they needed about the same level of knowledge as that indicated by engineers, managers and geologists: the scores of all four groups were near 3.5. The mean score of legislators was significantly lower from that of the other groups.

In the case of chemistry, the groups' mean scores were also different; $p = 0.0178$. Geologists and engineers, whose chemistry scores were approximately 3.8, felt they needed substantially more chemistry knowledge than did elementary school teachers and legislators, whose scores were around 2.5. Geologists' mean scores were significantly higher than those of the others, and the scores of legislators were significantly lower.

Elementary school teachers and legislators also saw substantially less need for knowledge of earth sciences than did the other four groups, and these differences were statistically significant. Engineers and geologists' perceived need for knowledge of earth sciences was significantly greater than did the group as a whole. The p value for this interaction was 0.0001. There were no statistically significant differences among the

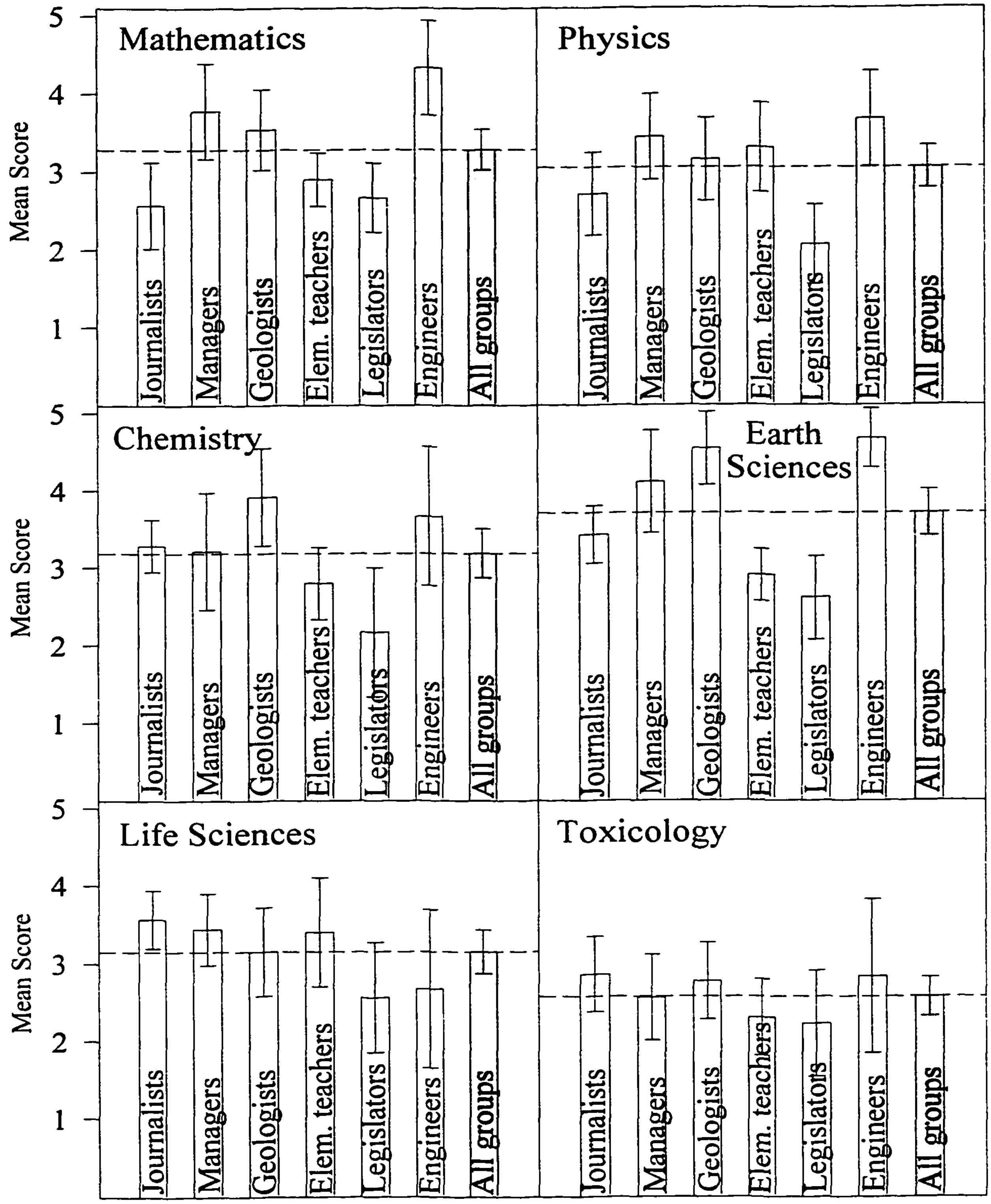

Figure 7. Levels of knowledge of various disciplines persons in selected professions felt were needed in order to understand the environmental issues relevant to that profession. Error bars represent two standard errors. Dotted lines represent the mean for all professions.

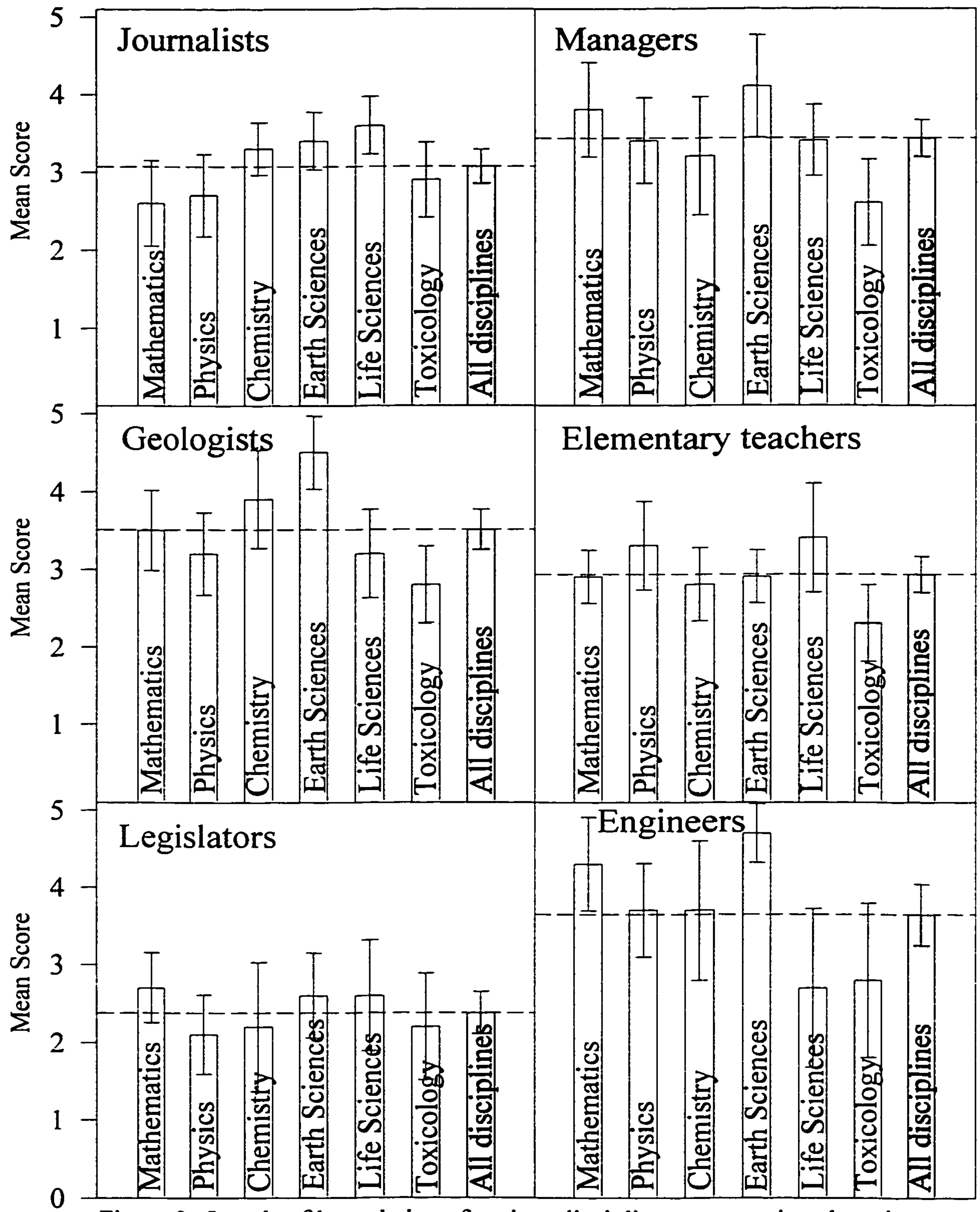

Figure 8. Levels of knowledge of various disciplines persons in selected professions felt were needed in order to understand the environmental issues relevant to that profession. Error bars represent two standard errors. Dotted lines represent the mean for all disciplines.

groups in perceived need for knowledge of life sciences (overall mean 3.2; $p = 0.2743$) or toxicology (overall mean 2.6; $p = 0.5299$).

Summary – Technical Knowledge

When taken together, mean scores for all groups were around 3.0 in most of the disciplines included in the survey; Level 3 represents the approximate level of knowledge that should be acquired in an introductory-level college course in each respective discipline. The following exceptions to this trend are noted:

The legislators surveyed felt the level of knowledge they needed in order to responsibly handle environmental issues they might encounter was below Level 3 in every discipline. The engineers surveyed felt the level of knowledge they needed in the areas of mathematics, physics, chemistry and earth sciences was significantly above Level 3; indeed, the engineers' scores were higher than those of all other groups except in the area of life sciences. This is not surprising since engineering is the most "technical" of the professions included. Managers felt the level of math and earth sciences they needed was closer to Level 4; however, with respect to the latter it should be remembered that these were managers in petroleum-related firms. Geologists felt the level of chemistry they needed was closer to four.

Among all the disciplines included in the survey, respondents overall felt they needed the most knowledge of earth sciences (3.7), and the least knowledge of toxicology (2.6). The high score in the area of earth sciences is a function of the fact that more than half of the respondents were either geologists, engineers, or managers in petroleum-related firms.

In hindsight, it would have been interesting to ascertain how many of the respondents had actually had significant exposure to toxicological concepts—i.e., is it possible that respondents' perceived lack of need for training in toxicology is a function of their lack of knowledge of how they would benefit from such training—perhaps this is true of the legislator mentioned above. It is my belief that nearly everyone would benefit from some knowledge of toxicology; otherwise, one must rely on information provided by others who a) may have little or no knowledge of toxicology themselves, or b) may not be completely truthful. This could, of course, be said of any other discipline. It is particularly important in the case of toxicology, however, because the question is likely to be whether or not one's health, or even one's life, is at risk from exposure to a particular concentration of an environmental contaminant. *Hinkley vs. PG&E*, on which the movie "Erin Brockovich" is based, is a famous example.

The most interesting result of this study was that the legislators (n = 9) who responded felt they needed less knowledge than any other group of every discipline except mathematics. In fact, legislators' mean responses differed from those of all other groups by a statistically significant margin in all disciplines except life sciences and toxicology, in which no statistically significant differences were seen among the groups. Tachibana (1998) wrote, "Since politicians are easily swayed by their perceptions of public opinion, key to promoting wise political decisions about scientific matters is a sound understanding of science among the general population and the media that feed, reinforce, and mobilize its views" (p. 778). One responding legislator enclosed a letter which appeared to disagree:

> . . . I feel that it is of utmost importance to make a serious point concerning the level of expertise that a Legislator contains in any given

> subject area. Please keep in mind that citizens serving in public office are first and foremost average citizens that have been elected by the voters of his or her district to serve in the voter's best interest. It would be impossible and improbable to have a person serve in an elective capacity that is an expert in all fields. Although I hold a B. S. Degree in Agricultural Economics, I am by no means an expert on agricultural or environmental issues. In the capacity of Chairman of the Senate Agriculture and Rural Development Committee, I rely heavily on the expertise of directors and engineers of other state agencies. . . . In my opinion, the most valuable asset a Legislator can have is the ability to bring several groups together to work out a compromise that will benefit the citizens of our state.

Further, this legislator's reference to the extent to which he relies on the expertise of others may be a manifestation of the warning of Hobson (1999) who wrote that "Industrial democracy cannot survive unless citizens are literate about science-related societal issues. If citizens cannot vote intelligently on these matters, then democracy will succumb either to gross misuses of technology, *or to a nonelected scientific elite that will make these decisions*" (p. 240; italics added).

Additionally, it was noteworthy that a legislator whose responses indicated he thought legislators needed relatively high levels of knowledge in most disciplines held a degree in dentistry (i.e., was highly educated); while one who had completed only a high school education checked Level One for all six disciplines. The latter wrote,

> As you can tell, I don't believe a legislator has to be an "expert" or a specialist in the field. We do have a wide array of resources available, like staff members to do research . . . I think that a legislator that is conscientious and utilizes the resources available can do a good job regarding environmental issues if the legislator has a sound ethical attitude toward the issue at hand.

Benjamin Shen (1975, as cited in Shamos, 1995) distinguished three forms of scientific literacy—practical, cultural and civic—referring to the latter as the "cornerstone of informed public policy." The aim of civic science literacy, he says, is to enable citizens and their representatives to bring an awareness of science to consideration of civic issues. Further, in defining the reasons why colleges and universities should "demand literacy in science, mathematics, engineering and technology," the National Research Council's Center for Science, Mathematics and Engineering Education contends that

> All people should be able to make intelligent and informed decisions not only about legislative and public policy issues but also about choices that affect them and their families. And science literacy is a powerful antidote to anti-science beliefs that periodically threaten the rationalistic underpinnings of society (p. 16).

Based on the comments of the two legislators quoted above, perhaps it is safe to assume legislators' perceived need for less knowledge than any other group of nearly every discipline is a function of legislators' reliance on nonelected persons—e.g., staff or other government employees—for the needed expertise. Nevertheless, it is disturbing that individuals (i.e., elected officials) who, through their policy decisions, arguably have more potential than any other single group to affect the environment positively or negatively, generally felt the need for less knowledge than any other group. One wonders about the ability of these legislators to understand the information relayed to them by experts, and what they might do in the event of conflicting "expert" opinions. A further cause for concern is the possibility of the experts' having an agenda of their own to promote—i.e., of lack of objectivity on the part of these experts.

The Relative Importance of Knowledge vs. Development of an Ethical Attitude

The journalists who responded to the survey indicated they thought the environmental education of journalists should overwhelmingly be concerned with knowledge as opposed to ethics (Figure 9a). While there were no significant differences among the groups as a whole ($p = 0.0759$), confidence intervals showed a significant difference between journalists' responses to this question and the responses of all the other groups. This is understandable since journalists obviously need a factual understanding of an issue in order to be able to write about it in a way that is cogent and accurate. The following passage from a university newspaper story, written by a senior journalism major, is a case in point in that it reveals the author's limited understanding of the issue:

> Global warming results from the generation of carbon, in part, from people's waste. People are concerned about global warming because of its negative effect on the air people breathe and the water people drink, essentials needed to sustain human life.
>
> . . . Waste prevention and recycling reduce these gases by reducing methane emissions and saving energy. Reducing gas emissions helps stop global climate change by decreasing the amount of heat-trapping greenhouse gases. These gases cause global warming (Miller, 2001, p. 1).

Interestingly, however, the journalists indicated more exposure to environmental ethics during their education than any other group (Figure 9b). Every responding journalist also indicated having taken an environmental course (Figure 9c); it is assumed that this is because these particular journalists (who are members of the Society for Environmental Journalists) have a particular interest in environmental issues.

All groups other than journalists felt approximately half the environmental education of those in their professions should be concerned with ethics as opposed to knowledge. Only about one third of the geologists, elementary teachers and engineers had been exposed to environmental ethics during their education.

The groups with the smallest proportion of individuals reporting having taken an environmental course (Figure 9c) were legislators and geologists; still, however, more than half the individuals in these groups responded positively to this question.

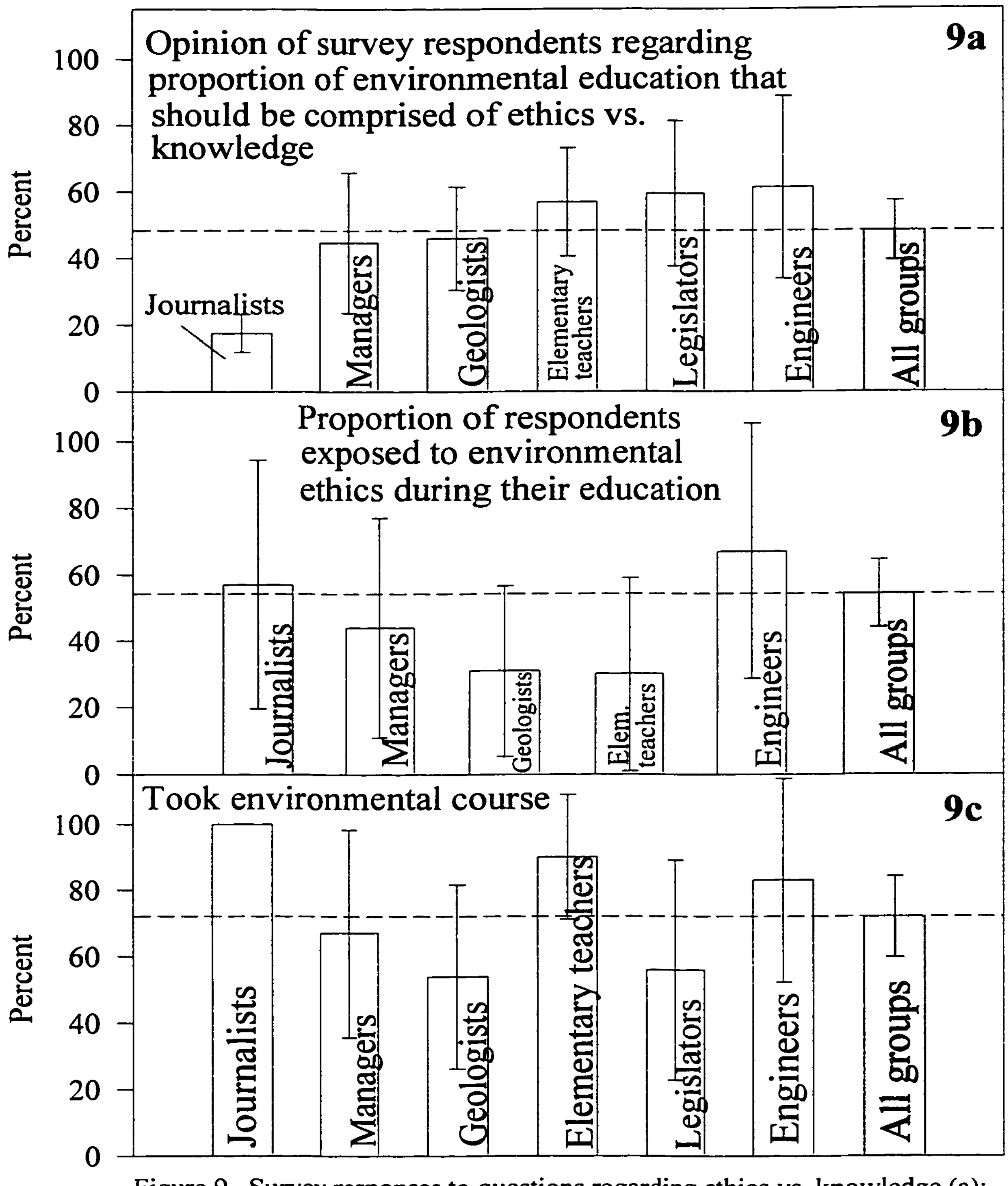

Figure 9. Survey responses to questions regarding ethics vs. knowledge (a); exposure to environmental ethics as part of their education (b); and whether the repondent took an environmental course (c). Error bars represent two standard errors. Dotted lines represent the mean for all professions.

Curricular Implications

Shamos (1995) contends that total scientific literacy is not needed "to profoundly alter the way that society deals with technical matters" (p. 196) but rather that a national scientific literacy rate of only about 20 percent would achieve this objective. He notes that 20 percent is very nearly the same as the percentage of college graduates in the U.S. adult population, so that if all college graduates were literate in science, there would be no problem (Shamos, 1995).

When taken together, the results of this survey suggest that, at a minimum, students in all majors need to complete the equivalent of a fundamental course in each of the disciplines mentioned. This may be viewed by some as impractical. I would argue, however, that the emphasis of higher education has shifted too far toward preparing students for careers rather than producing educated people who have the knowledge and skills necessary to function competently in all areas of life, and that additional science education is needed. Further, in a telephone survey of 604 graduates of North Dakota State University, 69.6 percent perceived "scientific knowledge" as being of "increasing importance" in "understanding the material world 5-8 years in the future;" only one percent perceived scientific knowledge as being of "decreasing importance." The remainder perceived scientific knowledge as being of "stable importance" (Klenow, et al., 1998).

One possible alternative solution is proposed by Westheimer (1994), who contends that "College is . . . where one acquires the background to facilitate a lifetime of learning" (p. 203), and that this background is particularly important in the sciences, which are organized vertically. He therefore proposes that nonscientists' science education should include a specially developed one-year course in physics and another in chemistry, since these are the disciplines that underlie the others.

Another possible solution is proposed by Chinnici and Hiley (1998), who contend that the vertical organization of the sciences constitutes one of the difficulties in including science in general education. Introductory courses in the sciences are considered necessary underpinnings of the vertical organization, providing both foundations and breadth of topics upon which to build the rest of the curriculum. Typically, it is these disciplinary-based introductory courses that are included in the general education program, with the implicit assumption that the goals of general education and the goals of introductory discipline-based science courses concur--an assumption which may be erroneous (Chinnici and Hiley, 1998).

At Virginia Commonwealth University, science faculty took seriously the need to rethink the role of the sciences in general education. They developed a set of new courses designed not only to provide students with a background in the concepts and methods of science, but also to enhance their critical-thinking skills and to provide for scientific literacy necessary for informed citizenship (Chinnici and Hiley, 1998).

K-12 Teachers

In the words of the NSF Advisory Committee, "we believe that undergraduate SME&T education is the linchpin of the entire SME&T education enterprise – for it is at the undergraduate level that prospective K-12 teachers are educated . . ." (p. 1). The Committee recommends that SME&T departments "work collaboratively with departments of education, the K-12 sector and the business world to improve the preparation of K-12 teachers (and principals)" (p. iv).

The National Research Council's Center for Science, Mathematics and Engineering Education (1996) has pointed out that colleges and universities "have a heavily leveraged influence on American education" through the education they provide to future K-12 teachers, in view of the number of students a teacher will influence over the course of his/her career; and that "Providing K-12 teachers with the training, resources, and support they need to master these subjects is a powerful means by which to improve the scientific and technical literacy and numeracy of the American public" (p. 17).

Further, the Center contends that a particularly strong link exists between undergraduate education and the needs of K-12 science education, for a couple of reasons. The first is that a sound precollege program depends on a flow of well-trained science teachers; and the second is that "sound curricula in the college years cannot be developed unless students are given a solid elementary and secondary science background on which to build" (p. 8).

Recommendations

Based on the results of this study and the literature reviewed herein, I would recommend that, at a minimum, students not majoring in the sciences should be required to acquire a fundamental understanding of physics and chemistry. The combined results of this survey suggest that a single, introductory course in each should be required. Again, however, it is worthwhile to note that Westheimer (1994), a professor emeritus of chemistry at Harvard, recommends that nonscientists' general education science requirements should be comprised of a full year each of physics and chemistry.

Students expecting to join the professions represented in this study should also be required to complete introductory courses in earth sciences and a life science (e.g. general biology). SME&T departments and Colleges of Education should collaborate to ensure that all K-12 teachers are well versed in mathematics and the sciences. Since the goals of introductory discipline-based courses and those of general education may differ, I would further recommend consideration of specially designed courses for non-scientists as suggested by Chinnici and Hiley (1998). For example, Westheimer suggests that nonmajors' year of chemistry should begin with general chemistry and should include introductions to organic chemistry and biochemistry. Chinnici and Hiley's institution developed an array of general education science courses in the departments of physics, chemistry and biology, and, since students previously had gravitated toward biology courses, requires that students take at least one physical science course.

As for journalists, I include here some germane recommendations by Smith (1992), who asserts that "Having journalism skills without specialized knowledge or conceptual skills is something like having a teaching certificate but not knowing anything about the subjects you are supposed to teach" (p. 193). He observes that, for this reason, most journalism curricula are comprised largely (75 percent) of "other subjects," but contends that this is not enough. He recommends that students who aspire to careers in journalism should "pursue degrees in other appropriate subjects as well as, or in lieu of, journalism" (p. 193). In analyzing coverage of the 1988 Yellowstone fires, for example, Smith found that news coverage of the fires was dominated by details of what happened to the exclusion of "why it happened or information that would allow an intelligent nonspecialist to reach an informed conclusion about whether some fires should be allowed to burn on public lands" (p. 53).

As expressed earlier, it is disturbing that the legislators who responded to the survey saw so little need for knowledge of mathematics and science. The case of legislators is a special one, as it would be nearly impossible for anyone to know, at the time s/he is a college student, that s/he will eventually be elected to a legislative body. In hindsight, it would have been interesting to have asked the legislators who completed the survey whether, at the time they were college students, they had any expectation of entering politics, as it seems unlikely that many persons would even hold such a goal as college students. This lends credence to the argument that all college students should acquire a background that would enable them to understand scientific issues, as suggested by Westheimer (1994) and Shamos (1995).

Studies of the Content and Process of Environmental Education

Chapter 4

Recommendations for Proposed Action

This chapter articulates my recommendations, based on what I have learned in these studies, for providing the maximum possible environmental education (EE) to college students in non-"environmental" majors. My recommendations are expressed on four levels: institutional, curricular, individual faculty member, and individual course for nonmajors.

I. Institutional

There are a number of reasons why sustainability and environmental responsibility should be adopted as priorities at the institutional level. The first is that it is no less the right thing to do than are, for example, fair hiring and employment practices. Like everyone else, colleges and universities should strive to minimize their "environmental footprint" through energy efficiency and conservation, employment of renewable energy technologies, environmentally benign groundskeeping practices, waste reduction and recycling, composting of food waste, giving preference to environmentally friendly products in purchasing decisions, etc.

Even more important than the effect of these "green" practices on the health of the planet, however, is their effect on the institution's students. When asked how to teach, Albert Schweitzer is purported to have replied that one needed to do three things in order to be an effective teacher: "First, set an example. Second, set an example. And finally, set an example" (Mosher, 1981, as cited in Knapp, 1983). As mentioned in Chapter 1, the lessons educators and institutions teach via their day-to-day activities can be thought of as the "latent curriculum" (Bloom, 1982). According to Bloom, the latent curriculum may actually be more effective than the "manifest" curriculum, and learning is most powerful when the manifest and latent curricula reinforce each other. When the two are in conflict, the latent curriculum is likely to dominate. Green campus practices can therefore have a multiplicative effect through impressing the need for environmental responsibility upon the thousands of students that matriculate through an institution over time.

Another reason why colleges and universities should make a commitment to sustainability is that it is entirely possible that, at some point, environmental literacy (EL) standards could be adopted by accrediting agencies or by governing bodies: the Council of State Governments' 1994 book of Suggested State Legislation (as cited in Wilke, 1995) included model environmental education legislation that was recommended for adoption by state legislatures. The model legislation says, in part, "Universities, colleges and vocational institutions are required to implement programs that encourage environmental literacy and provide opportunities for environmental stewardship among the student population." To accomplish this, the suggested legislation directs universities to implement "an environmental studies course requirement for all graduates, or the development of an integrated general education program that accomplishes environmental literacy through its integration in a variety of courses." Institutions that proceed now with the implementation of strategies for increasing their students' EL would therefore find themselves "ahead of the curve."

Specific Actions

As a first step toward building institutional commitment, colleges and universities should consider adopting the Talloires Declaration and making an institutional commitment to the fulfillment of its tenets. The Talloires Declaration is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities. It has been signed by over 275 university presidents and chancellors in over 40 countries, and is shown in its entirety in Appendix D.

Secondly, in order for faculty and staff to a) foster student learning about environmental and sustainability issues and b) set a positive example for students, institutions should take measures to foster environmental concern and responsibility among faculty and staff themselves. If an "environmental" academic program exists, it could conduct seminars or workshops for other faculty. Financial incentives could be offered to conductors and attendees of these sessions, following the example of Tufts University, which paid its faculty a summer stipend to attend workshops aimed at helping them rewrite their courses in environmentally sensitive ways. If no individual(s) or department exists that could appropriately conduct such sessions, they could be conducted by presenters brought in from outside the institution. One such possibility would be the arrangement of an on-site workshop by Second Nature, Inc., which, as mentioned in Chapter 2, is a nonprofit organization that helps colleges and universities make environmentally sustainable and just action a foundation of learning and practice. Alternatively, institutional support could be provided for faculty and perhaps graduate students to travel to Second Nature's regional workshops.

Institutions might also consider establishment of a "green" committee. Two institutions that have done so are Carleton College and Ball State University. Carleton established an environmental advisory committee of three administrators, three faculty members and three students to review all campus projects from a "green" perspective (Perrin, 2001). Ball State's provost established in 1991 a Green Committee whose charge was to raise environmental consciousness in the student body, foster conviction in students regarding environmental issues, and empower them with understanding of ways in which they might have a positive impact on the future. The committee produced a report that included 35 recommendations, 20 of which were implemented over the ensuing decade (Eflin, 2001).

Whether or not the Talloires Declaration is adopted or a Green Committee formed, however, institutions should convey to students the importance of environmental responsibility by adopting a policy of "greening" their campus operations, as discussed earlier. Other possible "actions" include the adoption of a faculty hiring policy that gives preference, whenever possible, to candidates who have expertise or interest in environmental and sustainability issues; one institution mentioned in Chapter 1 reported having strengthened its Environmental Studies curricular offerings through such a policy. Speakers could be brought to campus who are prominent environmentalists, e.g. Daniel Quinn, author of Ishmael or Dennis Hayes, Executive Director of the first Earth Day which occurred in 1970. Hayes is a good example of a student environmental activist; at the time U.S. Senator Gaylord Nelson asked him to organize a national Earth Day, he was a student at Harvard law school. Hayes led a group comprised heavily of current and former students who were involved in environmental issues (Strauss, 1996).

Student environmental organizations exist on many campuses. Space, funding and administrative support should be provided to these organizations, which represent significant potential for effecting positive environmental change. Students can influence and educate their peers about environmental issues, and student activism can influence their institutions, communities and nation. Involvement in campus environmental organizations can give students hands-on experience in advocacy and citizenship (Strauss, 1996).

Should higher education institutions adopt K-12 EE outreach as an institutional goal? Generally, I tend to think not. Before considering the adoption of such a goal, most higher education institutions have far too much work to do toward ensuring that their own students are educated about environmental and sustainability issues. However, K-12 outreach by individual faculty who wish to do so should be recognized as an activity as worthwhile as more "traditional" scholarly activities, and should be rewarded comparably. Publications related to K-12 outreach should be given equal "weight" with those related to more conventional research. Further, as a representative of one of the K-12 outreach programs described in Chapter 2 suggested, K-12 outreach activities could be allowed to "count" as part of faculty members' teaching requirements.

Anticipated Impediments

One of the primary objections that would, no doubt, be raised in consideration of the proposed actions discussed above is cost. In response I would, first of all, suggest perusal of Green Investment, Green Return: How Practical Conservation Projects Save Millions on America's Campuses (National Wildlife Federation, 1998). As the title suggests, this work provides examples of "green" campus initiatives that actually save money. Examples include energy efficiency/conservation projects, bus pass programs that eliminate the need for construction of additional parking capacity, water conservation projects, and elimination of disposable food and beverage containers.

Secondly, I would point to Oberlin College's $8.2-million Adam Joseph Lewis Environmental Studies Center, one of the most environmentally benign college buildings in the world. The funds to build it were raised as a result of a deal between David Orr, the department chairman, and the college's administration: Orr was allowed to raise money for his own program provided that he approached only people and foundations who previously had never shown any interest in Oberlin (Perrin, 2001).

Inevitably, additional resources would be required for some of the actions proposed in this essay. It is my contention, however, that the importance of environmental education should be as unquestioned as, for example, the importance of learning to write well. Writing education is required almost ubiquitously in higher education, and provision of the necessary resources is not a matter of dispute.

Another possible impediment that warrants consideration is resistance on the part of some members of the faculty, staff and/or administration who may not be convinced of the importance of environmental and sustainability education as part of the institution's mission. This is why it is so important that these members of the academic community be educated through seminars and workshops, and that incentives be offered, such as compensation for the time required.

Demonstrated support for these measures could also be tied to promotional opportunities. A former employer of mine strongly "encouraged" its employees contribute annually to the local United Fund, and specified a "suggested" minimum contribution. While the company described employee contributions as "voluntary," it made no secret of its position that employees who declined to contribute to the United Fund would be considered unsupportive of company policy, a fact that would be taken into account should the employee ever be considered for promotion. This was a heavyhanded strategy that caused considerable resentment. However, perhaps it could be effective without causing resentment if it were stated positively, e.g. "Demonstrated support of ______________ University's environmental and sustainability policies will be viewed favorably when faculty members are considered for promotion."

Finally, obstacles to interdisciplinary work by faculty must be removed. Many "environmental" programs are interdisciplinary. Currently, the traditional faculty rewards system treats work in one's own discipline with greater favor than interdisciplinary work. A change in this mindset would have a positive effect on interdisciplinary environmental programs.

II. Curricular

Educating the Entire Student Body

Institutions whose curricula are based on learning "outcomes" rather than content "inputs" should adopt EL as an "outcome," as was discussed in Iowa State University's response to the survey that forms the basis for Chapter 1 (see p. 29). As stated in Chapter 1, Roth's <u>Environmental Literacy: Its Roots, Evolution and Directions in the 1990s</u> (1992) may be helpful in this regard as it defines three levels of EL—nominal, functional and operational—on a continuum. Institutions could begin by adopting Roth's "nominal" level. Alternatively, institutions could begin by adopting the outcome, "understanding of the relationship between population, consumption and environmental damage." More in-depth outcomes could be adopted as appropriate learning activities are put into place for all students. Development of methods for assessing whether the designated outcomes have been achieved would, of course, be necessary.

Should EE be included in general education curricula? Yes. One of the most surprising findings of this study was the degree to which environmental courses already are included in general education curricula. At institutions that do not include such courses, the issue of resources would likely be raised: some would argue that this is impractical, that insufficient resources are available to institute such a requirement. Again, I would counter with the fact that writing courses are requirements in most institutions' general education curricula, and would argue that it is no <u>less</u> important for students to understand the gravity of current environmental problems than it is for them to learn to write well, since future generations' quality of life on this planet, and the ability of many species to even <u>survive</u> on this planet, hangs in the balance. Richard Wilke is Associate Dean of the College of Natural Resources at the University of Wisconsin-Stevens Point, which requires that all students complete an "environmental literacy" course in order to graduate. He writes, "There is no other instruction more basic than that which focuses on perpetuation of both environmental quality and the quality of life" (Wilke, 1995).

If the institution has no "environmental" program that could provide such a course(s), faculty could be hired for the express purpose of teaching these general education courses. The argument that an EL "requirement" is a "heavyhanded strategy likely to backfire" could be answered by the provision of several different courses from which students are allowed to choose. Again, however, I would point out that I, at least, have never heard the "heavyhanded" argument raised in opposition to requirements for courses in, say, writing or history; the need for such courses is unquestioned. So should it be with environmental courses. Institutions that offer a substantial number of courses with significant environmental content could publish a special catalog describing these courses; two respondents to the survey that forms the basis for Chapter 1 reported annual publication of such a catalog at their institutions.

The comparison between the importance of students' learning to write well and the importance of their learning about the environment can be carried a step further. The former is considered so important that an entire movement called "Writing Across the Curriculum" (WAC) was begun more than two decades ago; this in addition to most institutions' requirement of the completion of writing courses. "Sustainability Across the Curriculum" should be embraced by higher education in the same way that WAC was adopted, and in the same way that "environmental literacy" has been incorporated across the curriculum at some institutions such as Tufts. Further, this is a "cost effective" approach that could be employed almost immediately, whereas some time would no doubt be required to appropriate the necessary resources to accommodate an EL course requirement for all students.

In some ways, infusion of environmental and sustainability issues across the curriculum is a more attractive option than requiring all students to complete a course: it is less expensive, and does not depend upon a small number of faculty. I would argue, however, that requiring all students to take an environmental course is the most effective strategy for increasing college students' collective "environmental literacy." It is difficult to imagine that the same degree of depth would be achieved if "infusion across the curriculum" were the only strategy employed. On the other hand, the "learning outcomes" achieved in any course obviously are dependent upon the content included and the learning strategies employed. Recommendations for a non-majors course are made in Section IV that follows.

Another possibility for achieving an environmental literacy "outcome"—and/or satisfying a course requirement—would be through online courses which are, of course, becoming increasingly popular in higher education. One disadvantage of this approach, however, is the limited opportunity for "active" learning activities, which, as will be discussed in a later section, seem to be necessary for the achievement of a positive change in attitude toward the environment.

In sum, I agree with Gigliotti (1990) who contended that environmental education should be a fundamental part of the educational process and infused across the curriculum: "instead of worrying about whether environmental education is infused equally across curriculum materials . . . , *we need to make environmental education the focal point of the entire educational process*. Environmental education should not only share equal status with reading, writing, and arithmetic; it should also be an integral part of all courses" (pp. 11-12).

Specific Groups

Should students in particular majors be educated about the environment and sustainability to a greater extent than the student body as a whole? In part, the answer depends upon the extent to which the institution effectively fosters learning about these issues in the entire student body. If EL is not adopted as an institutional goal, certainly it could be adopted by particular colleges, schools or departments.

Regardless of the efficacy of an institution's efforts to foster EL in its entire student body, however, it is not sufficient that K-12 teachers be environmentally literate: they should also be trained in effective EE methods. The literature cited in Chapter 2 indicate that far too little environmental education is occurring at the K-12 level. Colleges of education should take it upon themselves to ensure that their graduates are environmentally literate, regardless of whether this is a requirement of the institution. They should also include training in effective EE methods. In addition, I would argue that "consciousness raising" about environmental issues among Deans of Colleges of Education would increase the likelihood of incorporation of EE into education curricula. Institutions' adoption of the Talloires Declaration might be a first step in this direction; "raising awareness" is addressed in the first of the ten points, and the seventh point suggests that presidents "Convene school deans . . . to develop . . . curricula for a sustainable future." Further, Colleges of Education should collaborate with SME&T departments to ensure that all K-12 teachers are well-versed in mathematics and the sciences.

Chapter 3 suggests that, in addition to acquiring a fundamental understanding of physics and chemistry, students expecting to join the professions represented in that study (managers in petroleum-related firms, elementary teachers, journalists, engineers, geologists, and legislators) should also be required to complete introductory courses in earth sciences and a life science. The case of legislators is a "special" one, since it is nearly impossible for a person to know, at the time he or she is a college student, that s/he will eventually be elected to a legislative body. In view of this, and also because of the increasing importance of science and technology in everyday life, I would argue that science requirements for all students should be strengthened.

III. Individual Faculty

Regardless of whether environmental education and environmental responsibility are adopted at the institutional and/or curricular levels, individual faculty who are interested in these issues can help to raise students' environmental awareness and set a positive example for environmental responsibility. Some of the academic disciplines that immediately come to mind when one considers environmental education at the college level are physical and life sciences, business and economics, and political science. Inclusion of environmental issues in science courses not only serves to educate students about these issues; these issues also serve as vehicles through which scientific principles can be made relevant to everyday life. Examples include population dynamics, the flow of energy through ecosystems, biodiversity and endangered species, water chemistry, and air pollution.

Economics faculty can include consideration of impacts of economic systems on the planet, and examination of the plenitude of the natural resources required for current economic systems. Business courses are an ideal place for discussing the dangers of our culture's encouragement of rampant consumerism, and for introducing the concept of life cycle assessment: i.e., evaluation of a product's effects on the environment throughout its life cycle, from the extraction or production of raw materials through the product's eventual disposal. Public policy courses can include issues of population, energy, natural resource protection, and pollution control.

For faculty in other academic disciplines, avenues for inclusion of environmental and sustainability issues into courses may be less apparent. However, English faculty, for example, can avail themselves of Teaching Environmental Literature (Waage, 1985), described by Grumbling (1996) as "a compendium of course descriptions and teaching techniques." Grumbling also mentions the existence of a journal called Interdisciplinary Studies in Environmental Literature. Steinbeck's The Grapes of Wrath might be used to foster discussion of the disastrous effects of poor land management practices. And of course, the writings of Thoreau are an obvious choice for extolling the virtues of living simply and close to nature.

History faculty might use an environmental viewpoint as a template by which to measure success or failure in civilizations (Opie and Black, 1996). Ideas for full courses in environmental history can be found in Opie and Black's (1996) chapter of Greening the College Curriculum, and at www.secondnature.org. Psychology courses might consider the source of humans' propensity to subjugate nature, and the ploys used by advertisers to convince consumers to purchase unnecessary products.

This discussion provides only a few ideas for inclusion of environmental and sustainability issues into courses in a few disciplines. More in-depth discussions, along with actual course plans, can be found in Greening the College Curriculum (Collett and Karakashian, eds., 1996). In addition, environmentally conscious faculty can obtain ideas for infusing environmental and sustainability issues into courses of all types from the profiles and syllabi posted on www.secondnature.org. Faculty members from any discipline who have travel budgets might attend a Second Nature regional workshop. All faculty and staff can set an example of environmental responsibility by, for instance, using both sides of paper when photocopying, foregoing the use of paper entirely by using electronic means of communication, practicing energy conservation, and avoiding disposable products. Those who have sufficient expertise can offer to contribute environment-related articles to campus publications. Sponsorship of student environmental activist groups is another possibility.

IV. What Should a Non-Majors' Course Look Like?

I must confess that my own temptation would be to attempt to include "Everything You Need to Know About the Environment" into such a course. There is, however, research that indicates that more learning is likely to occur in a course that focuses on a few basic principles placed into a social perspective than in a content-intensive course (Sundberg and Dini, 1993). Further, in view of Edwards and Iozzi's (1983, cited in Chapter 3) finding that growth in knowledge alone was rather short-lived, such a course should attempt to foster a positive change in attitude toward the environment.

I would therefore suggest learning objectives for such a course along the lines of the following:

- Understanding of the ways in which the environment is threatened, and ability to differentiate between major and (relatively) minor threats;
- Development of a positive environmental ethic in attitude, values and behavior;
- Ability to acquire whatever information is necessary to understand any environmental issue that might be encountered;
- Ability to properly scrutinize environmentally relevant information from various sources: polluters, environmental activist groups, the media;

- Ability to conceive potential solutions to environmental problems.

Content of such a course could be flexible. However, I would suggest the following as the "few basic principles" alluded to above, as I believe the greatest potential for fostering positive change lies in engendering understanding of, and critical thinking about, these:

1. The relationship between population, consumption, and environmental damage (Ed = P x C x D, where Ed = Environmental Damage, P = Population, C = Consumption per capita, and D = Environmental Damage per unit of consumption [McNamara, 1991]). Public health issues should be included in order to show that, for example, fertility rates decline as infant and child mortality decline (Bandarage, 1997).
2. The relationship between current energy consumption patterns and climate change[1]; and
3. Examination of the assumption that domination of nature is the rightful destiny of humans.[2]

If an "environmental" academic program exists, it would be the "natural" place in the curriculum for such a course. Otherwise, it seems the course would fall most naturally within the College of Arts and Sciences, since point #1 above falls, at least to some extent, within the purvue of sociology; points 1 and 2 are related to the sciences; and point 3 is a philosophical one.

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[1] Hungerford and Volk (1990) assert that, since "most success stories are issue-specific in nature" (p. 17), the results of most environmental education efforts are learners who may act in an environmentally positive manner with respect to the particular issue(s) in question. It is for this reason that I suggest selection of the issues that are most potentially devastating.

[2] According to a telephone survey of 763 "nonactivist" college students designed by the Institute for Global Ethics and conducted by The Gallup Organization in March 2000, students are more persuaded by arguments to "balance humanity and nature" than to adopt "limits to growth" or to assert "dominion over nature" (Loges and Kidder, 2000).

Learning Activities

The best work of which I am aware for fostering an understanding of the root of the near-ubiquitous assumption that domination of nature is humans' rightful destiny is Ishmael by Daniel Quinn. As well, it brings out the disturbing reality of the destination at the end of the path on which humanity currently is traveling. This book could be used as the basis for multiple critical-thinking essays as well as class discussions. Another excellent book that might be considered is How Many People Can the Earth Support? by Joel E. Cohen, if one is interested in making population a major course focus.

In Edwards and Iozzi's (1983) study, the activities that fostered "measurable and enduring change in a positive direction . . . by adults in attitude, values, and behavior" were "active learning" activities, e.g. field trips, audiovisual materials, and engagement in interactions with others. According to Bonwell and Eison (1991, as cited in Bonwell, 1996), active learning is preferable to traditional lecture if the desired outcome is development of higher-order thinking or a change in student attitudes. Other writers have contended that retention is greatly increased when "active" rather than "passive" learning techniques are employed. Such a course should therefore involve students in "active" learning to the greatest extent possible, e.g. in problem solving, field trips, service projects, and discovering knowledge for themselves (e.g. in research projects).

Service projects represent one possibility for experiential learning; tree planting projects might be considered, or presenting environmental lessons in K-12 classrooms. Researching possibilities for "greening" campus operations could also be considered; for example, students might conduct a study of campus groundskeeping practices, and make recommendations for implementing practices that are more environmentally benign.

Development of a population policy for the United States would be a worthy "hypothetical" research project; the problem could be posed along the lines of the following:

> Because of your reputation and expertise, the U.S. Congress has asked you to propose a U.S. policy on population control—both within the U.S. and with respect to the rest of the world. Your background information should include a discussion of the reasons why such a policy is needed, and a brief discussion of China's population control policy, including its positive and negative aspects. Your proposal should also address the following:
>
> - Should the U.S. limit immigration?
> - Should the U.S. government adopt a policy encouraging the limitation of family size? If so, what exactly should the policy be? How could objections of particular religious groups be addressed?
> - What, if anything, should the U.S. do to help limit population growth in other countries?

Either the "groundskeeping" or the "population" project, or others of which one might conceive, would serve as vehicles for development of "information literacy" with respect to environmental issues, as well as problem solving skills.

The interactive website http://www.rprogress.org/ provides the means for calculating one's "ecological footprint." The book Your Ecological Footprint by Mathis Wackernagel allows the calculation of the "ecological footprint" of one's diet, one's institution, etc. These resources could be used in in-class group activities to allow discovery of the inordinate amount of resources consumed by people living in developed countries.

Field trips are, of course, another avenue for "active" learning. Possibilities include power plants, wastewater treatment plants, composting or recycling facilities, organic farms, or facilities that derive energy from renewable sources. In order to increase the effectiveness of field trips, students could be asked to write an essay afterward, reflecting on what they learned and what thoughts were evoked.

Feedback and Assessment

I would propose evaluation of students on assigned projects, writing assignments, and quizzes; the latter would be used only to ensure assigned material is read. Projects would be evaluated on comprehensiveness and depth of the research and discussion, credibility of the arguments presented, and students' demonstrated proficiency in finding and using appropriate information. Writing assignments would be evaluated on organization, accuracy, clarity, logic, and degree of understanding reflected. If the class is large and/or a large number of essays are assigned, students could be required to keep all writing assignments in a portfolio that would be submitted at the end of the semester, at which time a small number of randomly selected essays would be evaluated and used as the basis for the grade.

Changes in attitude are, of course, one of the most difficult "outcomes" to assess. One possibility for evaluating attitude changes in this type of course would be Maloney and Ward's (1975) "Scale for the Measurement of Ecological Attitudes and Knowledge," which could be administered at the beginning and again at the end of the course. The "knowledge" section could be used to evaluate whether students have indeed developed the ability to differentiate between "major" and relatively "minor" environmental problems. It would, of course, need to be updated somewhat to reflect current issues.

V. Recommendations for Further Research

To gain greater insight into the effectiveness of various approaches to educating students in non-"environmental" majors about the environment, I recommend longitudinal studies at institutions that employ the various approaches identified in this study: core requirement; core option; "infusion" of EL across the curriculum; etc.

Ideally, such studies should be conducted at institutions that employ only one of the techniques, to avoid interference from other variables. Additionally, it would be interesting to examine the extent to which particular programs include environmental and sustainability issues in their curricula. To that end, surveys of (e.g.) Colleges of Business, Education and Engineering could be performed. Finally, it might be worthwhile to conduct another survey similar to that on which Chapter 1 was based after five or ten years have passed. Currently a significant amount of effort is being expended toward increasing the level of environmental literacy among college students by a number of higher education institutions as well as by other organizations such as Second Nature, Inc. There is, however, much more that must be done in order to “teach away” the “world devouring vision” referred to in the quote which begins this dissertation.

Studies of the Content and Process of Environmental Education

Chapter 5

Proposal for Further Research

Introduction

The results of the survey of Chief Academic Officers reported in Chapter 1 show that college curricula do, in various ways, include substantial course content related to the environment. Examples include environmental courses in core curricula, environmental courses as electives, "minor" courses of study, "infusion" of environmental content across the curriculum, etc. However, knowledge of environmental problems and their possible remedies will not necessarily ensure that a person will be motivated to act more responsibly toward the environment. Gigliotti (1990) asserts that "Our citizenry does not completely lack information. Instead, it is attitudes, which are based on a number of interrelated beliefs and values, that are the problem" (p. 10). Hungerford and Volk (1990) further contend that attitudes are a crucial determinant of whether people will take part in maintaining environmental quality. Learning activities aimed at effecting a positive change in students' <u>attitudes</u> toward the environment, and thus the likelihood of more environmentally responsible behavior, are therefore a critical component of environmental education.

Environmental sensitivity and a positive attitude toward the environment are considered "affective" learning outcomes (Lane, 1993). "Environmental sensitivity" is defined as "an empathetic perspective toward the environment" (Hungerford and Volk, 1990). Sia, et al. (1985/86) found that environmental sensitivity is a good predictor of responsible environmental behavior: it predicted almost 13 percent of the variance in environmentally responsible behavior among test subjects. There appears to be a correlation between environmental sensitivity and an individual's contact with the outdoors in relatively pristine environments: environmentally sensitive individuals reported hunting, fishing, and other outdoor activities as important variables. As well, numerous sensitive individuals reported that some experience with severe environmental degradation substantially increased their environmental sensitivity. Only a few deemed educational courses or books important (Hungerford and Volk, 1990).

A study by Edwards and Iozzi (1983) examined the effect of various activities on the environmental knowledge and affect of teachers participating in an environmental education workshop, and whether the changes observed at the end of the workshop endured over a two-year period. The authors employed a variety of "participatory activities" which included field trips, development and presentation of environmental education lessons, presentations by guest speakers from government agencies and business and industry, panel discussions, audiovisuals, and informal interactions among participants and faculty. In follow-up tests after one and two years, it was found that participants' increases in knowledge alone were rather short-lived, but gains in environmental affect and actual commitment (i.e., what test subjects actually did to improve environmental quality) actually increased over the two-year period.

According to Iozzi (1989), inquiry methods that directly involve students in investigating real environmental problems and phenomena, such as the case study method, seem to be effective in dealing with the affective domain. Another approach he advocates is that of presenting students with an environment-related moral dilemma and asking them to determine what should be done to resolve the dilemma and why. Asch and Shore (1975) found that elementary students exposed to particular environmental learning activities exhibited more "conservational" behavior than a control group; the activities included the employment of films, magazines and discussions, as well as investigation of environ-mentally harmful activities and suggestion of alternatives.

Many of the activities in the aforementioned studies fall under the rubric, "active learning," which is defined by Bonwell and Eison (1991) as "instructional activities involving students in doing things and thinking about what they are doing." Research has shown that active learning is preferable to traditional lecture if the desired outcome is development of higher-order thinking or a change in student attitudes (Bonwell and Eison, 1991, as cited in Bonwell, 1996). This may be the reason why the activities referred to in the aforementioned studies are effective in positively altering environmental attitude.

Other research suggests a relationship does exist between environmental knowledge and environmentally responsible behavior. Borden and Schettino (1979) found that both affective and cognitive experiences are involved in developing the highest level of environmentally responsible action. In a meta-analysis, Hines et al. (1986/87) found knowledge of issues and knowledge of action strategies to be among the variables associated with responsible environmental behavior. Ramsey and Rickson (1976) suggested the existence of a "circularity" between knowledge and attitudes and that one does not necessarily cause or precede the other. Rather, it seems that knowledge may lead to an initial formation of attitudes which, in turn, might lead to further gains in knowledge.

In summary, research has indicated that a relationship exists between environmentally responsible behavior and both environmental affect (i.e., attitude, sensitivity) and environmental knowledge. It has also been shown that learning activities that are more experiential or "active" have a positive effect on individuals' attitudes toward, or sensitivity to, the environment. To date there has not, however, been a controlled study that attempts to quantify the effects of such activities in a college-level environmental course. Further, there has been no study that examines the effect of these activities on gains in environmental knowledge. This chapter therefore proposes a research plan for investigating the effect of such learning activities on students' knowledge of, and attitudes toward, the environment. It could be employed at any institution at which a) an introductory-level environmental course is offered, b) a course unrelated to the environment could be used as a "control," and c) a statistically significant number of responses could be obtained in the experimental and control groups.

Figure 10 is a reproduction of Dale's "Cone of Experience, which is a visual analogy created to show the progression of learning activities from direct, firsthand participation in real or simulated experiences to abstract, symbolic visual or verbal expression. As one moves from the bottom to the top of the cone, the learning activities depicted become progressively more "passive" than "active," more "abstract" or symbolic than "concrete." The primary objective of this research is to determine whether learning activities such as those depicted in the bottom two thirds of the cone have a positive effect on students' attitudes toward the environment. Its secondary objective is to ascertain whether these activities simultaneously have a positive effect on gains in knowledge.

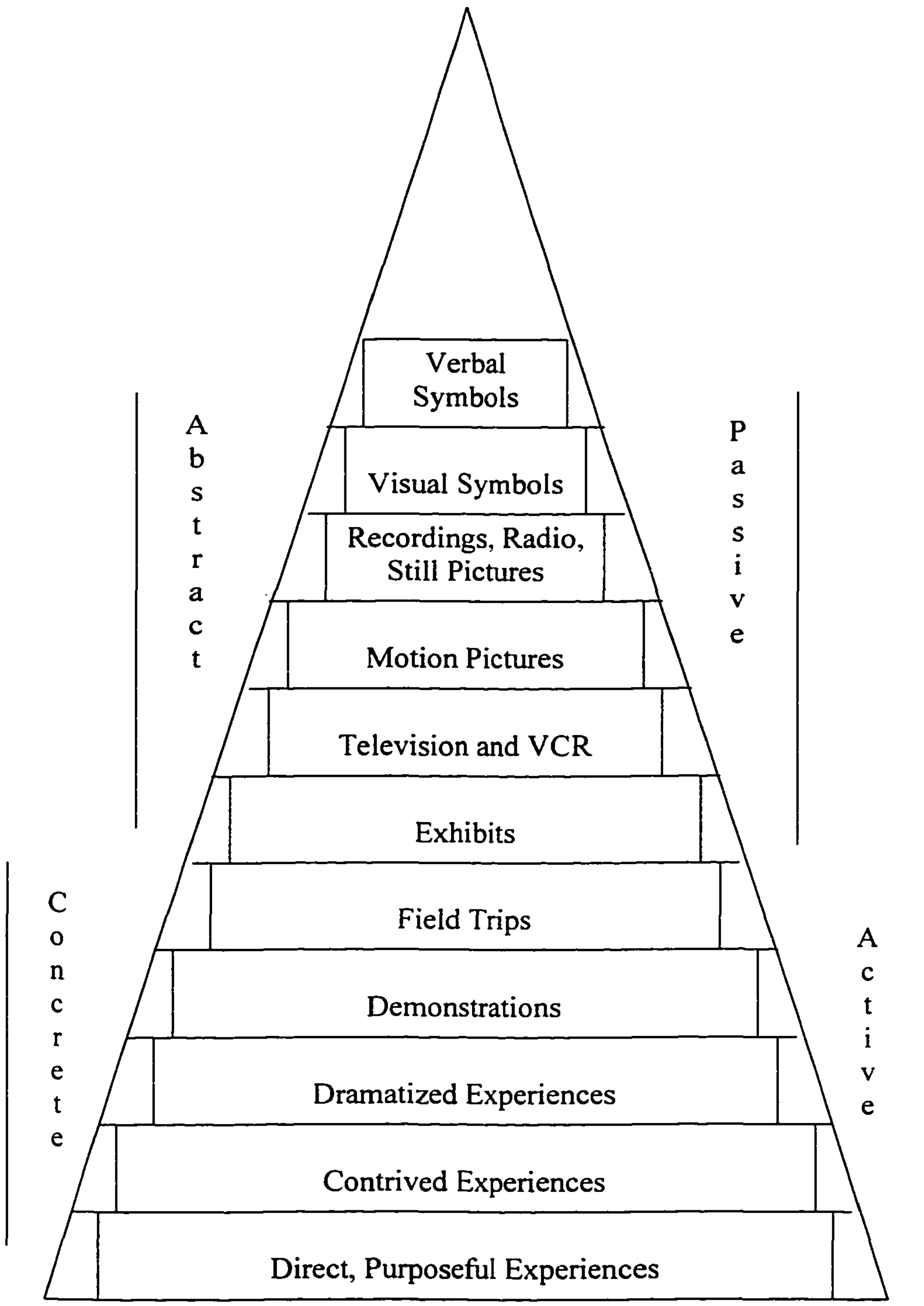

Figure 10. Dale's Cone of Experience (Dale, 1969).

Methods

Schindler (1995) designed and validated an "Ecology Issue Attitude Instrument" whose statements were selected to evoke strongly agree responses either from people concerned about the environment (ecocentric) or from people egoistic in terms of themselves specifically or humankind in general (egocentric). The instrument, which is shown in Appendix G, will be administered to control and experimental student groups at the beginning and at the end of the term. In addition, the cognitive portion of the Wisconsin Environmental Survey (Champeau, 1997), which is shown in Appendix H, will be used to assess knowledge levels of control and experimental student groups at the beginning and at the end of the term. Subjects will be asked to write their names or an identifying number on the instruments so that "before" and "after" responses for each individual can be paired.

Hypothesis 1: Learning activities that are more "active" or experiential have a significant positive effect on students' attitudes toward the environment that cannot be wholly explained by increases in knowledge.

Hypothesis 2: These same activities have a significant positive effect on increases in knowledge.

Control and experimental groups will be comprised as follows:

Control Group 1 will consist of students in a course(s) that has nothing to do with the environment, e.g. history. In order to maximize demographic parity between this course and the other two, the course selected should be at the same level (i.e., freshman, sophomore, etc.) as the Control 2 and Experimental courses. In addition, the course should be selected so as to obtain a similar mix of "major" and "non-major" students to that expected in the other two courses. For example, if the course that is used for the Control 2 and Experimental groups can be used to satisfy general education "distribution" requirements, a course of which the same is true should be selected for Control group 1. Further, it may be desirable to select a course from within the same school or college as the Control 2 and Experimental courses, as this might also might also help to maximize parity among the courses.

Control Group 2 will consist of students in a survey "environmental" course such as an introductory course that might be offered by an Environmental Science or Environmental Studies department. In this section students would simply "learn" content: listen to lectures, read, take exams.

The Experimental Group will consist of students in a course identical to Control 2 in terms of content; i.e., a second section of the same course. However, students in this section would also be exposed to learning activities hypothesized to positively alter their attitudes toward the environment. These may include (some depending on circumstances):

- Group discussions
- Group case studies and problem solving
- *Watching films, e.g., on population, energy issues, air pollution, water pollution, endangered species, etc.
- *Service projects such as planting trees, organic gardening or picking up trash
- *Field trips, e.g. to a park or nature preserve, wastewater treatment facility, landfill
- *Role playing, e.g. opposing sides in a controversy that will impact the environment

- Development and presentation of an environmental lesson for elementary school students

In order to encourage reflective thinking, students will be asked to write a short essay about activities followed by an asterisk. Students might also be asked to write such essays at the end of a class period. Essays would include reflection on such questions as (Fink, in press):

What did I learn?

What role do I expect this knowledge to play in my own life?

What feelings were evoked by the activity or the material?

What are some possible solutions to the environmental problems identified by the activity or the material?

These essays may be exchanged among the class in a way that preserves anonymity, and used as the basis for class discussions.

At the end of the term, the Ecology Issue Attitude Instrument will be re-administered. A minimum of 30 paired survey responses will be needed in each group; a sample size of 30 or more is considered sufficiently large for assumption of a normal distribution (Mendenhall and Sincich, 1995). The experiment will be repeated in multiple semesters until a sufficiently large number of paired responses is obtained in the Control 1, Control 2 and Experimental groups. Responses from strongly agree to strongly disagree on a five-point Likert scale will be solicited. Ecocentric items will be scored as follows:

A) Strongly agree - 5

B) Agree - 4

C) Undecided - 3

D) Disagree - 2

E) Strongly disagree - 1

Egocentric items will be scored using the reverse scale:

A) Strongly disagree - 5

B) Disagree - 4

C) Undecided - 3

D) Agree - 2

E) Strongly agree - 1

This scoring method will allow the quantification of environmental attitudes across a spectrum, with highly ecocentric, non-egocentric attitudes at one end (the highest scores), and highly egocentric, non-ecocentric attitudes at the other end.

As well, the Wisconsin Environmental Survey will be re-administered at the end of the term. Scoring will be based on number of correct answers divided by the total number of questions.

Data analysis. Data obtained in multiple semesters will be combined and scores will be analyzed for significant differences among Control 1, Control 2 and Experimental groups. Scores will be analyzed for significant differences among the groups in alterations in attitude as reflected in paired "before" and "after" responses to the attitude instrument, and in knowledge gains as reflected in paired "before" and "after" responses to the knowledge instrument. A paired *t*-test will be used to test for differences in "before" and "after" scores at the $\alpha = 0.05$ significance level. Differences in attitude and knowledge change among experimental groups will be tested by ANOVA, also at the $\alpha =$

0.05 significance level. Linear regression will be used to determine whether a correlation exists between knowledge gains and positive changes in attitude. The hypotheses predict that a) no significant differences will be seen among the groups pre-treatment; b) post-treatment knowledge scores of both the Control 2 and Experimental groups will be significantly higher than the post-treatment knowledge scores of Control 1; and c) post-treatment attitude and knowledge scores of the Experimental group will be significantly higher than those in both control groups.

Diversity

It is expected that minorities and women would be represented in the courses upon which this study is based at the same ratio at which they are represented in the institution's overall student population.

Time Schedule

In order to ensure sufficiently large control and test populations, the study will encompass two semesters. Should insufficient data be obtained in two semesters, the study will be extended for additional semesters. The projected schedule is shown in Table 7.

Table 7. Time-line for Proposed Activities

Activity	Spring 2003	Fall 2003	Spring 2004	Summer 2004
Data collection in Control 1, Control 2 and Experimental Courses	X			
Data collection in an identical set of three courses: Control 1, Control 2, and Experimental		X		
Analysis of data and preparation of manuscript			X	
Submission of manuscript for publication				X

Benefits and Dissemination of Results

As discussed in the introduction, positive changes in attitude toward the environment result in more environmentally responsible behavior. As well, Edwards and Iozzi (1983) showed that positive changes in attitude are more enduring than gains in knowledge. If hypotheses 1 and 2 are shown to be true, results of this study will help environmental educators choose learning activities that are most effective in increasing students' knowledge of environmental issues as well as in positively altering their attitudes toward the environment, and thus in eliciting more environmentally responsible behavior. If one hypothesis is shown to be true but not the other—i.e., significant positive changes are seen in the Experimental group's attitude without increases in knowledge or vice versa—the learning activities will still have been shown to be worthwhile. Environmental educators could use this study as justification for any expenses associated with such learning activities as those used in this study, e.g. filmstrips. If, however, no significant differences are seen between the Control 2 and Experimental groups, it will still be useful to environmental educators to know that the activities employed in this study have no effect on students' knowledge and attitudes.

Results of the study will also be useful to environmental advocacy groups in planning strategies for educating the populace about environmental issues. Further, there is no reason to think the principles employed in this study could not be extrapolated to other disciplines: for example, educators in the field of political science might want to undertake a similar study to evaluate the effects of group discussions, case studies, problem solving exercises, films, service projects, field trips, etc. on students' civic attitudes and knowledge of political issues.

Results will be submitted to the Journal of Environmental Education, a quarterly peer-reviewed journal with an estimated readership between one and two thousand.

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Appendix A

Questionnaire sent to Chief Academic Officers

Please place an "x" next to all statements that apply to your institution:

[] 1) As part of this institution's core curriculum, all students are REQUIRED to take one or more courses specifically intended to increase their "environmental literacy."

[] 2) All students are NOT **required** to take an "environmental literacy" course as part of this institution's core requirements; however, such a course **is AVAILABLE** and **may be counted** toward the fulfillment of core requirements.

If you placed an "x" beside Statement (1) or (2):

a) Please type the name of the course(s):

b) Please type the name of the academic program(s) which offer(s) it:

[] 3) An "environmental literacy" course is neither a requirement nor an option in this institution's core curriculum; however, there are (is a) **particular academic unit(s) that require(s) such a course**.

If you placed an "x" beside Statement (3), please supply the name of the academic unit(s) (e.g., school, division, or college):

4) The following **academic program(s)** (e.g., concentration, department, school or college) **exist(s)** at this institution (check all that apply):
[] Environmental Science
[] Environmental Studies
[] Environmental Health
[] Environmental Education
[] Environmental Engineering
[] Other "environmental" program (please specify)
(If your institution offers NONE of the above programs, proceed to Question 6.)

5) The FIRST program checked in Question 4 offers the following (check all that apply):
[] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[] Major for an undergraduate degree
[] Master's degree

[] Doctoral degree
[] An "environmental" minor is offered by **another academic unit** than Environmental Science, Environmental Studies, etc. (**If you placed an "x" by this statement,** please supply the name of the unit:

The SECOND program checked in Question 4 offers the following (check all that apply):
[] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[] Major for an undergraduate degree
[] Master's degree
[] Doctoral degree

The THIRD program checked in Question 4 offers the following (check all that apply):
[] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[] Major for an undergraduate degree
[] Master's degree
[] Doctoral degree

The next three questions are in regard to your future plans; please place an "x" next to all statements that apply:

[] 6) While an "environmental literacy" course **currently is not a requirement** in this institution's core curriculum, we plan to consider/are considering instituting such a requirement.

[] 7) While an "environmental literacy" course **currently is not an option** in fulfilling this institution's core requirements, we plan to consider/are considering instituting such an option.

[] 8) While this institution **currently offers no course** appropriate for increasing the environmental literacy" of non-environmental majors, we plan to consider/are considering instituting such a course.

9) With zero indicating "completely unimportant" and six indicating "extremely important," please indicate **your opinion of how important it is** for institutions of higher learning to increase the environmental literacy of all students.
[]0 []1 []2 []3 []4 []5 []6

10) If your institution has an **approach to increasing the environmental literacy of non-environmental majors that is not covered in the above questions**, will you please take a few moments to tell us about it? If not, please feel free to add other comments.

Appendix B

Statistical Methods

- Confidence interval = $p \pm z_{\alpha/2}\sqrt{pq/n}$, where
  - p = proportion of positive responses and $q = 1 - p$ (Mendenhall and Sincich, p. 388).
- $z = (p_1 - p_2)/\sigma_{(p1 - p2)}$, where
  - p_1 and p_2 = proportions of positive responses,
  - $\sigma_{(p1 - p2)} \approx \sqrt{pq[(1/n_1) + (1/n_2)]}$,
  - $p = (y_1 + y_2)/(n_1 + n_2)$,
  - y_1 and y_2 = numbers of positive responses, and
  - $q = 1 - p$.
  - Rejection region: $|z| > z_{\alpha/2}$.

<u>Sample calculation</u>:

$n_1 = 64$; $n_2 = 161$; $p_1 = 0.672$; $p_2 = 0.522$; $y_1 = 43$; $y_2 = 84$

$p = (43 + 84)/(64 + 161) = 0.564$

$\sigma_{(p1 - p2)} \approx \sqrt{(0.564)(1 - 0.564)[(1/64) + (1/161)]} \approx 0.073$

$z = (0.672 - 0.522)/0.073 = 2.05$

The proportions of positive responses were assumed to be approximately normal as the sample sizes were sufficiently large that $n_1p_1 \geq 4$, $n_1q_1 \geq 4$, $n_2p_2 \geq 4$, and $n_2q_2 \geq 4$ (Mendenhall and Sincich, p. 469).

Appendix C

Responses to Open-Ended Questions from Survey of Chief Academic Officers

Institutions are separated by a solid line. Identifying information, such as persons' names or the name of the institution, has been replaced with asterisks.

I. Public Research Institutions

2a) In many different departments
4) ESc concentration in Botany
ESt concentration in Architecture
EEd concentration in Education
EE concentration in Engineering

*****,
I completed this from our perspective. I didn't try to answer for Environmental Engineering, Environmental Chemistry, or other programs that might have relevance to the survey. ISC 2003 ("Global Change, Its Scientific and Human Dimensions") probably also fits the description of an "environmental literacy" course.
2) Counts as Social Science elective
2a) Environmental Science

4) (COMMENT: ENVIRONMENTAL STUDIES IS A MAJOR IN THE GEOGRAPHY DEPARTMENT BUT WITH AN INTERDISCIPLINARY CURRICULUM. NUMEROUS OTHER DEPARTMENTS HAVE ENVIRONMENTAL "CONCENTRATIONS." ENVIRONMENTAL CHEMISTRY AND ENVIRONMENTAL ENGINEERING COME TO MIND FOR UNDERGRADS. MANY OF THE SCIENCES CONSIDER THEMSELVES TO BE ENVIRONMENTAL, HOWEVER (E.G., METEOROLOGY, gEOLOGY).

2a) Numerous courses (approximately 10-15 depending on the semester), For example:
HPER R425 Ecosystem Management
HPER R317 Wilderness in the American Mind
SPEA E162 Environment and People
SPEA E272 Introduction to Environmental Sciences
GEOL G171 Environmental Geology
BIOL L350 Environmental Biology
COAS E105 Energy Issues in Our Future
COAS E105 Nature, Nurture and Human Behavior
2b) School of Public and Environmental Affairs, School of Health, Physical Education

and Recreation, Department of Geology, and Department of Biology.

4) "Other" = Recreation and Park Administration: major in outdoor resource mgmt.

6) But unlikely to be approved by faculty.

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3) College of Agriculture
10) Through our curriculum process, we are looking at re-defining our core set of expected outcomes for students. Among those being considered is environmental literacy. This approach is the best for our institution. We have seven undergraduate colleges, and few general education requirements for all students at *****. Our focus on core student outcomes is the way in which we achieve common curricular goals without requiring all curricula to accomplish those outcomes in the same way (namely, with the same course requirements). we believe that his approach is consistent with current trends in higher education focusing on student learning outcomes rather than curricular inputs.

2a) Intro to the Environment
Environmental Resources
2b) Environmental Engineering Technology
Geology

2a) Historical Geology
Geography of a Global Village
Dinosaur World
Global Change
Atmospheric Science
Introduction to Human Geography
Fundamentals of Ecology
Introduction to Urban Geography
Oceanography
Cultural Geography
History of Modern Architecture
Resources and the Environment
History of Ancient Architecture
Survey of Architectural History I and II
History of Building Techniques
Planet Earth
Agricultural Power and Energy Systems
Hydrologic Principles in Agriculture
Soil and Water Conservation Systems
Unit Operations for Food and Agri Engineering
Water Quality Engineering
Air Pollution Engineering
Process Safety Engineering
Environmental Control for Plant and Animal Syst
Fundamentals of Environ Remediation Processes
Environmental Engineering
Water Resources Engineering
Environ Engineering Processes and Management
Engineering Environ Systems
Environ Practices and Public Health
National Environmental Systems
Public Works Engineering
Hydrology
Industrial Hygiene Engineering

System Safety Engineering	Product Safety Engineering
Air Pollution Engineering	Ethics and Engineering
Radiation Protection Engineering	Environmental Nuclear Engineering
Environmental and Nat Resources Economics	Intro to Bioenvironmental
Sciences	
Fundamentals of Ecology	Fundamentals of Environ Decision-
Making	
Agro Environmental Soil Science	Ecology of Agrichemicals in Field
Crops and Turf	
Range and Forest Watershed Management	Natural Resource Law
Conservation of Natural Resources	Development and Management of
Protected Areas	
Fundamentals of Ecology	Ecosystem Management
Wildlife Conservation and Management	Animal Ecology

b) Agricultural Engineering; Chemical Engineering; Civil Engineering; Safety Engineering; Bioengineering; and Nuclear Engineering in the Dwight Look College of Engineering

Geography; Geology; Meteorology; Oceanography in the College of Geosciences

Architecture and Environmental Design in the College of Architecture

Agricultural Economics; Renewable and Natural Resources; Rangeland Ecology and Management; Recreation, Park and Tourism Sciences and Wildlife and Fisheries Sciences in the College of Agriculture and Life Sciences

4) "Other": College of Agriculture and Life Sciences:

A. Bioenvironmental Sciences
B. Forestry
C. Plant and Environmental Soil Science
D. Rangeland Ecology and Management
E. Recreation, Park and Tourism Sciences – Park and Natural Resources Management Option
F. Renewable Natural Resources
G. Wildlife and Fisheries Sciences
   Conservation Biology and Biodiversity Option
   Wildlife Ecology and Management Option

A. Bioenvironmental Sciences

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors

[] Minor
[X] Major for an undergraduate degree
[] Master's degree
[] Doctoral degree
[X] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

B. Forestry

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[X] Master's degree
[X] Doctoral degree
[X] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

C. Plant and Environmental Soil Science

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[] Master's degree
[] Doctoral degree
[X] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

D. Rangeland and Ecology Management

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[X] Master's degree
[X] Doctoral degree
[X] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

E. Recreation, Park and Tourism Resources

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[X] Master's degree
[X] Doctoral degree
[X] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

F. Renewable and Natural Resources

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[] Master's degree
[] Doctoral degree
[] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

G. Wildlife and Fisheries Science

[X] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose
[] Course DESIGNED to increase the environmental literacy of non-environmental majors
[] Minor
[X] Major for an undergraduate degree
[X] Master's degree
[X] Doctoral degree
[] An "environmental" minor is offered by another academic unit than Environmental Science, Environmental Studies, etc.

10) Offering our core courses and other courses with an environmental component enhances the environmental literacy of students outside the environmental fields. One division of the Center for Environmental Rural Health, housed in the College of Veterinary Medicine, is the Environmental and Rural Health Partnerships (a NIH funded program) that interfaces with public school students and teachers to address the education

of the lay public. The information learned through this program may be used to further develop non-environmental science majors at *****.

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3) School of Natural Resources

2a) Human Population and the Earth's Environment b) Interdisciplinary
4) "Other": Environmental Health Sciences
5) "Other": Interdisciplinary

2a) 1. EARTH SYSTEM SCIENCE 10 - THE PHYSICAL ENVIRONMENT
2. EARTH SYSTEM SCIENCE 14 - GEOLOGY
3. EARTH SYSTEM SCIENCE 15 - ATMOSPHERIC POLLUTION, OZONE, AND CLIMATE
4. EARTH SYSTEM SCIENCE 20E - THE ATMOSPHERE
5. EARTH SYSTEM SCIENCE 20F - OCEANOGRAPHY
6. ENVIRON. ANAL. & DESIGN E1 - NATURAL DISASTER
7. ENVIRON. ANAL. & DESIGN E3 - HUMAN ENVIRONMENTS
8. ENVIRON. ANAL. & DESIGN E5 - INTRODUCTION TO ENVIRONMENTAL QUALITY & HEALTH

b) 1. DEPARTMENT OF EARTH SYSTEM SCIENCE , SCHOOL OF PHYSICAL SCIENCES
2. DEPARTMENT OF ENVIRONMENTAL ANALYSIS & DESIGN, SCHOOL OF SOCIAL ECOLOGY

3) 1. DEPARMENT OF CIVIL & ENVIRONMENTAL ENGINEERING - MAJOR IN eNVIRONMENTAL ENGINEEERING
2. DEPARTMENT OF CHEMICAL & BIOCHEMICAL ENGINEERING & MATERIAL SCIENCE SPECIALIZATION IN ENVIRONMENTAL ENGINEERING
3. SCHOOLS OF BIOLOGICAL SCIENCES AND SOCIAL ECOLOGY - MAJOR IN APPLIED ECOLOGY
4. DEPARTMENT OF ENVIRONMENTAL ANALYSIS & DESIGN - MAJOR AND MINOR IN ENVIRONMENTAL ANALYSIS & DESIGN
5. DEPARTMENT OF ENVIRONMENTAL ANALYSIS & DESIGN - MINOR IN ENVIRONMENTAL DESIGN
6. INTERDISCIPLINARY PROGRAM - MINOR IN GLOBAL SUSTAINABILITY

4) "Other": 1. EARTH SYSTEM SCIENCE
2. ENVIRONMENTAL ANALYSIS & DESIGN
3. APPLIED ECOLOGY
4. GLOBAL SUSTAINABILITY

10) THE UNIVERSITY OF *****, HAS DEMONSTRATED ITS COMMITMENT TO INCREASING THE ENVIRONMENTAL EDUCATION OF ITS NON-MAJORS

THROUGH VARIOUS PROGRAMS. SOME OF THESE ARE INCLUDING ENVIRONMENTAL LITERACY COURSES AS OPTIONAL COURSES IN THE NATURAL SCIENCE GENERAL EDUCATION REQUIREMENT FOR ALL MAJORS, OFFERING THE ENVIRONMENTAL ENGINEERING SPECIALIZATION AND CONCENTRATION, AND DEVELOPING AN INTERDISCIPLINARY MINOR IN GLOBAL SUSTAINABILITY. FURTHER INFORMATION ON THESE PROGRAMS MAY BE OBTAINED FROM THE CURRENT ON-LINE UNIVERSITY OF CALIFORNIA, IRVINE, GENERAL CATALOGUE,
>> HTTP://WWW.EDITOR.UCI.EDU/CATALOGUE/.

2a) Cluster Course - The Global Environment: An Interdisciplinary Approach (see http://www.college.ucla.edu/ge/m1abc.htm) for the course website.
b) General Education Cluster Course for Freshmen Students; this course (a year-long series) is one option for our Science GE requirement. The course is offered as part of General Education through the Institute of the Environment (IoE). See: http://www.ioe.ucla.edu/IoE.html

10) See http://www.ioe.ucla.edu/IoE.html for information about *****'s Institute of the Environment.

2a)ENVIRONMENTAL STUDIES 12 THE PHYSICAL ENVIRONMENT, 13 THE BIOLOGICAL ENVIRONMENT, AND 115 ENERGY AND THE ENVIRONMENT

4) Other: DONALD BREN SCHOOL OF ENVIRONMENTAL SCIENCE AND MANAGEMENT (GRADUATE PROGRAMS ONLY)

10) YOU MAY BE INTERESTED IN THE INFORMATIONAL BROCHURES FROM THE DONALD BREN SCHOOL OF ENVIRONMENTAL SCIENCE AND MANAGEMENT AND OUR ENVIRIONMENTAL STUDIES PROGRAM. WE WILL BE HAPPY TO SEND YOU THE PUBLICATIONS.

2a) Environmental Ethics: Core requirement Ideals and Values
2b) Dept. of Philosophy

2a)ENVIRONMENTAL SCIENCE & HUMAN AFFAIRS
b) ENVIRONMENTAL ENGINEERING SCIENCES

10) WHAT THE FACULTY THINK IS CRUCIAL. Whereas some think a general environmental literacy component is essential, a much larger proportion think that a shallow and perfunctory treatment cannot provide students enough substance to do independent, critical thinking about complex environmental problems. Therefore we are

following two other strategies. A centralized strategy is creation of a new (1995) interdisciplinary, science-based, rigorous environmental science degree program (undergraduate and graduate), for those students who want an interdisciplinary degree. The other is to suffuse substantive environmental courses into existing disciplinary majors (such as environmental accounting, environmental history, artistic expressions of man in nature). Most of our faculty think these two strategies are more effective that a general literacy requirement. However, in accord with those who espouse the literacy strategy, we also have a number of courses (Environmental Science & Human Affairs, Wildlife Issues, Biodiversity, Food and Man, and many more) that satisfy part of the general education biological science requirement, for those non-science freshmen or sophomores who wish to select one of these instead of Biology I.

2a) EnvSt 236 and others
2b) Environmental Studies and Crop Sciences
4) "Other": Parks and Recreation; Environmental Economics; Environmental Planning

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3) College of Liberal Arts.
012:008/159:008, Introduction to Environmental Science, is co-offered by the Dept. of Geoscience and the Env. Studies Program
5) ESc is an interdisciplinary B.S. program
Est is a "track" within the Department of Geography, B.A. and B.S. degrees available
ESt:
?] Master's degree (There is an "environmental systems" focus that can be chosen in the Master's program in Geography, but I don't know enough about it to be more sure of this response.
[?] Doctoral degree (Again, students may be able to focus on environmental studies through the Geography Ph.D.
I can't speak for the curriculum in Environmental Health in the College of Public Health, except to say it is not an undergraduate program - but it does participate in the Global Health certificate that is open to undergraduates, so there could be some connection there. The rest of the answers in this section would have to supplied by someone in the College of Public Health.
9) I think the Provost or Associate Provost should answer this, not the College of Liberal Arts; but it is true that our College is very supportive of our Environmental Science BS and the Environmental Studies track in Geography. We are also committed more broadly to a solid understanding of the natural science for all of our students, which cannot help but include environmental literacy.

2a) Introduction to Environmental Studies
10) The University of ***** offers an interdisciplinary minor in Environmental Studies. The program is located in the College of Arts and Sciences.

The description of the minor offered here reads: "Environmental considerations permeate almost every facet of modern life, and concern for "the environment" is practically universal as we approach the twenty-first century. The minor in Environmental Studies is designed to provide students with the opportunity to become conversant in a range of environmental topics, whether as private citizens in their daily lives or as professional members of corporate, government, legal, medical, and educational circles.

The minor draws on topics and perspectives from the natural and physical sciences, the social sciences, and the humanities to underscore the interdisciplinary nature of environmental issues and problems. Students taking the minor are encouraged to integrate the program with their major study focus in order to gain a competitive advantage in grappling with environmental topics."

2a) ENVIRONMENTAL SCIENCE (BSCI 205) APPROVED FOR CORE
ENVIRONMENTAL SCIENCE (ENSP 101) SUBMITTED FOR CORE (APPROVAL PENDING)
ENVIRONMENTAL POLICY (ENSP 102) SUBMISSION FOR CORE PLANNED

b) BIOLOGICAL SCIENCES (BSCI 205)
ENVIRONMENTAL SCIENCE AND POLICY (ENSP 101, ENSP 102)

4) ENCE is developing an undergraduate program in environmental engineering, completely separate from ENSP. He believe it is in the works somewhere and says ***** knows more.

10) MANY COURSES OFFERED TO MAJORS AND NON-MAJORS AND MANY THAT MEET CORE REQUIREMENTS HAVE SUBSTANTIAL ENVIRONMENTAL COMPONENTS AND A GROWING NUMBER HAVE INTERDISCIPLINARY APPROACHES.

CPS is an option only for students invited to participate.)

ENVIRONMENTAL LITERACY IS ADDRESSED FOR NON-MAJORS THROUGH THE ***** SCHOLARS LIVING-LEARNING COMMUNITY AND ITS COURSES—ENVIRONMENTAL HISTORY, ENVIRONMENTAL ETHICS, ENVIRONMENTAL SCIENCE, AND ENVIRONMENTAL POLICY. THE FIRST TWO ARE COLLOQUIA (1 CREDIT) AND ARE NOT LISTED ABOVE AS 3-CREDIT COURSES AVAILABLE TO ALL STUDENTS. HOWEVER, THE CONCEPT OF DEVELOPING ENVIRONMENTAL LITERACY THROUGH THE SPECIALIZED CURRICULA OF ***** SCHOLARS IS EFFECTIVE IN ENGAGING MOTIVATED STUDENTS IN THIS AREA, EVEN THOUGH THEY MAY NOT HAVE AN INTEREST IN THE ENVIRONMENT IN AN ACADEMIC SENSE.

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3) The School of Natural Resources and Environment
5) "Other": College of Literature, Science and the Arts

10) We are adopting a "Global Change Minor" that involves collaboration across several of our schools and colleges.

2a) Biology 6 Environmental Studies
Natural Resources 60 Ecology and Conservation of Living Resources
Geology 10 Environmental Geology
Geography 103 Environmental Geography
Rural Sociology 120 Population and Ecology

b) Departments and course numbers are listed with course titles

4) Other "environmental" program (please specify)
Fisheries and Wildlife
Forestry
Civil and Environmental Engineering

5) minor offered by another program: Forestry

10) We don't have a major called environmental studies, but we stress to students that all majors have the option of being environmental, from business to biology. We do have majors that lead to "environmental" careers, particularly in engineering and natural resources, but government, ngos, and businesses that deal with environmental problems need people skilled in accounting, communications, psycology, law, etc.

What the environmental studies program offers is a certificate, the equivalent of an 18 hour major, that is interdisciplinary as well as environmental. We encourage the student to take any environmental courses offered in their major, then for the certificate they take two foundation courses that introduce them to environmental problems from a perspective outside their major area (natural and applied science or social and behavioral science). Then they take a seminar in the sophomore or junior year that encourages discussion among students from different majors about environmental problems. Next they take 2 upper level courses that allow them to develop a mini specialization in one area - water quality, law, etc. Finally, they take a capstone class in their major that has to incorporate some kind of environmental information.

Our strategy has not worked as well as we hoped in terms of reaching students early in their course of study. Ideally we would have freshman and sophomores enrolling in the certificate program so that they could take environmental courses for their general education credit. In practice we see a lot of juniors who have realized they are close to getting a certificate anyway so they try to fit in a few more classes in their last year.

Our enrollment has gone up slowly but fairly steadily in the 5 years of the program's existence. We graduated 10 students with certificates last spring and currently have 22 students enrolled. The most effective tool seems to be word of mouth, either recommendations by faculty, advisors or students. We post flyers, visit clubs and classes, and table, but these efforts are directed more at increasing awareness.

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1) STUDENTS ARE REQUIRED TO TAKE 2 COURSES IN HUMAN BEHAVIOR, CULTURE AND SOCIAL ORGANIZATIONS AND 1 COURSE IN SCIENCE AND TECHNOLOGY. THE TWO COURSES IN HUMAN BEHAVIOR ET AL ARE EXPECTED TO PROVIDE: "KNOWLEDGE OF THE INDIVIDUAL AND GROUP BEHAVIOR, THE NATURE AND ORIGINS OF CULTURE, THE STRUCTURE AND GOVERNANCE OF SOCIETIES, THE CHARACTERISTICS OF ECONOMIC PRACTICES AND SYSTEMS, AND THE INTERPLAY OF HUMAN BEHAVIOR (URBRAN, AGRICULTURAL, AND INDUSTRIAL) AND THE NATURAL ENVIRONMENT."
THE COURSE IN SCIENCE AND TECHNOLOGY IS EXPECTED TO PROVIDE: "KNOWLEDGE OF THE NATURAL WORLD AND ITS INTERRELATIONSHIP WITH HUMAN EXISTENCE, OF THE AIMS AND METHODS OF SCIENTIFIC EXPLORATION, AND THE CREATIONAND SOCIAL IMPACT OF TECHNOLOGY."

2) IN ADDITION TO THE ESSENTIAL STUDIES REQUIREMENT (CORE), ALL STUDENTS HAVE AVAILABLE ADDITIONAL COURSES WHICH WOULD CONSIDER ENVIRONMENTAL ISSUES.

a) Please type the name of the course(s): SOME OF COURSES WHICH MEET THE REQUIREMENTS INCLUDE:
INTRO TO ECONOMICS IN AGRICULTURE
RESOURCES & ENVIRONMENTAL ECONOMICS I
RURAL SOCIOLOGY
INTRODUCTION TO INTERNATIONAL AGRICULTURE ISSUES
AGRICULTURE POLICY
WORLD FOOD ECONOMICS
ANTROPOLOGY OF THE GREAT PLAINS
CONFLICT AND CONFLICT RESOLUTION
INTRO TO ECONOMICS
PRINCIPLES OF MACROECONOMICS
PRINCIPLES OF MICROECONOMICS
INTO TO PUBLIC OPINION
LEGISLATIVE PROCESS
THE JUDICIAL PROCESS
POLITICS OF INDUSTRIAL RELATIONS
NATURAL RESOURCES POLICY
NORTH AMERICAN ENVIRONMENTAL HISTORY
QUALITY OF THE ENVIRONMENT

b) Please type the name of the academic program which offers it:
AGRICULTURAL ECONOMICS
SOCIOLOGY, POLITICAL SCIENCE AND PSYCHOLOGY
ANTHROPOLOGY

ECONOMICS
POLITICAL SCIENCE
FORESTRY, FISHERY AND WILDLIFE
GEOGRAPHY

4) Env. Studies program is interdisciplinary.

5) [] Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose INTERDISCIPLINARY PROGRAM SO COURSES ARE FROM DEPARTMENTS AND UTILIZED BY THE INTERDISCIPLINARY PROGRAM - ESSENTIAL STUDIES COURSES ARE INTENDED TO BE APPROPRIATE FOR NON-MAJORS
[] Course DESIGNED to increase the environmental literacy of non-environmental majors SEE COMMENT IMMEDIATELY ABOVE

6) OUR ESSENTIAL STUDIES PROGRAM IS IN PLACE -- SEE DESCRIPTION ABOVE.

8) WE ALREADY OFFER SUCH COURSES.

10) CO-CURRICULAR - NON-COURSE SPEECHES, STUDENT GROUPS ETC ARE INFLUENTIAL.

2a) Several courses in the curriculum in Env. Sciences and Studies (can be found in on-line catalog).

2a) WE OFFER A "CERTIFICATE IN ENVIRONMENTAL STUDIES" WHICH IS AN OPTIONAL PROGRAM. ITS CURRICULUM IS MADE UP OF 26 CREDITS OF INTERDISCIPLINARY, ENVIRONMENTAL COURSE WORK. ANY OF THESE COURSES WOULD ENHANCE THE ENVIRONMENTAL LITERACY OF THE PARTICIPANTS, BUT THREE COURSES IN PARTICULAR COULD BE SINGLED OUT AS PRIMARY COURSES FOR "ENVIRONMENTAL LITERACY":

ENVIR ST 112, "ENVIRONMENTAL STUDIES--THE SOCIAL PERSPECTIVE"
ENVIR ST 113, "ENVIRONMENTAL STUDIES--THE HUMANISTIC PERSPECTIVE"
ENVIR ST 126, "ENVIRONMENTAL SCIENCE"

b) INSTITUTE FOR ENVIRONMENTAL STUDIES

4) Environmental Science (THERE ARE A NUMBER OF UNITS WHICH OFFER MAJORS RELATED TO THIS SUBJECT; E.G., OUR COLLEGE OF LETTERS AND

SCIENCE OFFERS A MAJOR IN THE BIOLOGICAL ASPECTS OF CONSERVATION
Environmental Education (SOME OF THE MAJORS WITHIN OUR SCHOOL OF EDUCATION INCLUDE AN ENVIRONMENTAL EDUCATION COURSE REQUIREMENT
"Other": Environmental Toxicology
OUR COLLEGE OF AGRICULTURAL AND LIFE SCIENCES OFFERS A NUMBER OF MAJORS WHICH ARE ENVIRONMENTAL.

5) Minor: WITH ITS 26-CREDIT CURRICULUM, OUR "CERTIFICATE IN ENVIRONMENTAL STUDIES" IS MUCH LIKE A MINOR. IT IS AN OPTIONAL PROGRAM AVAILABLE AS AN "ADD-ON" FOR UNDERGRADUATES IN ALL MAJORS.
OUR CIVIL ENGINEERING MAJOR OFFERS AN "OPTION IN ENVIRONMENTAL ENGINEERING" AT THE UNDERGRADUATE LEVEL

10) ALTHOUGH WE DO NOT CURRENTLY OFFER AN UNDERGRADUATE MAJOR IN ENVIRONMENTAL STUDIES, WE BELIEVE THAT OUR OPTIONAL CERTIFICATE IN ENVIRONMENTAL STUDIES IS VERY SUCCESSFUL AT RAISING THE ENVIRONMENTAL AWARENESS OF OUR UNDERGRADUATES. BECAUSE THE PROGRAM IS AVAILABLE AS AN OPTIONAL CERTIFICATE, STUDENTS ARE ABLE TO PURSUE BOTH A TRADITIONAL MAJOR AND THE CERTIFICATE IN ENVIRONMENTAL STUDIES (AND STUDENTS FROM ALL MAJORS ARE ENCOURAGED TO CONSIDER THIS POSSIBILITY.) SUCH A DESIGN MAKES IT POSSIBLE FOR STUDENTS TO INTEGRATE AN ENVIRONMENTAL PERSPECTIVE INTO THEIR CHOSEN MAJORS.

A COMPLETE DESCRIPTION OF OUR ENVIRONMENTAL STUDIES PROGRAMS IS AVAILABLE THROUGH OUR WEB SITE AT
http://www.ies.wisc.edu
WITH OUR UNDERGRADUATE CERTIFICATE PROGRAM DESCRIBED AT
http://www.ies.wisc.edu/cert/

I looked over your questionaire and would not be able to address the questions that you raised. At ***** University, we have a new "General Education" program - called Core or University Studies at some institutions. Ours begins when students are freshmen and ends when they are seniors. The environmental components are found in the "breath" courses that are at the 2000 level. All students would have the basic concepts that you describe.

2a) Environmental Science (for non science majors)
Ecology of Urban Environments (for science majors)
b) Dept. of Biology & Center for Environmental Studies

4) EEn program pending; will offer B.S.
"Other": Environmental Policy – grad.

I hope this is helpful. You will see that the environment is important in many of our programs and curricula. My answers below show courses and programs that actually use the word "environment" in their names. The University offers 26 undergraduate and 30 graduate Environmental Sciences and Energy Systems-related programs in six of its colleges, with more than 8,000 students involved. Please follow the links pasted in this message following #9 for detailed information.
2) Environmental Law (Agriculture and Applied Economics)
Introduction to Environmental Engineering (Civil Engineering)
Energy, Resource Development and the Environment (Engineering)
Fundamentals of Environmental Science (Environmental Science)
Environmental Problems, Population, and Development (Geography)
Resources and the Environment (Geological Sciences)
Global Environmental Issues: Interdisciplinary Perspectives (Urban Affairs and Planning)
Women, Environment, and Development in Global Perspective (Urban Affairs and Planning)
The Environment, Society and the Use of Wood (Wood Science and Forest Products)

4) "Other": Environmental and Water Resources track in Civil Engineering
Environmental Economics, Management and Policy option in Agricultural and Applied Economics
Environmental Policy and Planning
Environmental Resource Management option in Forestry

9) At ***** we have many programs that place the environment high on their list of priorities. As part of the University's driving Cross-Cutting Initiatives we have a focus on Environmental Sciences and Energy Systems. (Please see http://www.unirel.vt.edu/cci/envirenergy.html for greater detail.)
The environment is very important to our extension mission. The state's extension program is run from *****. (Please see http://www.ext.vt.edu/)

And our Office of International Research and Development has many environmental projects around the world, many funded in the $millions. (Please see http://fbox.vt.edu:10021/admin/international/resdev/)

Further, "Ecology" often finds its way into special topics courses. We have a Literature and Ecology course in the English Department. I invite you to visit our home page at http://www.vt.edu to browse our many programs.

2a) PHY 1070 Energy and the Environment
CHM 1000 Chemistry and Your World

2a) Environmental Science and Policy
10) Although under the auspices of Engineering and Science the minor uses courses from 4 of the 5 colleges. Its curricular affairs are overseen by a standing committee that reports to the Dean of Undergraduate Studies. It is widely advertised and some course work in each of three areas: Science and Engineering; Resource Management; and Environmental Policy and Social Impacts. There is a second minor for Engineers entitled Environmental Engineering.

2a) A secondary major (24 hours) entitled Natural Resources and Environmental Sciences, with about 180 students enrolled. The courses in this also support a large number of students not specifically taking the secondary major.
2b) Interdisciplinary: Agronomy, geography, landscape architecuture, maybe one other. I don't recall off the top of my head.

2a) Biological Sciences--Ecology, Evolution and Society
Chemistry--Chemistry in our World
Geography--Introduction to Geography
Geology--Environmental Geology
Geology--Oceanography

4) "Other" WE HAVE AN ASSOCIATE DEGREE IN ENVIRONMENTAL TECHNOLOGY AND ONE IN ENVIRONMENTAL MANAGEMENT TECHNOLOGY. EITHER MAY BE COMBINED WITH MAJOR COURSEWORK TO RECEIVE A MAJOR IN RELATED AREAS--BIOLOGY, GEOGRAPHY, AMERICAN STUDIES, EARTH SCIENCE, BOTANY, CONSERVATION OR ZOOLOGY.

5) Associate degree in the two above programs

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4) "Other" Environmental Conservation
5) EEng - Emphasis in B.S. program
Env. Conservation – option in Wildlife Management

2a) courses in
Environmental and occupational health
Env. Biology
Env. Chemistry
Env. Geography
Env. Geology
Env. Pre-law

4) "Other" – Environmental and plant biology

5) Env. Studies offers a "certificate."

2a) ENVR 1113 – Elements of Environmental Science
Physical Geography
Physical Geology
2b) Environmental Science Geography Geology

8) WE HAVE A COURSE BUT TO EXPAND IT INTO THE REALM OF BEING REQUIRED WOULD REQUIRE NEW RESOURCES TO HAVE ENOUGH FACULTY TO TEACH THIS COURSE TO ALL OF THE NEW STUDENTS THAT MATRICULATE YEARLY.

10) WE DO PLAN TO EXAMINE THE GENERAL EDUCATION REQUIREMENTS AND DETERMINE HOW THEY CAN BE CHANGED. WHEREAS THE STATE OF OKLAHOMA MANDATES COMPLETION OF NATURAL SCIENCE, WE MAY REQUIRE A COURSE ON THE ENVIRONMENT TO FULFILL PART OF THIS REQUIREMENT. A COMMITTEE WILL BE ASSESSING THIS PROPOSAL IN THE NEAR FUTURE.

10) AT THIS POINT WE HAVE ONLY THOUGHTS ABOUT HOW WE MIGHT CHANGE GENERAL EDUCATION TO PROVIDE EVERYONE WITH NECESSARY INFORMATION ABOUT THE ENVIRONMENT(INCLUDING PHYSICAL, SOCIAL, BIOLOGICAL, AND HUMAN PERSPECTIVIES).

2a) PLB 301C – Environmental Issues Contemporary World
ZOOL 312I – Conservation Natural Resources

2a) BIOL 1402, 1403, 1404, 3309; HIST 3327, CE 3309
3) Biology, Civil Engineering, Environmental option

2a) Env. Geology
2b) Dept. of Geology
4) "Other": Bachelor of Landscape Architecture

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5 "Other": Earth Sciences; Biology

10) WE HAVE AN ENVIRONMENTAL STUDIES MAJOR, WHICH COMES FROM A FACULTY WHO ARE A MIXTURE OF SOME SOCIAL SCIENTISTS AND SOME NATURAL (EG, BIOLOGICAL) SCIENTISTS. IT IS INTERDISCIPLINARY IN A WAY THAT IS NOT USUAL, AND IT OFFERS PROGRAMS FROM BACHELOR'S THROUGH THE DOCTORATE.

2a) Please see web site below.
2b) Please see our web site www.udel.edu/provost/environmental.html
4) "other": Please see UD web site.
5) "other" minor: Wildlife Conservation and Natural Resource Management
10) There has been no integrated effort to ensure that environmental literacy is addressed across the university.

GOOD LUCK WITH YOUR SURVEY. I PERSONALLY THINK ENVIRONMENTAL LITERACY IS OF THE UTMOST IMPORTANCE FOR MEMBERS OF THIS DEMOCRATIC SOCIETY AS WE ENTER THE 21ST CENTURY. AMERICANS HAVE TO BE LITERATE ENOUGH ENVIRONMENTALLY TO KNOW HOW TO VOTE IN THEIR OWN BEST INTERESTS, A DIFFICULT TASK GIVEN THE CONTRADICTORY WEALTH OF INFORMATION AVAILABLE.

2a) Intro to Enviro. Science EnvS 101, 102
b) Environmental Science program
5) "Other": RESOURCE RECREATION AND TOURISM DEPARTMENT OFFERS AN ENVIRONMENTAL COMMUNICATION MINOR.

2a) Environmental Geology, Environmental Biology, Environmental Ethics, Human Impact on the Environment, Environmental Economics
b) 5 Different Departments and the School of the Environment
10) See our Sustainable Universities Initiative (http://www.sc.edu/sustainableu. We educate all incoming freshman thru workshops, dormitories etc.

Note: UVM does not have a core curriculum but college specific standards.
3) School of Natural Resources
Environmental Sciences program
Environmental Studies program

2a) Environment & Natural Resources 1000 "Introduction to Studies in Environment & Natural Resources"
ENR 2000 "The Environment & Society"

b) The School of Environment & Natural Resources (SENR)
4) "Other": UW offers an ENR concentration as a complement to 30 different undergraduate majors; we also offer a graduate minor in ENR. Please note, however, that we are moving toward an undergraduate major in ENR as well as professional Master's degree in environmental science and management (hope to have in place by Fall 2000).
10) The fundamental principle in SENR's approach to ENR education is that students should leave the university with a certain level of expertise in a distinct field-we try to avoid an approach that is too broad, i.e. an introduction to everything environmental. As we redesign our own program, we are looking to the ***** School at ***** University as a model; yet we do hope to examine and correct for some of the shortcomings of that program. One area, in particular, where we hope to blaze a new trail is in the integration of the humanities, the social sciences and the natural sciences into a curriculum that fosters students' abilities to deal with the great complexity of natural resource and environmental problems. (This may sound vague. It is difficult to do justice to such a complex process in a brief manner. Please feel free to contact me if you would like more clarification.)

2a) ES/RP 101 THE ENVIRONMENT AND HUMAN LIFE
ES/RP 150 NATURAL SCIENCE IN THE ENVIRONMENT
ANTH 309 CULTURAL ECOLOGY
NATRS 303 CONSERVATION OF RENEWABLE RESOURCES
HIST 409 AMERICAN ENVIRONMENTAL HISTORY
SOC 415 ECOLOGY OF HUMAN SOCIETIES
AM ST/ENGL 472 ECOLOGICAL ISSUES AND AMERICAN NATURE WRITING

4) "Other": Biological Systems and Engineering

10) WSU HAS A "DIFFUSION" STRATEGY IN WHICH STUDENTS ENCOUNTER ENVIRONMENTAL ISSUES IN MANY COURSES IN THE GENERAL EDUCATION PROGRAM. A TYPICAL STUDENT WHO DOES NOT ENROLL IN ONE OF THE COURSES LISTED ABOVE (WHICH ARE EXPLICITLY FOCUSED ON ENVIRONMENTAL ISSUES) WILL NONETHELESS ENCOUNTER SUCH ISSUES IN MULTIPLE CONTEXTS.

10) WSU HAS MADE A CONCERTED EFFORT TO DEVELOP MODULES, ASSIGNMENTS, ETC. IN A WIDE VARIETY OF COURSES SO THAT ENVIRONMENTAL ISSUES PERVADE THE GENERAL EDUCATION CURRICULUM. STUDENTS ENCOUNTER THE ISSUES IN MANY DIFFERENT DISCIPLINES AND CONTEXTS AND IN ADVANCED AS WELL AS INTRODUCTORY COURSES. THE UPPPER DIVISION CAPSTONE COURSES, FOR EXAMPLE, OFTEN CONTAIN EXTENSIVE RESEARCH PROJECTS ON CONTEMPORARY PROBLEMS AND ISSUES OF SIGNIFICANCE. WE

REGARD THESE ISSUES AS BEING OF CENTRAL CONCERN TO THE GRADUATES/CITIZENS OF THE FUTURE.

MORE DETAIL AVAILABLE UPON REQUEST.

1a) TOO MANY TO LIST--THIS FALL SEMESTER ALONE, WE ARE OFFERING 50 COURSES IN 26 DEPARTMENTS THAT MEET THIS REQUIREMENT.
4) "Other": ENVIRONMENTAL DESIGN, ENVIRONMENTAL HORTICULTURE, ENVIRONMENTAL GEOSCIENCES, ENVIRONMENTAL ASSESSMENT AND MONITORING, ENVIRONMENTAL POLICY (LATTER IS GRAD ONLY)

10) OUR STUDENTS ARE REQUIRED TO TAKE AT LEAST ONE COURSE IN EACH OF FOUR THEMES, OF WHICH ENVIRONMENT IS ONE. A DESCRIPTION OF OUR LIBERAL EDUCATION REQUIREMENTS CAN BE FOUND ON OUR WEB SITE AT
http://onestop.umn.edu/Registrar/libed/requirements.html

II. Private Research Institutions

***** UNIVERSITY HAS NEITHER A CORE CURRICULUM NOR ANY REQUIRED COURSES IN ANY AREA. THEREFORE, QUESTIONS 1-3, 6 AND 7 REMAIN UNANSWERED.

2a) W1300 Environmental Science (Biology)
V1005 The design and maintenance of a habitable planet (Earth and Environmental Sciences)

2a: There are a large number.
2b: They come out of several departments, above all the ***** School of the Environment but also several other departments, including Political Science.

3) ***** School of the Environment

2a) ENVS 120 Human and Natural Ecology (Science course without laboratory-GEN. ED. REQ.)
ENVS 130 Global Earth Systems (Science course with laboratory-GEN. ED. REQ.)
ENVS 142 Evolution of the Earth (Science course with laboratory-GEN. ED. REQ.)
b) Environmental Studies Department, ***** College
3) Environmental Studies Department, ***** College
10) By creating a department of Environmental Studies in 1998, ***** College and ***** University made a statement that environmental literacy should be a component of

undergraduate education. Developing that literacy of the ***** community is a programmatic goal of the Department of Environmental Studies. That goal is sought through a number of pathways. One is the departmental seminar series where students and faculty are invited to interact with a diverse set of speakers on topics of the environment. The department also offers a wide set of courses to non-majors through cross-listing with departments of economics, political science, religion, biology and history. The department also engages students in community outreach programs such as Adopt-a-stream with a local NGO, interaction with private science museums and high school programs.

Certainly, making an environmental literacy course that fulfills a general education requirement is one approach. Although I don't know of such courses at *****, faculty led eco tourist trips for alumni is another way of increasing the enviromental literacy of alumni. Also, continuing education or night courses provide other vehicles.

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4 "Other": Individual subjects, seminars, special programs.

10) Your questionnaire does not really correspond well to our academic programs. Please refer to the listing at our web site, http://curricula.mit.edu/CEI/Education/courses.html

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2a) THERE ARE MORE THAN 80 COURSES AT ***** WITH A STRONG ENVIRONMENTAL THEME, OFFERED BY MANY DEPARTMENTS ACROSS SEVERAL SCHOOLS (INCLUDING ARTS & SCIENCES, FLETCHER SCHOOL OF LAW AND DIPLOMACY, AND THE NUTRITION SCHOOL) PROMINENT (MOST POPULAR) AMONG THESE COURSES ARE

ENVIRONMENTAL BIOLOGY
PRINCIPLES OF CONSERVATION BIOLOGY
CHEMICALS, HEALTH, AND THE ENVIRONMENT
TIME, NATURE AND HUMANITY
ENVIRONMENT AND TECHNOLOGY
ENVIRONMENTAL GEOLOGY

b) BIOLOGY DEPARTMENT
DEPT OF URBAN ENVIRONMENTAL POLICY (A GRADUATE DEPT)
HISTORY DEPARTMENT
COLLEGE OF ENGINEERING
GEOLOGY DEPARTMENT

10) WE FEEL THAT THE BEST WAY TO PROMOTE ENV. LITERACY IS TO OFFER COMPELLINGCOURSES ORIENTED TOWARD ENVIRONMENTAL ISSUES. STUDENTS ARE DRAWN TO THESE BECAUSE OF INTEREST AND REPUTATION, *NOT* BECAUSE THE COURSES ARE REQUIRED! REQUIRING STUDENTS TO TAKE COURSES RESULTS IN A DISINTERESTED STUDENT

AUDIENCE AND LOWERED QUALITY OF INTERACTIONS IN THE CLASSROOM.

ANOTHER ROUTE THAT HAS PROVEN SUCCESSFUL IN ENHANCING ENV LITERACY AT ***** HAS BEEN TO INVEST IN FACULTY DEVELOPMENT PROGRAMS, OFFERING WORKSHOPS TO HELP FACULTY DESIGN AND INCORPORATE ENVIRONMENTAL UNITS OR PERSPECTIVES IN THEIR ALREADY-ESTABLISHED COURSES. THESE WORKSHOPS HAVE GONE A LONG WAY IN 'SEEDING' DOZENS OF COURSES WITH ENVIRONMENTAL PERSPECTIVES ACROSS THE CURRICULUM RANGING FROM ENGINEERING TO DRAMA.

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3) *I am defining courses in "environmental literacy" as courses at the introductory or non-major level that provide an overview of environmental systems, issues and/or movements, and/or courses that approach a traditional discipline from an explicitly environmental perspective.*
Courses: Anthropology 370 "Ecological Anthropology"
Chemistry 250, "Environmental Chemistry"
Economics 333, "Environmental Economics"
Ecology, Evolution and Organismal Biology 104, "Environmental Biology"
Env. Studies/ Ecology, Evolution and Organismal Biology 377, "Mississippi River Basin Colloquium" (Examines the natural and social dimensions of the Mississippi River.)
English 363-79 and Ecology, Evolution and Organismal Biology 466-33H "Expository Writing for Environmental Studies" and "Case Studies in Environmental Science" A coordinated course in environmental science and writing.
Geology 202, "Environmental Geology"
History 394, "Environmental History of South Louisiana"
Philosophy 334, "Humanity's Place in Nature"
Philosophy 662 "Environmental Ethics"
Political Science 462 "Global Environmental Politics"
Political Science 423 "Environmental Politics and Policy"
Sociology 260, "Environmental Sociology"
b) These courses, offered by the Faculty of Liberal Arts and Sciences, can fulfill distribution requirements for majors in Liberal Arts and Sciences.
They also fulfill major requirements in the Environmental Studies major.
4) Es = Earth and Ecosystems Sciences

9) (Though I should note my bias here--I'm the ***** Environmental Coordinator and it's my job to promote this idea!)

10) --The Green Club, a student environmental organization, and the Environmental Studies Program produce an annual catalog of environmental courses and programs at *****, which is advertised and made available to all students.

--The Green Club does a number of environmental education projects--events, toxic tours, etc--and publishes a campus environmental newsletter.
--As a result of student activism and research, ***** recently created an Office of Environmental Affairs to promote campus greening efforts. Proposals for a "Sustainable Campus Design" section of the Campus Master Plan, and the implementation of an environmental management system are now being made to top administration--if these move forward they will greatly increase the environmental literacy of students, staff and faculty.
--A new grant program for students encourages and supports student environmental research and education projects that focus on the campus and community.
--The Center for Bioenvironmental Research and the Environmental Studies Program offer a number of internships and student worker positions in environmental research and projects.

The "Enviro Counter Culture Catalog: A Guide to Environmental Classes at *****" is a fabulous project--student produced, includes student evaluations of courses, helps environmental studies majors negotiate the program, and illustrates to all students that "environment" is a part of every field of study. I'm sending you a copy and also a press release describing it in more detail.

2a) General Education: Crisis of a Planet – Geology
Environment and Ethics – Geography
Humans and Their Environment – Biology

2a) Example of such courses include:
- Diversity of Life
- Multidisciplinary Approaches to Managing Earth and Its Resources
- Environmental Aspect of the Technological Society

b) • Ecology and Evolutionary Biology
- Studies in the Environment
- Forestry and Environmental Studies

4) "Other": This is the School of Forestry and Environmental Studies, a professional graduate school. It does not offer undergraduate degrees but contributes to teaching in ***** College.

10) A grassroots campaign by The ***** Student Environmental Coalition (*SEC) working with the Administration exists at *****. In 1998, *SEC issued The ***** Green Plan encompassing educational and other institutional policies as they affect the environment. *SEC publishes "the green book: environmental courses at *****" annually listing over 100 courses at both undergraduate and graduate levels. Twenty departments and four professional schools participate in the environmental literacy and

specialization programs. The ***** approach to addressing the environmental literacy of non-environmental majors is fostering educational opportunities for students, faculty, and staff through multidisciplinary courses and programs actively.

***** University continues to engage its students, faculty, and staff through various environmental educational plans. In conjunction with the educational opportunities, the University actively engages in environmental planning and maintenance of its facilities practicing what we preach. Our communications strategy includes students and practitioners of the environment.

2a,b) ENVIRONMENTAL BIOLOGY BIOLOGY
INTRODUCTION TO GEOLOGY GEOLOGY
DISEASE AND PUBLIC HEALTH MICROBIOLOGY
INTRODUCTION TO THE ATMOSPHERE AND WEATHER PHYSICS & ASTRONOMY

10) A. OUR STUDENTS HAVE SOME BASIC ENVIRONMENTAL LITERACY WHEN THEY ARRIVE. THEY ARE HIGH ACHIEVERS RANKING IN THE TOP 5% OF HIGH SCHOOL GRADUATES AND HAVE TAKEN A LOT OF SCIENCE AT THAT LEVEL.

B. ALL STUDENTS TAKE OUR REQUIRED GENERAL BIOLOGY COURSE WHICH DEALS EXTENSIVELY WITH ENVIRONMENTAL ISSUES.

C. ALL STUDENTS HAVE ACCESS TO A RICH ARRAY OF ENVIRONMENTAL COURSES TAUGHT IN A WIDE VARIETY OF DISCIPLINES. WE DO NOT FIND IT APPROPRIATE TO COMPEL ANY STUDENT TO PURSUE ENVIRONMENTAL STUDIES BEYOND THE BASIC GENERAL EDUCATION COURSE.

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4) "Other" – Environmental and Resource Policy
10) A few years ago ***** had a joint program with EPA to make ***** a "green" university. There was lots of publicity about the program, with VP Gore giving the kick-off speech. Lots of recycling bins have been placed all around the campus. The program and people involved in it have faded into the recycling bins.

1b) Students are expected to become literate about the natural world—there are many ways to accomplish this.

*****, INTERIM PROVOST HAS ASKED ME TO RESPOND TO YOU QUESTIONAIRE ABOUT ENV LITERACY. I AM THE DIRECTOR OF OUR UNDERGRADUATE ENVIRONMENTAL SCIENCE PROGRAM AND GENERALLY FAMILIAR WITH OUR ENV PROGRAMS. MY RESPONSE IS

BELOW. PLEASE CONTACT ME IF YOU NEED MORE INFORMATION OR FURTHER CLARIFICATION.

SINCERELY, *****

2) SEVERAL COURSES PROVIDE AT LEAST A PARTIAL "ENVIRONMENTAL LITERACY" BUT THEYARE SMALL COURSES (ABLE TO ACCOMMODATE 10 TO 40 STUDENTS), NONE HAS BEEN DESIGNED WITH THIS PURPOSE IN MIND, AND IN TWO CASES THE COURSES CANNOT BE USED TO MEET ANY CORE REQUIREMENTS.

1) INTERDISCIPLINARY ACROSS SCIENCE, SOCIAL SCIENCES, HUMANITIES AND TO SOME EXTENT, ENGINEERING; INTRODUCTORY LEVEL; FIRST YEAR ENVIRONMENTAL SEMINAR I & II; CANNOT BE USED TO MEET ANY UNIVERSITY CORE REQUIREMENT. ENVIRONMENTAL SCIENCE UNDERGRADUATE DEGREE PROGRAM.

2) INTERDISCIPLINARY ACROSS SCIENCE, SOCIAL SCIENCES, HUMANITIES AND TO SOME EXTENT, ENGINEERING; INTRODUCTORY LEVEL; INTRODUCTION TO ENVIRONMENTAL STUDIES. SCIENCE AND TECHNOLOGY STUDIES DEPARTMENT.

3) INTERDISCIPLINARY ACROSS SCIENCE, SOCIAL SCIENCES, AND HUMANITIES; ADVANCED LEVEL; ONE MILE OF THE HUDSON RIVER I; CANNOT BE USED TO MEET ANY UNIVERSITY CORE REQUIREMENT. ENVIRONMENTAL SCIENCE UNDERGRADUATE DEGREE PROGRAM.

4) PRIMARILY SCIENCE WITH SOME CONSIDERATION OF SOCIAL SCIENCES AND ENGINEERING; ADVANCED LEVEL; GLOBAL ENVIRONMENTAL CHANGE. ENVIRONMENTAL SCIENCE UNDERGRADUATE DEGREE PROGRAM AND DEPT OF EARTH AND ENVIRONMENTAL SCIENCES.

SEVERAL OTHER COURSES CONSIDER ENVIRONMENTAL ISSUES IN A SUBSTANTIAL WAY WITHIN THE CONTEXT OF THE SUBJECT: INTRODUCTION TO BIOLOGY, BIOLOGY FOR NON-MAJORS, NATURAL SCIENCE I & II, PLANET EARTH: OCEANS AND ATMOSPHERE, AND ENVIRONMENTAL GEOLOGY -- ALL INTRODUCTORY AND ALL CAN BE USED TO MEET CORE SCIENCE REQUIREMENT.

3) BIOLOGY (BIOL DEPT) AND GEOLOGY (EARTH AND ENV. SCIENCES DEPT) MAJORS WILL HAVE SOME EXPOSURE TO "ENV LIT" AS WILL ENV ENGINEERING MAJORS BUT ONLY ENVIRONMENTAL SCIENCE MAJORS (SCHOOL OF SCIENCE) AND THOSE IN THE JOIN PROGRAM BETWEEN ECONOMICS AND SCIENCE AND TECHNOLOGICAL STUDIES (ECOLOGICAL ECONOMICS, VALUES, AND POLICY) (SCHOOL OF HUMANITIES AND

SOCIAL SCIENCES) ARE REQUIRED TO TAKE COURSES THAT HAVE "ENV LIT" AS A MAJOR GOAL. STUDENTS IN THE SCIENCE AND SOCIETY TRACT OF THE SCIENCE AND TECHNOLOGY STUDIES MAJOR
WILL ALSO HAVE REASONABLE EXPOSURE TO "ENV LIT" AS WILL THOSE IN ECONOMICS WHO FOCUS ON ECOLOGICAL ECONOMICS.

4) Environmental Studies NOT A DEGREE BUT AN UMBRELLA FOR ENV MAJORS SO THAT A STUDENT WHO IS INTERESTED IN AN ENV DEGREE CAN ENTER WITHOUT DECLARING A SPECIFIC MAJOR -- NOT CONSIDERED BELOW BECAUSE NOT RELEVANT.
9) [X]6 THIS IS MY OPINION NOT THAT OF MY INSTITUTION BECAUSE IF IT WERE, WE WOULD BE DOING FAR MORE THAN WE ARE. AT THE SAME TIME, WE HAVE A NEW PRESIDENT (THE PAST PRESIDENT DID NOT BELIEVE THAT THE BIG ENVIRONMENTAL WERE OF ANY RELEVANCE TO THE SCHOOL) WHO MAY HAVE A DIFFERENT PERSPECTIVE THAT TRANSLATES INTO ACTION ON THE IMPROVING THE ENVIRONMENTAL EDUCATION OF OUR STUDENTS IN GENERAL.

10) WE HAVE REALLY DONE NOTHING UP TO THIS TIME TO BE COPIED BY OTHERS; HOWEVER, SEVERAL OF OUR SMALL SCALE ACTIVITIES DO HAVE PROMISE. OUR FIRST YEAR ENV SEMINAR I&II ARE ONE CREDIT COURSES THAT MEET ONCE A WEEK FOR 1 TO 2 HRS DEPENDING UPON THE VENUE TO INTRODUCE STUDENTS TO THE WIDE RANGE OF APPROACHES AND METHODS OF UNDERSTANDING THE WORLD, THE CHALLENGES PRESENTED BY HUMAN ACTIVITIES, AND POSSIBLE RESOLUTIONS TO THESE CHALLENGES HAS WORKED VERY WELL TO INITIATE FIRST YEAR ENVS MAJORS (AND A FEW OTHER MAJORS) TO ENV LITERACY. THIS IS UNFORTUANTELY A BIT LABOR INTENSE AS IT ONLY WORKS WELL WITH A SMALL GROUP (LESS THAN 25) AND REQUIRES DISCUSSIONS AND SHORT PAPERS. WE HAVE THE STUDENTS READ TWO BOOKS IN THE FALL (ISHMAEL, DANIEL QUINN; PARADISE FOR SALE: A PARABLE OF NATURE, CARL McDANIEL AND JOHN GOWDY) AND ONE IN THE SPRING (A GREEN HISTORY OF THE WORK: THE RISE AND FALL OF GREAT CIVILIZATIONS, CLIVE PONTING) AS THE BACKDROP TO INDIVIDUAL SEMINARS BY HISTORIANS, ECONOMISTS, PHYSICISTS, GEOLOGISTS, BIOLOGISTS, PHILOSOPHERS WHO CONSIDER SPECIFIC ENVIRONMENTAL TOPICS FROM A DISCIPLINARY AND BROADER PERSPECTIVE.

OUR UPPER LEVEL GLOBAL ENVIRONMENTAL CHANGE COURSE THAT IS SCIENCE BASED BUT INCLUSIVE OF OTHER PERSPECTIVES. CONSIDERS THE BIG ISSUES -- POPULATION, POLLUTION, CLIMATE CHANGE, BIODIVERSITY LOSS, GEOPHYSICAL CYCLES, ETC – AND USES A CASE STUDY APPROACH. SUCH A COURSE COULD BE PRESENTED AT AN INTRODUCTORY LEVEL TO REACH ALL UNIVERSITY STUDENTS.

IF YOU WANT MORE INFORMATION ON THESE, PLEASE CONTACT ME

4) "Other": Env. Policy

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2) Biology 109 Our Living Environment
Earth and Atmospheric Science:
101 – Earth Systems I
103 – Earth Systems II
114 – Earth History
115 – Dinosaurs – Evolution/Extinction

2a) ENVIORNMENTAL POLUTION AND POLICY, POPULTION AND ENVIRONMENT, GLOBAL ENVIRONMENT, THE NATURAL ENVIORNMENT, ENVRONMENTAL GEOLOGY,

2b) GEOGRAPHY, GEOLOGY (EARTH SCIENCES), COLLEGE OF ENVORONMENTAL SCIENCES AND FORESTRY (***** SYSTEM)

3) GEOLOGY, GEOGRAPHY

10)I SUGGEST YOU CONTACT PROFESSOR *****, CHAIR OF DEPARTMENT OF EARTH SCIENCES, AND PROFESSOR *****, CHAIR OF ENVIRONMENTAL ENGINEERING

III. Public Doctoral Institutions

2a) Environment and Society NREM 101
b) University Core Curriculum Science Distribution elective

4) "Other": Natural Resources and Environmental Management
Environmentally Sustainable Clustered Minors Program
Minor in Environmental Management
Minor in Natural Resources

2a) ENVS 101: Introduction to Environmental Studies
ENVH 210: The Global Commons: International Perspectives on Environmental Health and Protection
2b) 1) Environmental Studies; 2) Environmental Health

2a) BSC202 Humans and the biosphere
HSC156 Environmental health in the 21^{st} century: meeting the global challenge
SWK125 Building healthier communities through community involvement

AGR203 Agriculture and the environment
FCS/HPR/HSC208 Dynamics of US contemporary health issues

b) All of these are courses included in our general education core; they are not specifically required, but students may select them. There are various other relevant courses contained under different major curricular requirements. The courses above are offered by the departments of Biological Sciences, Health Sciences, Social Work, Agriculture, and Family and Consumer Sciences/Health Physical Education and Recreation/Health Sciences(jointly), respectively.

10) At ***** University, we have a general education core which has three levels (inner, middle and outer) and all students must complete each of the three levels. The outer core is composed of several different categories of largely interdisciplinary courses from which students must select four courses. Environmental health content information is spread throughout the outer core and in relation to various disciplines. Thus, you see the many different departments listed above. This is a rather unique multidisciplinary and integrated approach.

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a) BOT 131 Plants, Humanity and Environment
BOT 171 Ecology of North America
ZOO 121 Environmental Biology
GLG 121 Environmental Geology
MBI 121 The Microbial World
PHY 121 Energy and Environment
PPS 120 Comparing environmental Systems of Developing and Developed Countries

b) Botany, Zoology, Geology, Microbiology, Physics (all in the College of Arts and Science). Paper Science and Engineering (School of Engineering and Applied Sciences)

9) WE ARE CONSIDERING OFFERING AN UNDERGRADUATE MAJOR IN ENVIRONMENTAL SCIENCE

2a) There is a Cluster on Environmental Management that may be used to fulfill the upper-level General Education program. Students choosing this option must complete three of the following courses: BIOL 317, Environmental Issues; CE 458, Sustainable Development; ECON 447, Natural Resources and Envorinmental Economics; GEOG 306, Hazards: Natural and Technological; and PHIL 344, Environmental Ethics.

2a) Environmental Ethics & Policy
Ecological Agriculture
Urban Sociology

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5) EE offers concentration

10) A course - not taught but organized by at least two faculty members from different disciplines. Guest speakers from environmental: law, political science, physics, mathematics, engineering, sociology, literature, psychology, business, govt. agencies. Format: lecture by guest on one day a week, discussion by class and instructors on one other day.

2a) GEO 314: Physical Geography: Landscape Processes
b) Geography

Environmental Studies: new minor to be first offered in 2000

A new environmental sciences track is under consideration at the University of *****.

1a) EARTH AND ENVIRONMENTAL SYSTEMS
b) JOINTLY OFFERED BY THE DIVISION OF ENVIRONMENTAL SCIENCE AND ENGINEERING AND THE DEPARTMENT OF GEOLOGY AND GEOLOGICAL ENGINEERING
4) "Other": Division of Environmental Science and Engineering
10) WE OFFER A REQUIRED COURSE FOR ALL UNDERGRADUATES ENTITLED "EARTH AND ENVIRONMENTAL SYSTEMS" IF YOU ARE INTERESTED, I CAN SEND YOU SOME INFORMATION ABOUT IT.

2a) Env. Science I, II
Geology I, II
Physical Geography

2b) College of Arts and Sciences
4) "Other": Earth Systems Science

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4) "Other": School of Public & Environmental Affairs
10) An area certificate in environmental studies is offered as an option for all other majors at ***** campuses.

2a) Introduction to Biological Sciences includes a significant environmental component. The course can be used to meet the laboratory science requirement.
4) "Other": Applied Ecology degree (BS) in School of Forestry

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2a) Technology, Society, and Environment

b) Part of the General University Requirements taken by all ***** students
4) EH - we offer a track in Urban and Environmental Health as part of our Masters in Public Health
"Other": We offer the MS in Environmental Policy Studies
5) "Other": The minor in Science, Technology, and Society has a very strong environmental emphasis. This minor is offered by the Department of Humanities and Social Sciences
10) Under a grant from the Environmnetal Protection Agency, we developed the course Society, Technology, and Environment as part of our core required curriculum. A textbook--Environmental Protection--has been published and is widely available, and our experiences with the curriculum have been published in peeer-reviewed journals.

While I will phone you to tell you more about our work, I believe that our approach has been very, very successful for our students.

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4) "Other": Wildlife Biology

2a) ES 101 Environmental Science
b) Dept. of Atmospheric Science

2a) Chemistry and the Modern World	Chemistry
Biology and Society	Biology
The Oceans	Fisheries and Ocean Science

4) "Other": Chemistry B. S.: Env. Chemistry option; M.S. and Ph.D. in Env. Chemistry
10) In terms of degree programs, we try to address environmental issues/literacy mostly intwo ways: environmental components built into appropriate majors and interdisciplinary programs of study.

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4) "Other": Geography and Environmental Sytems
Interdisciplinary Studies concentration in Environmental Studies

10) regular column in student weekly newspaper on environmental literacy; a conservancy area adjacent to the campus and owned by the campus used by faculty to teach environmental science/studies courses, and literacy; active environmentalists who influence campus land use decisions significantly; planned undergraduate majors in environmental science/studies and environmental engineering to be implemented within next two years

Please contact Professor ***** to learn more about CERA, our conservancy area; please contact ***** to learn more about her activities and the weekly newspaper column--she also is requesting we construct a greenway on land we own to serve as part of a larger greenway system; ***** has also been actively involved in other issues related to environmentalism.

5) env. minor offered by Geology/Biology

2a) Geol 103, Introduction to Env. Issues
2b) Environmental Geology and Technology

4) "Other": We offer a Bachelor's degree in Env. Geology and Technology, and a Bachelor's degree in Geography with an emphasis in environmental geography.

VICKIE--I HOPE THIS IS HELPFUL. IN ESSENCE: *SU OFFERS TWO uNDERGRADUATE ENVIRONMENTAL SCIENCE COURSES THAT CAN BE COUNTED TOWARD THE GENERAL EDUCATION REQUIREMENT. WE ALSO OFFER AN INTERDISCIPLINARY ENVIRONMENTAL SCIENCE MS.

2a) BIOLOGY 370Q: INTRODUCTORY ENVIRONMENTAL SCIENCE AND GEOLOGY 262Q:CULTURAL GEOGRAPHY

4) Env. Science MS is interdisciplinary

10) *SU IS TRYING TO ATTRACT MAJORS TO ITS ENVIRONMENTAL SCIENCE MS PROGRAM. WE ARE NOT HAVING MUCH LUCK. WE OFFER A FEW COURSES THAT ARE OF HELP TO UNDERGRADUATES: BIOLOGY 370Q--INTRODUCTORY ENVIRONMENTAL SCIENCE; AND GEOLOGY 262Q: CULTURAL GEOGRAPHY. BOTH OF THESE COURSES WILL COUNT TOWARD OUR GENERAL EDUCATION REQUIREMENT.

2a) 1) ENVIRONMENTAL SCIENCE (HAS AND ENVIRONMENTAL SCIENCE LAB WITH IT) -- ONE OF THE CHOICES FOR FULFILLING NATURAL AND LIFE SCIENCE REQUIREMENT.
2) INTRODUCTION TO CONTEMPORARY ENVIRONMENTAL ISSUES -- ONE OF THE CHOICES FOR FULFILLING THE HUMANITIES REQUIREMENT.

b) 1) DEPARTMENT OF BIOLOGICAL SCIENCES
2) DEPARTMENT OF PHILOSOPHY AND RELIGION STUDIES

4) "Other": INSTITUTE OF APPLIED SCIENCES IN DEPARTMENT OF BIOLOGICAL SCIENCES

10) ENVIRONMENTAL EDUCATION IS CENTERED IN THE INSTITUTE OF APPLIED SCIENCES ADMINISTERED IN THE DEPARTMENT OF BIOLOGICAL SCIENCES. THE INSTITUTE DEVELOPS RESEARCH AND EDUCATIONAL

PROGRAMS THAT ADDRESS THE NATURAL AND HUMAN RESOURCE ISSUES FACING TEXAS, THE NATION, AND THE WORLD. WITH AN EMPHASIS ON WATER, LAND, PEOPLE, AND COMMUNITIES, THE INSTITUTE SEEKS TO EXPLORE RESOURCES FOR THE FUTURE. IT SPONSORS AND COORDINATES INTERDISCIPLINARY EFFORTS IN INSTRUCTION, RESEARCH, AND COMMUNITY SERVICE. OTHER DEPARTMENTS THAT COOPERATE IN THESE INTERDISCIPLINARY EFFORTS ARE HISTORY, PHILOSOPHY, JOURNALISM, GEOGRAPHY, AND CHEMISTRY.

IV. Private Doctoral Institutions

2a) Social Sciences and Environmental Problems
Natural Sciences and Environmental Problems

4) EENG – cooperative arrangement, 3-2 program

10) Designing a non-majors English course in environmental Literature, presently under construction.
Carefully chosen public speakers
Interdisciplinary strong links to School of Education, School of Business. School of Business now employs an environmental economist.

2a) IDSC 321 and 322 (interdisciplinary science?)
Scientific Inquiry I and II, 4+4 quarter credits

5) “Other”: College of Arts and Sciences

10) Our degree program is Interdisciplinary, building on courses in the sciences as well as geography, political science, ethics and philosophy. It is governed by an interdepartmental committee. It was created with this type of curriculum after doing a needs assessment with local environmental managers about the market for skills related to managing environmental issues. They support our preparing broadly educated graduates who will be flexible in their ability to wear the many "hats" needed by environmental management.

The coordinator for this program is *****, professor of botany. He may be reached at *****.

2a) (1) ENS 1001 THE WHOLE EARTH COURSE,
(2) BIO 2510 ECOLOGY OF A CHANGING PLANET

b):(1) ENVIRONMENTAL SCIENCES PROGRAM IN THE DIVISION OF MARINE AND ENVIRONMENTAL SYSTEMS,

(2) BIOLOGICAL SCIENCES DEPARTMENT

10) FACULTY ARE ENCOURAGED TO COVER ENVIRONMENTAL CONSIDERATIONS IN ANY COURSE WHERE APPROPRIATE. SYLLABI SHOW SUCH COVERAGE IN SEVERAL COURSES INCLUDING BUT NOT LIMITED TO: CIVIL ENGINEERING, CHEMICAL ENGINEERING, BUSINESS, AND , OF COURSE, BIOLOGY, ENVIRONMENTAL SCIENCE, AND OCEANOGRAPHY.

2a) BIRU 1000-Life on Planet Earth
b) BIRU 1002-Ecology: A Human Approach
PYRU 1203-Environmental Physics
b) Natural Science

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3) Environmental Engineering

2a) Earth
B) Science, Technology and Society

1a) The Living Earth b) required science course for all *SU undergraduate students
10) We feel very strongly about students developing ownership to local environmental issues. We have them form an actual ***** non-profit environmental corporation to solve a specific problem they have researched and selected.
I will be glad to send you information about the "activist" model we have developed.

2a) General Ecology b) Biological Sciences

2a) Environmental Ethics b) ES&P

2a) Environmental Studies 1: Humans and Nature in North America (humanities perspective)
Environmental Studies 2: Introduction to Environmental Science
Environmental Studies 3: Nature and Society (social science perspectives)
4) "Other": Environmental Biology
Environmental Earth Science
Engineering modified with Env. Science
10) ***** College was one of the first universities to establish an Environmental Studies Program and remains a leader in this area. Many departments and programs at *****

consider environment as an important part of their curriculum and it is difficult to capture this infusion in a survey of this type.

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3) School of Public Health, "Principles of Environmental Health"

2a) Chemistry and the World Around Us, Science and Business b) College of Arts and Sciences
5) "Other": Interdisciplinary programs within College of Arts and Sciences
10) Service learning projects are effective (citizen activities in environmental clean up, for example). We have used this approach for biology majors in the Ecology course. Students wrote a 'reflective essay' afterwards. Another approach that appears promising follows David Orr's ideas about environmental literacy, and more recently involving campus projects in environmental architecture. For another model, see ***** College, where literature and environmental studies are joined through writing 'on the trail'.

1a) Core 340: "Toward a Sustainable Planet"
b) Multidisciplinary: Biology, Chem or Physics + another discipline: "Ecology & Bioethics" (Biol. & Philosophy) or "Sunshine & Water" (Biol. & History)

In addition, the following may be counted toward area requirements:
HUM 110 Introduction to Peace Studies
BIOL 101 Life Science: The Human Environment
CHEM 251 Energy Issues
NASC 102 Physical Science: Human Environment

2a) Ecology and Env. Biology Plants and Peoples
b) Biology

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4) "Other": Environmental Economics and Public Policy
Interdisciplinary Environmental Studies
Emphasis on ecology or env. biology within Biology/Biotechnology

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3a) Department of Environmental Engineering

V. Public Master's Institutions

2a) Env 101 Introduction to Environmental Science
b) Biology and Geology
10) We, in the past, had a multi-disciplinary--Biology, chemistry, Geology--major program in environmental science which proved to be unpopular with our students and

was consequently closed down. The course listed above is the remaining vestige of that program. I do not anticipate any enhancement of this course or program.

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3) Environmental Biology course can be used to satisfy a core requirement for Biology majors and minors.

2a) Physical Geology b) Gen Ed Curriculum
4) "Other": Plant and Soil Science
Env. Biology
Botany
Entomology
Zoology
Chemistry

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10) We offer a course in this area but it is not an option in the core curriculum.

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3) Dept. of Geology & Geography
4) "Other": Env. Geography

1a) People and the Environment along with a special topics course
>b) The core course is offered by the environmental studies program. The special topics courses are drawn from any number of disciplines.

2a) BIOL 205 – Biology of Env. Pollution
PHSC 101 – Earth Science

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3) Dept. of Education (School of Education and Professional Studies
Dept. of Natural Sciences (School of Arts and Sciences)

Vice President ***** asked that I respond to your survey. I am a Professor of Earth Sciences, and Acting Vice President for Academic Planning. Please contact me if you have any questions.

In responding to your two first questions, I considered our general education offerings carefully. Title V, the state code that directs our general education requirements, states that each student must have both a life and a physical science. Our general education science courses include environmental aspects, but, except for one upper division course, do not focus on environmental science. I've decided to take the narrower view that we don't require an environmental literacy course, but do include one in our general education program.

If you would prefer that I take a broader view, please let me know and I will revise my response.

2a) Natural Processes and Human Welfare
b) Department of Earth Sciences
4) "Other": Earth Sciences

2a) GEOL 167 Oceans and Atmosphere
GEOL 168 California's Earth System
N SCI 115 Environmental Earth and Life Science
PLANT 105 Food, Society, & Environment
RLS 80 Lifelong Learning in the Natural Environment

b) GEOLOGY, NATURAL SCIENCES, PLANT SCIENCE, RECREATION & LEISURE STUDIES

4) ES is interdisciplinary degree pending final approval

2a) Geology 120 Global Environmental Problems Geological Science
Sociology 361 Population and the Environment Sociology

2a) All Environmental Studies ENVT courses for transfer students, Environmental Science ENSC 2800 Environmental Problems of California for sophs.
b) Geography and Environmental Studies Department for ENVT courses, the School of Science for ENSC course.

5) EH offers option for UG degree
EE offers GR emphasis

2a) Humans and the Biological Environment Biology
Physical Geography Geography

2a) Introduction to Natural Environment
b) Geography

2a) ENV 1010 Principles of Ecology

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4) "Other": Env. Geology
10) Creating two minors in Env. Studies – one for science majors and the other for non science majors.

NYPIRG chapter is on campus and is active. (Actually, ***** College was one of the founding members of the PIRG family.

2a) ENVS 1105 – Environmental Studies
b) Environmental Science

10) THE UNIVERSITY OPERATES TWO SPECIAL PURPOSE CENTERS RELATING TO THE ENVIRONMENT. THESE CENTERS ARE OPERATED IN PARTNERSHIP WITH REGIONAL K-12 SCHOOL DISTRICTS AND CITY/COUNTY GOVERNMENT AGENCIES. THE CENTERS ARE (1) COCA-COLA SPACE SCIENCE CENTER AND (2) OXBOW ENVIRONMENTAL LEARNING CENTER. PROGRAMMING FOR K-12 STUDENTS ARE OPERATED AT EACH CENTER, A COMMUNITY EDUCATION PROGRAM IS OPERATED BY EACH CENTER, EACH CENTER SERVES AS A LABORATORY FOR UNIVERSITY STUDENTS IN BOTH CORE SCIENCE AND MAJOR SCIENCE COURSE OFFERINGS. IN ADDITION, OUR UNDERGRADUATE PROGRAMS IN BIOLOGY AND GEOLOGY OFFER SPECIALIZATIONS IN ENVIRONMENTAL SCIENCE. WE OFFER A M.S. DEGREE IN ENVIRONMENTAL SCIENCE.

SPECIFIC DETAILS ON THE OPERATIONS AND PROGRAMMING OF THE COLUMBUS STATE UNIVERSITY OXBOW MEADOWS ENVIRONMENTAL LEARNING CENTER CAN BE OBTAINED FROM ITS DIRECTOR, DR. *****. SHE CAN BE REACHED AT ***** OR BY GOING DIRECTLY TO THE OXBOW MEADOWS ENVIRONMENTAL LEARNING CENTER'S WEB PAGE AT . . . www.oxbow.edu OR BY GOING TO THE ***** UNIVERSITY HOMEPAGE AT . . . www.colstate.edu AND THEN SCANNING TO 'COMMUNITY OUTREACH' SECTION AND CLICKING 'ENVIRONMENTAL LEARNING CENTER'.

2a) BIOL 1060 Environmental Biology
b) Department of Biology, College of Arts and Sciences
3) BIOL 1060 is required in the following:
Biology Academic Concentration (for some teaching degrees)
BS in Management of Recreation Facilities and Services
BS in Environmental Health
BS in Social Work

EHLT 2110 is required in the BS in Environmental Health; however, EHLT 2110 cannot count toward the university's "core" requirement

4) "Other": Environmental Biology Concentration in the BS in Biology

The University of ***** General Administration and Board of Governors has approved the plan for a BS in Environmental and Pollution Control, with a tentative implementation date of January 2002.

5) 2nd program: BIOL 1060 is not a requirement in the minor

2a) Human Ecology

b) Biology

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3) Environmental Earth Science – School of Arts and Sciences

4) "Other": Environmental Earth Science

2a) Environmental Politics and Policy

Environmental Physical Science (plus lab)

Environmental Life Sciences

Environmental Chemistry

Economics of National Resources: Analysis of Natural Resources and the environment

b) Biological Sciences

Chemistry

Political Sciences

Economics

Geology/Geography

4) "Other": Biological Sciences offers an option in Environmental Biology

Geology/Geography offers a concentration in Environmental as part of B.S. degree in Geography

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6) We are developing a Master of Science degree in Environmental Health Sciences.

2a) FNR 103 INTRO TO ENVIRONMENTAL CONSERVATION

GEOG G315 ENVIRONMENTAL CONSERVATION

SPEA E162 ENVIRONMENT AND PEOPLE

b) AGRICULTURE AND FORESTRY

GEOGRAPHY

ENVIRONMENTAL AFFAIRS

2a) Biology 101, 102; Physical Geography
b) Biology Dept. Physical and Earth Sciences Dept.

10) We have been supported by a grant from the EPA to help educate K-12 teachers in the importance and pedagogy of environmental knowledge in the curriculum. this innovative project has enabled participating teachers to become familiar with different cultural ways of thinking about and relating to the environment.

You may contact eith Dr. ***** or Dr. ***** for more information about this project.

1a) Cluster 3 of Gen Ed
b) Gen Ed program

2a) Introduction to Environmental Studies (ENST 100)—about 250 majors and non-majors take this course annually out of about 1000 students.
ENST 210 – Energy and the Environment—majors and non majors
Ecology and Environmental Issues (BIO 107)—non-majors (all students required to take one Bio course and about 200 per year out of 1000 new students opt for this heavily environmental issues course).
Essay writing (English 101)—a section of English "comp" for students who elect tolive in the Environmental House (35 students total, 15 new students per year, both majors and students with 1) a serious interest in the environment, 2) willingness to take linked sections of ENST 100 and English 101, 3) willingness to participate in a one credit service-learning seminar as upperclassmen)
Sociology of the Environment (Soc 399) for majors and non-majors, an experimental course which seems an instant success;
Environmental Economics (Econ 340), primarily for majors in ENST, Econ or other social sciences;
Environmental Geology (GEOL 305), primarily for majors in ENST and Geology;
Chemistr of the Environment (Chem 101) Enst Policy majors and non-majors;
Chemical Analysis of the Environment (Chem 351) for majors in Enst and Chem;
Oceanography (Geol 202) majors and non-majors;
Natural Resource Management (Geography 330), for Enst and Geog majors.

10) ***** College has considerable success in integrating the environmental educational experience of students across the curriculum and across outside the classroom. We have established the President Commission for a Sustainable Future based on an open "Speak-Out" planning session involving 350 faculty, students and staff from across the campus. Anyone was able to champion an issue, and those that for interest and support were identified and incorporated into the campus strategic "Our Plan." The President's Commission was one result. This commission has supported environmental education and awareness across the campus through the Environmental House living/learning residence hall, through increased efforts in recycling, development of a campus

arboretum, greater success of Earth Week, current efforts to develop a college interactive "report card" bulletin board for the Student Center, increased service learning opportunities in the community, selection of Habitat for Humanity spring trips to environmentally unique sites (Cumberland Island, GA in spring 99), largest ever membership in the student organization Campus Ecology, etc.

We have had a major in Env. Studies since 1979, but our broader efforts across the campus have largely occurred in the last five years. We are proud of our progress while acknowledging that we have far to go. We believe that we are poised for significant success in broadening our educational efforts for all students.

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10) Students in our Honors Program have an elective course available in Env. Science.

2a) Geography 120 Environment and Culture
Phil 311 Environmental Ethics
b) Env. Studies Program, Science Department, English and Philosophy

4) "Other": Associate of Science Program in Environmental Science

10) The Environmental Studies program coordinates numerous classes with various departments that are designed in part to increase environmental literacy. These classes are open to all majors, mostly at the upper division level. These include Environmental Studies, Geographic Information Systems, Environment & Art, Environmental History, Environmental Sociology, Ecology, and Geography courses.

2a) Introduction to Env. Health
2b) Biology
4"Other": Water Quality Technology: Environmental Health

2a) World Agriculture
Env. Biology Lecture and lab
Evolution and Ecology
Ecology
Applied and Environmental Microbiology
b) Ag Dept. for AG course and Biological Sciences Dept. for all others

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4) "Other": Biology, Geosciences, Toxicology
10) Various speakers in various series that include the topic.

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3) Dept. of Biological Sciences

2a) Science 2020
b) Dept. of Life Sciences

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3) Health Sciences, Arts and Sciences
4) "Other": Environmental Resource Management
5) Env. Resource Mgt. Is actually a "specialization," not a minor

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2a) There are many courses which are appropriate including: Environmentalism in US History; Energy, Politics and Public Policy (History); Environmental Psychology; & courses on ecology in the depts. of Biology and Engineering to name some of those most often offered.

5) WE ARE IN THE PROCESS OF DEVELOPING AN INTERDISCIPLINARY MINOR WITHIN THE SCHOOL OF ENGINEERING, MATHEMATICS AND SCIENCE

7) ALTHOUGH WE HAVE NO COURSE TITLED, ENVIRONMENTAL LITERACY, WE OFFER QUITE A FEW COURSES RELATED TO ENVIRONMENTAL ISSUES WHICH CAN BE USED IN CERTAIN MAJORS FOR CORE CREDIT.

Geology
    Physical Geography
    Geography--Intorduction to Environmental Studies

4) "Other": Geography, Geology, and Chemsitry all have an environmental emphasis and faculty in a wide variety of programs teach about environmental issues

10) Because of our location, there is considerable emphasis on the environment and we have a beautiful conservancy that is used by many programs from Biology to Art to Appalachian Studies. Faculty do research on Environmental issues and include their undergraduates in the work. One of my goals is to have a more explicit requirement and thus I would be interested in receiving information from this survey.

2a) Environmental Problems: An Ecological Approach	Biology
Conservation of Natural Resources	Geography
Our Geological Environment	Geological Sciences

4) "Other": B.S. in Geography with a concentration in Environment
B. S. in Biology with a concentration in Environmental Biology

B. S. in Geological Sciences with an Environmental Geology Concentration

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2a) BIOL 220 Humans and the Environment
CHEM 109 Chemistry and the Environment
ENGL 337 Nature in Literature
GEOG 107 Weather and Human Affairs
HIST 389 Environmental History
MATH 144 Environmental Mathematics
PHIL 318 Environmental Responsibility
POSC 360 Environmental Politics
SOCI 390 Sociology and the Environment
IDIS Environmental Perspectives

10) Enviromental Studies Minor
Interdisciplinary Courses Offered for General Education Credit

***** has answered the survey that you sent about environmental education. He also asked that some faculty members respond to question 10.

***** university currently has an interdisciplinary environmental minor program. As a steering committee member, I have been involved in planning the new curriculum for the minor. A new interdisciplinary course in environmental studies that involves faculty from ecology, philosophy, and economics has recently been developed in order to provide unity to the minor. This course is currently being taught in the fall 1999 semester and has been very successful thus far.

I think that providing the students with this interdisciplinary approach to the environment can greatly improve the program in many ways. First, the course introduces students to the different ways of approaching environmental issues. This knowledge could increase students' interest in environmental courses that they never would have taken prior to the interdisciplinary course. Second, the course provides the students with a framework for the interdisciplinary minor. Because the minor has courses from many departments the students may feel that the minor is disjointed. A course such as this - that is required of the minor - could help to avoid this feeling. And lastly, the course mimics the real world. Environmental studies are interdisciplinary by nature - and should be addressed this way in the classroom.

2a) BIO 134 Contemporary Biology
BIO/ESC 147 Environmental Science
b) Biology

2a) Environmental Problems and Solutions

Environmental Geology
Energy and its Environmental Issues
Environmental Health
Endangered Cultures
Environmental Perception
Agriculture and Food Supply
San Francisco Bay Area Environmental Issues
Geography of Garbage: Recycling and Waste Reduction
Politics, the Environment, and Social Change
Principles of Ecology
Our Endangered Planet
b) General Education

2a) Our university has an upper division GE requirement in the Earth and Environment area. There are 24 different courses in 14 different departments that are approved to satisfy this requirement.
10) I believe our General Education Program does this, but it is a minimal one course requirement.

2a) BIO 145: Problems of the Environment
BIO 235: Introduction to Ecology

2a) Several courses from the depts. listed below
b) Environmental Geosciences
Geography & Environmental Studies
Parks and Recreation

1a) Have just added a two-credit requirement in the gen ed core which will be implemented beginning with new students coming in next fall. There will be a variety of courses tha can be used and more may be proposed by depts in the future.
5) "Other": Biology

2a) GBIO 281 – Environmental Awareness
b) Department of Biological Sciences

2a) Interdisciplinary studies courses: Natural Resources; Global Problems and Human Survival; and Living Ecologically
Distribution requirements include multiple courses in biology, environmental studies, and geography.

b) all in the College of Arts and Sciences.

2a) Earth Science 111, 112
b) Geology/Sciences

2a) ESCI 1470: Environmental Science
10) Dr. *****, the chair of our Physical and Life Sciences department, would be a good contact point for this effort. He may be contacted at ***** for a detailed description of the ***** approach to environmental literacy as a core curriculum option.

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10) First, the State of Texas has mandated the core requirements, which limit our choices severely. We are considering building an environmental science masters degree when we can identify the resources for it.

This probably is not what you are looking for, but we have a science station about six hours south in Mexico at Rancho del Cielo, property that our institution owns in what is now a world wildlife site. Our students take field trips there, but not all our students, and not as part of our core program. Biology majors, of course, go there, but so do art students for drawing and painting purposes and various other groups that are looking for a retreat site such as this is. This ecological niche is a place where the southern ecology meets the northern ecology, so that we have, for example, sugar maples mixed with bromeliads.

4"Other": Geography and env. Studies

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3) School of Natural and Applied Science; School of Business and Public Administration

4) "Other": Environmental Management

5) "Other": School of Business and Public Administration
School of Natural and Applied Sciences

***** is an upper-level/graduate institution that does not offer a lower-level core or, currently, natual science programs. We have generic requirements, but students meet these at a number of different institutions, mainly community colleges--or wherever they do their lower-level course work. Some have environmental science options and some do not. I know of none that have an environmental science or studies course as part of the core requirements.

2a) ENS 351 Introduction to Environmental Studies b) Environmental Studies
10) In addition to the course listed above, we also offer upper division Public Affairs Colloquia as part of our upper division general education requirements. Several of these each semester are in the area of environmental literacy or are in an environmental area. Undergraduate students are required to take 12 hours of upper division general education courses, so many take these courses. As part of our lower division general education curriculum, now being developed for the lower division that will open with our first freshman class in Fall 2001, there will also be an environmental sciences course required of all students. This coures is now being developed

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2a) Environmental Science 275: Introduction to Environmental Science
b) Department of Natural Sciences, Env Sci program

2a) Introduction to Environmental Science
Environment Issues and the 21st Century
b) Earth and Resource Science

4) "Other": Program in Resource Ecology
Program in Resource Planning

5) We have an Environment Studies track in the Master of Arts in Liberal Studies program.

10) there are a lot of competing pressures, and only 120 credit hours for an undergraduate degree!

2a) Biology 1001 (Biology and Society)
Biology 2803 (Issues in Global Ecology)
Geology 1130 (Introduction to Environmental Science)
Geology 2350 (Earth's Resources)
Geography 2306 (Environmental Conservation)
Education 1201 (Managing Planet Earth)
b) all listed courses above are in one or more of the programs in question 4.

2a) Environmental Biology
Chemistry in the Environment & Society
Intro to Earth and Environmental Science
Society, Environment, & Resource Conservation; Environmental Geology
Environmental Ethics
b) Biology, Chemistry, Geology, Geography, Philosophy, Sociology.

2a) ENS 100 – Humans and the Environment
10) Environmental literacy has not been an issue on this campus. A recent revision of the core curriculum requirements did not address it.

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3) Department of Chemistry and Industrial Hygiene
4) "Other": Industrial Hygiene

2a) Conservation Biology
Environmental Dilemma
Environmental lab
b) Biology
Earth Sciences
Civil Engineering
4) "Other": Environmental Geology
Environmental Biology
Environmental Information Systems

2a) Environment, Technology and Society
b) Science Education
On our website www.uni.edu go to the College of Natural Sciences, Find Environmental Programs (Grad Program) and you will see a Capstone link. Follow it for a description of our undergrad course that ALL students at UNI must take as Juniors or Seniors.

2a) Biology 180: Conservation of the Environment
Biology 330: Ecology
Economics 268: Environmental Economics
Geography 178: Conservation of the Environment
Geography 378: International Enviornmental Problems and Policy
Geology 115: Environmental Geology
Geology 301: Earth Resources
b) All courses listed above are found in departments housed in the College of Arts and Sciences
5) "Other": Liberal Arts option within the College of Arts and Sciences

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5) env. Minor offered by College of Liberal Studies
10) We do have an environmental council that is working on increasing the environmental literacy of the campus. The council is composed of professors and

students. The council has considered an environmental literacy class to be an offering in the gen ed. curriculum.

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4) "Other": Environmental Law Environmental Communication
5) All programs are minors

2a) Environmental Science (2 credits)

2a) BIO 100 Environmental Science and accompanying lab, BIO 101 Explorations in Environmental Science

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3) Arts and Sciences, BS in Environmental Geography
4) "Other": Environmental Geography
10) Will develop a minor in environmental studies and expect literacy to be a component

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2a) Environmental Concerns
2b) Biology

2a) Environmental Geology
Environmental Health Science: Systems & Solutions
2b) Geosciences and Natural Resource Management
Environmental Health
ES program brand new

2a) INTRODUCTION TO HUMAN GEOGRAPHY
ENERGY AND EARTH RESOURCES
INTRODUCTION TO ENVIRONMENTAL STUDIES
BIOLOGICAL CONCEPTS
CONTEMPORARY CHEMISTRY
ENERGY AND THE ENVIRONEMT
OCEANOGRAPHY
HISTORY OF THE EARTH
WORLD REGIONAL GEOGRAPHY
EARTH SCIENCE

3) INTERDISCIPLINARY MINOR OFFERED BY GEOGRAPHY, GEOLOGY, CHEMISTRY, PHYSICS, AND BIOLOGY IN THE COLLEGE OF ARTS AND

SCIENCES. COURSES ALSO MAY BE USED BY STUDENTS TO MEET GENERAL EDUCATION REQUIREMENTS.

2a) Foundations of Environmental Studies
4) Environmental Affairs Environmental Technology

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4) "Other": Environmental Policy minor

2a) Environmental Biology
2b) Department of Biological Sciences

2a) Economics 321: Environmental Economics; Political Science 320: Environmental Politics; Chemistry 381: Technology, the Environment, and You (All of these are options under a "Global Issues/non-Western Studies distribution requirement.)

10) Environmental awareness is also promoted through co-curricular activities such as Earth Day.

2a) Biological Concepts, Man and the Environment
2b) Department of Natural Sciences

2a) Biological Concepts, Intro. to Ecology, Introductory Chemistry, Geography of Western North America, Human Environment, Environmental Resource Economics, Intro. to Mathematical Modeling, American Public Policy, Environmental Geology, Bioethics

b) This is an "across-the curriculum" requirement. Courses are offered by many departments.

2a) BIOL SCIENCES 003 --- ENVIRONMENTAL SCIENCE
GEOSCIENCE 40 --- THE SEA AROUND US
EARTH & MINERAL SCIENCES --- OUT OF THE FIERY FURNACE
(history of interactions between man, energy and materials)
All three courses are nontechnical science electives.
b) SCHOOL OF SCIENCE

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10) We include environmental literacy in parts of several courses in our general education requirements.

2a) Economics of the Environment
b) Economics

2a) Environmental Chemistry
b) Chemistry

VI. Private Master's Institutions

As a church-related institution, we have been involved in environmental literacy as a Christian stewardship concern. Our institution has received a modes grant that has supported the development of a theology of environmental stewardship that guides our activities in this area.

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4) "Other": Environmental Policy & Planning

The Environmental Studies Division is active is offerring courses which promote environmental literacy. However, these courses are not required and do not always meet a degree requirement - many are taken as electives. The Division is also active in promoting seminars, speakers, etc. to enhance understanding of the issues.
I also believe that most engineering and science programs address these issues directly in course work that they offer.

2a) Humans and the Environment
b) Dept. of Biology and Chemistry

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3) College of Arts and Sciences
5) "Other": DEPARTMENT OF BIOLOGICAL SCIENCES; COLLEGE OF ARTS AND SCIENCES
10) WE ARE DEVELOPING A CORE OF INTEGRATED SCIENCE COURSES THAT ARE BASED ON THE ILLINOIS LEARNING STANDARDS. THIS COURSE WILL BE DIRECTED AT ELEMENTARY SCHOOL MAJORS BUT WE BELIEVE IT WILL ULTIMATELY BECOME THE SCIENCE CORE FOR ALL NON SCIENCE MAJORS AT THE INSTITUTION. ONE OF THE COURSES WILL BE AN ENVIRONMENTAL LITERACY COURSE.

2a) Environmental Geology
b) Dept. of Geology
3) Environmental Science major and minor

1a) Freshman seminar
b) FRESHMAN SEMINAR IS AN INTERDISCIPLINARY COURSE AND IS PART OF OUR GENERAL EDUCATION REQUIREMENT.

1a) Liberal Arts and Science 101 and 102
10) OUR CORE CURRICULUM IS AN INTERDISCIPLINARY ONE CONISISTING OF 53 credits. THE TWO COURSES INDICATED ABOVE ARE REQUIRED OF ALL AND ARE AN ATTEMPT TO WEAVE NUMEROUS THREADS OF LEARNING. THE PLANNED OUTCOME IS CONSCIOUSNESS OF THE GLOBAL REALITY AND OF HOW ALL KNOWLEDGE IS CONNECTED AS PART OF OUR WORLD TRUTH. A SENSE OF RESPONSIBILITY FOR THAT WORLD IS ALSO HOPED FOR.

2a) Current Events in Env Sci, Science and Society, Global History, The Nuclear Age, Politics and Environmental Regulation
b) Departments that offer the courses above are Environmental Affairs, Chemistry, History, Sociology, Political Science, respectively. The courses are all ones that may satisfy requirements in the required liberal arts core.

Note that there are many other courses that are requirements or electives in discipline areas that focus on environment--courses in philosophy, economics, environmental affairs. Other courses potentially focus on environmental issues--"Topics" courses in science, sociology, community involvement and internships.

4) “Other”: Environmental Affairs

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10) While we do not offer (or plan to offer) an environmental literacy course, we do promote this concept by way of a student organization: Women Involved for a Safer Environment (WISE). This co-curricular group "promotes environmental awareness on campus" and takes on such projects as recycling (glass, aluminum, plastic, paper).

2a) General Biology: Earth Keeping

Ecology, in the Biology Dept., is offered as an elective and as an "option" for Biology majors.

2a) MANY COURSES--INTRODUCTION TO ENVIRONMENTAL SCIENCE;
ENVIRONMENTAL ECONOMICS;
EARTH ENVIRONMENT;
ECOLOGY;
ENERGY AND ENVIRONMENT;
ENVIRONMENTAL MANAGEMENT AND POLICY;
ETHICS AND THE ENVIRONMENT;
ENVIRONMENTAL HEALTH AND SAFETY

2a) Man and the Environment and Environmental Science

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5) ES is a concentration within the biology major.

2a) Environmental Issues
b) Biology
10) Initiatives by student leadership groups are strongly encouraged and supported. Faculty and students are involved in environmental issues through initiatives re: Earth Day, etc.

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3) Biology

2a) Scientific and Technological Literacy—Environment theme
b) Scientific and Technological Literacy (core curriculum in science for non-science majors)

2a) Ecology of the Southwest
b) It is part of our first year core program. This course is taught by faculty from our Life Sciences department.

4) "Other": Sustainable agriculture

10) We have an extremely active student club on campus that holds regular meetings and events for the entire community on ecological concerns. They

have spearheaded the campus recycling program (we have a strong program). They are continuing to work with the administration and student government to upgrade our campus to a Green status.

In addition, because of the nature of our insitution, the faculty, staff and students are naturally very aware of environmental concerns. For example: our dining facilities serve only vegetarian fare which at present is 75% organic. We are working to make it 100%.

Our entire core curriculum is designed to increase awareness of global environmental and social concerns

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2a) Environmental Science

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1) SC 100, Discovery and Thinking in Natural Science, a required course in the Foundation Distribution of General Education (GE), has a section on ecology.
This course is given by the Department of Chemistry, Medical Technology, and Physics.
2) *AN 275, Global Environmental Problems, satisfies the Advanced Distribution of GE. The History/Anthropology Department offers this course.
*BY 115, Spring Ecosystems; BY 117, Caribbean Ecology; BY 120, Ecology satisfy the Foundation Distribution of GE. The Biology Department offers the courses *PR 405, Toxic Waste satisfies the Advanced Distribution of GE. This is a course in the Perspectives Program, and it is offered by the Department of Interdisciplinary Studies.
*Internships in environmental areas satisfy the Experiential Education requirement of GE.
A Faculty Director oversees the EXED program, with direct reporting line to the Provost's Office.

2a) Environmental Science b) General Ed option for natural science requirement
4) "Other": Environmental Management
5) "Other": Dept. of Mathetmatics, Science and Humanities

2a) Bio 111 Contemporary Biology
Bio 109 Human Biology
Sci 111 Understanding our Environment

2a) Environmental Geology - Dept. of Geological and Marine Sciences
Introduction to Environmental Science -Environmental Sciences major program

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2a) Science, Technology and Values
b) We have a department in the College of Liaberal Arts called Science, Technology and Society.

2a) At this institution, <u>many</u> courses may be used for this purpose. I should estimate that at least 12 different courses in Biology, Chemistry, and Environmental Studies may be used.
b) these courses lie within the Arts and Sciences program.

4) "Other": Environmental Management

10) We expect nearly all of our general education courses in the physical and biological sciences to include important components of environmental science. This approach seems to work well for our students. We expect to continue with this approach in the future, but we would not be adverse to creating new and more defined courses focusing on environmental literacy.

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3) Dept. of Chemistry, College of Arts and Sciences

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1 or 2a) Environmental Studies b) Biology Dept.

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4) ES minor is offered through Biology Dept.

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2) BIO 3310 Ecology -Biology Dept.

8) We have an initial meeting Nov. 16 to discuss
10) We are considering instituting an undergraduate degree program in environmental studies.

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3) Ecological Studies Program in the College of Arts and Sciences
4) "Other": Ecological Studies program, an interdisciplinary program including equal requirements in natural sciences, social sciences, and humanities (plus aninternship and a statistics course), all focused on the theme of ecology. We use the term "ecology" instead of "environment" because the latter often connotes nature apart from humans, whereas ecology, with its root meaning "home", includes the human.

10) WE HOLD AN ANNUAL EARTH FAIR ON CAMPUS, AS WELL AS AN ANNUAL EARTH DAY LITURGY. BOTH OF THESE ARE CAMPUS-WIDE

EVENTS THAT WE HOPE WILL HELP EDUCATE ALL MEMBERS OF OUR CAMPUS COMMUNITY ABOUT ENVIRONMENTAL LITERACY. IN ADDITION, THE "EARTH ACTION COALITION" (STUDENT CLUB) HOSTS VARIOUS EVENTS DURING THE YEAR.

I'D SUGGEST CONTACTING "UNIVERSITY LEADERS FOR A SUSTAINABLE FUTURE" (www.ulsf.org) FOR FURTHER INFORMATION. THEY HAVE A GLOBAL NETWORK OF PEOPLE WORKING ON ENVIRONMENTAL LITERACY IN HIGHER EDUCATION.

2a) Introduction to Environmental Studies
10) I would defer to the head of our Env. Studies program: Dr. *****.

2a) Environmental Studies

2a) blank; b) Earth Sciences

2a) General Ethics (it has a component on environmental ethics aimed at environmental literacy.
b) Philosophy
10) We are completing movement to a full bachelor's degree program. We believe that when we are done we will have an interesting Interdisciplinary Model to be shared. However, we need to implement it fully.

2a) Bio 1103 Current Environmental Topics
BIO 4170 Ecology
b) Biology

2a) Environmental Issues b) Div. of Math and Natural Sciences

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3) Environmental Studies Dept., College of Arts & Sciences
4) "Other": Environmental Management
10) Although we have not created a GE requirement dealing with environmental literacy, we offer a number of courses in different departments (e.g., History, Economics, Government, Philosophy, Religious Studies) that deal with environmental issues as primary themes. These courses contribute to the environmental literacy of our students. We have hired faculty in a number of these departments with special emphasis on competence and interest in environmental education.

The approach to faculty hiring described above has been quite successful. We have been intentional in advising departments that they will increase the likelihood of having a faculty position request approved if that position would bring someone to campus who would assist with the Environmental Studies Program. The latter is cross-disciplinary (as are most environmental stuidies programs) and depends on courses from faculty all across the curriculum. We have strengthened our environmental studies program itself and our curricular offerings in this area through this hiring process.

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10) Respect creation and use resources wisely is one of our institutional values.

2a) Science and the Human Environment
b) This is a natural science course which is taught by people in the sciences for non-science majors (can be used to fulfill their science requirement) but there is a special "beefed up" section that is required of our environmental science majors.
5) Est is actually a concentration, not a minor

2a) Human Ecology b) Biology
9) DEPENDS ON WHAT YOU MEAN BY LITERACY. MANY PROGRAMS ARE SO BIOLOGY-BASED AND DEVOID OF ECONOMIC CONSIDERATIONS THAT THEY ARE REALLY ADVOCACY PROGRAMS. LITERACY ABOUT IMPLEMENTING ENVIRONMENTAL POLICY, COMBINING BIOLOGY, ECONOMICS, AND PUBLIC POLICY IS EXTREMELY IMPORTANT.

I've looked at the questions and have to say that ***** University currently does not have courses or courses of study related to developing environmental literacy and that ***** University is not currently considering such courses. Personally, I believe that interest in such courses will emerge within the next 5 years, but no initiative in this direction has yet begun.

2a) Biological Perspectives of Env. Science
Ecology
Science and Society
Principles of Env. Chemistry
Env. Ethics
b) Biology/Chemistry Dept.
Philosophy Dept.
10) We have implemented an environmental risk forum for students and faculty.

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3) Environmental Science Major

Group Minor in Environmental Studies
Geography Major
Geography Minor
Geology/Earth Sciences Major
Third World Development Studies Minor
4) "Other": Geography Major and Minor
Third World Development Studies Minor
10) We have an Environmental Stewardship student organization that is quite active. We also have a major initiative, with external grant funding, that incorporates students from a variety of courses into an environmental service-learning project called CEAP (the Campus Environmental Assessment Program), which monitors environmental quality and practices on campus and in surrounding neighborhoods.

1a) Foundations of Scientific Inquiry; Principles of General Biology
b) Science Dept.
4) "Other": Environmental Biology

1a) Ecology and the Environment
Natural History
Marine Biology b) Biology
4) "Other": Sustainability focus in graduate business
10) I am responding to the last question of the questionnaire you sent to *****. I am the Dean of the School of Arts and Sciences at ***** and former Chair of the Department of Biological and Natural Sciences.

In 1987 the College changed its General Education requirements. At that time the faculty decided that the most important scientific information students needed to know was how the earth's ecosystems are structured and how human relationships with the environment are important to long-term survival of not only humans but other species as well.

Faculty developed student learning outcomes for each area of general education. The learning outcomes for the G.E. category Natural World are:

Students will demonstrate:

1. A comprehension of some fundamental scientific structures and systems of the natural world.

2. The ability to evaluate issues of the environment and articulate the pros and cons of proposed solutions to environmental problems.

Only science courses with a significant environmental focus were passed by the G.E. Selection Committee to fulfill the Natural World Requirement. Such classes included Marine Biology, Ecology and the Environment, A Study of Birds: An Environmental Approach, Animal Behavior, and Earth Science.

The G.E. program is currently under revision and the faculty have again determined that the course used to fulfill the science requirement will be a course focused on the environment. Revision is still in process but suggestions have been made that the

Ecology and the Environment course be the only course that students can take since that course presents the issues of sustainability most clearly.

When our evening program was developed in 1991 the science requirement was limited to the Ecology and Environment course. This course is described in the catalog as follows:

Ecology and the Environment: Crises and Conflicts (3 units). Investigation of ecological principles involved in human relations to and interaction with the environment. Emphasis is given to political and economic aspects involved in the solution of environmental problems. A number of laboratory/field problems are studied.

This has been a very popular course and students have indicated that their lifestyles have been positively impacted by this environmental study.

I hope this helps to put *****'s commitment to undergraduate environmental education into perspective.

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1) Yes, we have several courses which contain significant emphases on environmental issues.

a) GLOBAL FUTURES; A COURSE THAT IS TAKEN IN THE JUNIOR YEAR AND SERVES AS A CULMINATION OF THE GEN. ED. PROGRAM--A SYNTHESIZING EXPERIENCE. TRENDS ARE EXAMINED AND SCENARIOS FOR THE FUTURE CONSIDERED. ENVIRONOMENTAL POSSIBILITIES PLAY A LARGE ROLE IN THE COURSE.

SCIENCE AND INQUIRY; AN INTEGRATED, INTERDISCIPLINARY (6 HOUR) SCIENCE COURSE FOR NON-MAJORS ALSO INCLUDES UNITS ON ENVIRNOMENTAL SCIENCE. THIS PRECEEDS THE GLOBAL FUTURES COURSE AND HELPS PREPARE STUDENTS TO DISCUSS ENVIRONMENTAL ISSUES IN AN INFORMED WAY IN THAT COURSE.

b) GLOBAL STUDIES; OUR GENERAL EDUCATION PROGRAM IS CALLED 'GLOBAL PERSPECTIVES 21' AND IT IS ADMINISTERED BY THE CENTER FOR INTERDISCIPLINARY STUDIES.

10) THE GENERAL EDUCATION PROGRAM==CALLED GLOBAL PERSPECTIVES 21==FOCUSES ONDEVELOPING THE LIBERAL ARTS SKILLS/KNOWLEDGE WITH A PARTICULAR EMPHASIS ON APPRECIATING THE DIVERSITY OF THE HUMAN EXPERIENCE, DEVELOPING MATH/SCIENCE/TECHNOLOGICAL LITERACY, AND ENVIRONMENTAL AWARENESS. THE GENIUS OF THE PROGRAM IS THE INTEGRATION OF THE ISSUES OVER SEVERAL SEMESTERS IN SEVERAL CLASSES. THE STUDENTS ENCOUNTER ENVIRNOMENTAL CONCERNS IN AT LEAST TWO LACES (THE MATH/SCIENCE SEQUENCE--12 HOURS--AND THE SYNTHESIZING CAPSTONE COURSE, GLOBAL FUTURES. MANY OF THEM WILL ALSO ENCOUNTER ENVIRONMENTAL CONCERNS IN OTHER COURSES, FOR EXAMPLE, THE AMERICAN EXPERIENCE (THE FRESHMAN COURSE) AS

THEY LOOK AT VARIOUS ASPECTS AND CHALLENGES OF AMERICA IN THE LATE 20TH CENTURY.

IF YOU WISH ADDITIONAL INFORMATION FEEL FREE TO CONTACT ME OR *****, DIRECTOR OF THE CENTER FOR INTERDISCIPLINARY STUDIES.

1a) Environmental Science 300
b) Science Division

2a) ENV 300 "Environmental Issues"
9) Note: As an "International" university, environmental literacy is an explicit part of our mision: "***** University believes ... that persons with an **U education will become dynamic and productive citizens with a sense of global responsibility, including care for the earth;
"***** University states its purposes: ... to foster an awareness of and appreciation for the interdependence of all life on earth and a sense of ecological responsibility."

2a) GNSC 383 Environmental Science
b) Division of Science and Math
Here are the 2 courses we require of ALL students to take at least 1. People with a lot of science take 381, those without take 383.

GNSC 381 Environmental Stewardship. A development of sound principles of stewardship of the created order. The discussion centers on fundamentals of responsible attitude and action in the environment. Student participation in dialog is an important aspect of the course. Each student develops an environmental ethic for personal and corporate action. One class meeting per week. Fall and Spring.

GNSC 383 Environmental Science. An examination of living systems and their functional relationships with their environment. Special emphasis is given to development of sound principles of stewardship of the created order. Student participation in large and small group discussion is an important aspect of the course. Each student develops an environmental ethic personal and corporate action. Three class meetings per week. Fall and Spring.

***C incorporates components of environmental questions into several existing science and behaviorial science courses but does not have a program and/or course devoted to this topic exclusively.

2a) Introduction to Environmental Science (ENVR 101)
5) "Other" minor: Environmental Chemistry (Dept. of Chemistry)
Environmental Policy (Dept. of Political Science)

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4) "Other": Environmental Management major (combination of Chemistry/Toxicology, 24 hours in Business and 2 specialty courses with an internship, plus Environmental Ethics.
10) Service learning (credit) and recycling programs are strongly encouraged.

Scie 2320 Science In Perspective is a required general education course. Every undergraduate who is not majoring in a laboratory science must take this course. Course objectives are to teach students to distinguish between science and pseudoscience, understand the difference between science and technology, appreciate the historical and philosophical background of science, and understand the role of science in creating and solving crurrent societal problems. THE COURSE INCLUDES MODULE(S) IN APPLIED ENVIRONMENTAL SCIENCE.

We also offer the following course as an elective:
ENVS 2324 Environmental Studies.
BIOL 4442 Population Biology and Ecology is taught as part of the biologymajor.

2a) Environmental Issues is a team-taught course by Biology and Political Science
4) "Other": Pre-Environmental Science and Forestry program

1a) NSC 105 Introduction to Natural Science
b) This course is part of the first year experience and is an interdisciplinary course.

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3) Natural Sciences Department – Biology major
10) The University of ***** has several courses in related areas, such as: Ecology, Conservation and management of Natural Resources, Introduction to Marine Biology, Introduction to Speleology.

1a) All introductory science courses have specific environmental components. Also available are a number of courses in a variety of departments including Environmental Spirituality in Religious Studies.
10) Environmental literacy is a part of an overlay system rather than a single course. A number of courses have included an environmental component and it is one of these that is required.

2a) Bio130 Environmental Science b) Biology for lab science Gen Ed req.
10) Outdoor recreation program. Thank you for this survey. It raises an important issue to which we will give attention.

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3) Environmental Studies Dept.
We have a wellness component that is required in our curriculum. This can include environmental issues.

VII. Public Baccalaureate Institutions

2a) Introduction to Environmental Studies
4) "Other": Marine Science
5) "Other": Criminal Justice – Environmental Crime track
10) General Studies curriculum contains several environmental courses (e.g., Green Politics)

2a) ENVR 130, Intro to Environmental Science
10) There is a non-science major chemistry course which emphasizes environment applications of chemistry.

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3) Civil Eng
4) "Other": Environmental Leadership and Management minor
5) "Other": Civil Eng
10) We require 8 credit hours of chemistry for all students, and these courses have some environmental content. Dr. ***** will mail you material on our Environmental Leadership and Management minor, which is designed for liberal arts majors, and is team taught by science, engineering, and liberal arts faculty. We generate financial support for this minor from a statewide environmental conference held on our campus each year.

2a) GS 321 Environmental Studies
BI 321 Conservation Biology
BI/GO 341 Biogeography
BI 303 General Ecology

b) GS 321 is a general elective and, until Fall 2000-2001, may be used to satisfy the University's general education requirement for a natural science course; the course also may be elected to satisfy a physical science requirement in the BSEd Comprehensive Science (Earth and Space Science option) major; either BI 321 or BI/GO 341 must be completed in this major. In the BSEd Comprehensive Science (Biology option) major, the student must satisfy a requirement for a biology elective, which may be either BI 321 or BI 341. The BS degree seeking Biology major must complete BI 303, and may complete BI 321 and/or BI 341 as an elective in that program of study.

3) School of Education/Secondary Education/GS 321 (as described in 2b); School of Arts and Sciences/Biology/BI 303.

4) "Other ": BSEd Comprehensive Science (Earth and Space Science option)

5) "Other": A Biology minor must complete BI 303 and may incorporate BI 321 and/or BI 341 as electives in the minor.
School of Arts and Sciences/Biology

10) For all public institutions of higher learning in the state, the State of Alabama recently legislated a General Studies Core Curriculum (43 semester hours) to be completed by each degree-seeking student, including an Area III requirement for 11 semester hours of lab-based natural science (8 semester hours). A state level Articulation General Studies Committee then approved certain lab-based natural science courses taught at Alabama College System schools (i.e., state junior/community colleges) for transfer to Alabama's senior (baccalaureate degree-granting) institutions. Although lab-based and considered to be a natural science course, as offered by the Alabama College System, PHS 120 Environmental Science was not approved for use to satisfy an Area III requirement, nor was any equivalent course offered by a senior institution; rather, standard lab-based courses in biology (i.e., Principles of Biology I, II), chemistry (i.e., College Chemistry I, II), and physics (i.e., General Physics I, II; Calculus Physics I, II) were approved to satisfy the Area III requirement for lab-based natural science. To the extent that environmental science content is made part of these standard lab-based courses in biology, chemistry, and/or physics, effective Fall 2000-2001, that content will be required for all State of Alabama college/university graduates.

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10) Incorporated in existing Biology, Chemistry and Physical science requirements.

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3) Agriculture Dept., School of Science and Technology
4) ES – Agriculture Dept., School of Science and Technology
ES – multiple units involved: History and Humanities; Biological Sciences; Politics, Sociology and Criminal Justice; and Business.
5) ES "appropriate" course is ENVSCI 2004, Introduction to Env. Science
Est "appropriate' course is BIOL 2444, Environment and Man

We are a virtual college (external degree program) and, as such, do not offer a full array of course. Currently we offer only about 20 distance learning courses. typically, students earn credits toward their degree at ***** by taking classroom-based or distance learning courses from other accredited colleges and universities, through college-level testing, or assessment of college-level learning through portfolio or ACE recommendations. We offer only one degree and it is in General Studies. Baccalaureate degree candidates must complete a 36 credit concentration and it is possible to do one in Environmental Studies.

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10) We will re-examine and strengthen the Gen Ed options relative to the environment and schedule them more consistently.

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10) Environmental literacy is one of the topics covered in the general education biology courses which many students take.

2a) Biology 300: Environmental Biology b) Biology
3) Bachelor of Science in Education-Composite Science and Biology, both require the Environmental Biology course. Both BS and BA in Biology recommend this course as an elective.

10) **U requires a lab science for a general education component. Most students enroll in a general biology course. This course has a heavy environmental component within it. Specific programs have environmental courses built within it; generally in the natural sciences. However, we do require all elementary education majors to take a course in science methods which is heavily oriented toward environmental education and ***** flora/fauna. Also, our vocational agriculture program and the agriculture concentration in business requires a course in grasslands ecology, **U is located in the heart of the western ***** national grasslands.

Our general lab sciences, especially general biology and chemistry, which are required for general education all have a heavy component of environmental literacy content within them. This seems to be the best way to educate non-environmental majors.

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3) Environmental Studies within School of Education and Business Programs
6) Current General Education program being examined right now.

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4) "Other": Environmental Technology

2a) The college has a two semester upper division core requirement which focuses on ethics in the first semester and values in the second. Included in the selections are:

FP 351 Nature and the Media (Fine Arts)
LL 350 Ethics and Ecology (Literature)

LL 351 Values: Seminar on Wilderness (Literature)
NS 350 Environmental Intervention (Science)
NS 350 Science and Society (Science)
NS 351 State of the World (Science)

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2) (Bachelor degree students must take a science seminar with sections designed to increase environmental literacy.)
a) Liberal Arts Science seminars b) Depts. of Biology and Geology
3) (The ** Department of Education required Elementary Education and Secondary Education majors (Biology and Geology) to take a unit in environmental studies.)
College of Education and Health Science
4) "Other": Environmental Biology, Environmental Geology
5) Minor: concentration only
10) No, however **U offers extra-curricular opportunities available with the environment as a focus. E.g., Earth Day and various speakers.

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10) This topic is covered as part of individual courses through the science department. It is also a topic in some education courses. We do not have a specific course, but teach the concept as part of other regular courses.

2a) ENGS 101 Introduction to Environmental Science
ENGS 110 Introduction to Environmental Restoration and Waste Management
b) Environmental Science and Technology

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3) Biology Dept.
4) "Other": Biology major, Ecology and Conservation emphasis
Ecolonomics & Sustainability certificate program
5) 3rd program is a 13-credit certificate program
10) Sent by surface mail a copy of brochure for Ecolonomics Certificate Program.

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3) Science/Math/Nursing

2a) General Biology, Energy b) Natural Science

1a) Social Issues b) School of Social Science/Human Services
10) With support from an Environmental Literacy grant, Professor ***** engaged in a multiyear course infusion project. Among the courses which were targeted were algebra, social issues and anthropology.

2a) Varies—most instruction is done on the basis of guided independent study.
b) Science, Mathematics and Technology

The ***** campus does not have a program incorporating "Envir Lit." Please refer your questions to the ***** Campus.

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3) The Bachelor of Environmental Studies program

2a) ENV 111 Natural Resource Ecology b) Environmental Studies program

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3) Environmental and Natural Resources

2a) 1-Environmental Communications	Public Relations
2-Environmental Politics	Geology and Political Science
3-Chemistry of the Environment (with optional lab)	Chemistry
4-Environmental Geology (with optional lab)	Geology
5-Senior Colloquium: Living Dangerously	Geology, History (team taught)

10) We are currently developing a major in Environmental Studies. This will most likely increase the course options for non-majors as well.

1a) Foundations of Physical Science & Foundations of Life Science
b) the Interdisciplinary Studies program

2a) Environmental Life Science, Environmental Earth Science b) Biology, Geology

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We have no environmental literacy course. We have a two member department and are overloaded. We are unable to teach anymore courses and do not have time to develop a new one or we would have. I feel it is very important. I try to integrate the subject into all my courses.

2a) Environmental Studies 210, Science, Technology and the Environment
3) Behavioral and Social Sciences (which houses ENVS minor)

2a) SocSc 326: Environmental Studies (will soon change its name to Hawaiian and Pacific Environments, as we add a field component
Please note that we are an upper division institution, and so the concept of "core" may not be applicable. We offer no freshman or sophomore courses.
b) Social Sciences
10) We have recently proposed to our Board of Regents an Environmental Studies Certificate, which would be available to all interested students in any discipline. It will not be required of anyone, but we will have "environmental" offerings in all disciplines and encourage students to take advantage of them.

2a) Natural history of Northwest Indiana
Natural History of the Great Smokie Mountains

b) Both are offered by the Biology Dept.

10) The Natural History of Northwest ***** uses the resources of the National Lakeshore Park for extensive field experiences for its students. The course is offered only during the summer session to insure that weather is conducive to extensive field experiences.

The Natural History of the Great Smokie Mountains has a lecture portion on campus before the class departs for the Great Smokie Mountains for a week of intensive field experiences at the Great Smokie Mountain Institute in Tremont, Tennessee. The students live in the Smokies and the entire week is part of the experience. Even dinners play a role in conservation. Participants are permitted to eat as much as they wish but scraps and waste for the entire group are weighed after each meal and the goal is to reduce the amount of waste over the course of the week. The program is particularly good for our adult students because they have an opportunity to experience living in a student setting for a week without the cares and distractions of job and family and to access to faculty members for the whole week to explore research projects. Employed students simply use a portion of their job's vacation time to participate. The program is now in its 11th year and we have had a full house for the class every year. Note other universities and colleges are at the Smokie Mountain Institute at the same time, so the students have an opportunity to network with faculty and students from other institutions. Student evaluation of the program has been extremely positive. Students who became teachers have indicated that they have incorporated lessons from the program into their classwork in the elementary schools.

VIII. Private Baccalaureate Institutions

2) The course meets the current requirement for 1 semester of a science course with lab section.
a) Biology 108 Environmental Biology b) Department of Biology

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2a) ONE of the following:
Environmental Anthropology, Animals and Human Societies, Population and Environment, Environmental and Natural Resource Economics, Environmental History, Contemporary Moral Problems, Environmental Ethics, Public Policy Analysis, Introduction to the Environment, Environmental Communication, Oceanography, Earth Resources and the Environment, Environmental Geology, Tropical Forest and Reef ecology, Chemistry that Matters, Chemistry and Social Problems, United States Economic History, Environmental History, Physics of Urban and Environmental Problems, Religion and Ecology.
b) many departments
5) CONCENTRATION in both Esc and Est: ***** has an Institute for the Study of the Environment which offers both an Environmental Studies Concentration and an Environmental Sciences Concentration. A "concentration" is a course of study about as rigorous as a major, (thus I did not check minor above). Concentrations include internships, are explicitly pre-professional, and are taken in addition to a major in a traditional liberal arts department.

10) Our college has, I believe, a successful and innovative way of addressing the issue of environmental literacy. A part of our general education requirement is that students must complete three (four as of next year) "Category" courses. Students must take approved category courses in ethnicity, gender, environment and, starting next year, global studies. These courses originate from all departments on campus and are approved by committees that validate the courses' meeting specific sets of goals.

The new Institute for the Study of the Environment works with departments in enhancing these offerings. Currently, instructors from many departments are meeting bi-weekly in a workshop in which the content and methods of individuals' courses are shared with colleagues. We plan to build these presentations into a multi disciplinary set of case studies to be used in our instruction. Our goal is to use these case studies, and our own experiences in the workshop, to help us show students the connections among ideas and problems that are so fundamental to an understanding of environmental issues. For example, last week's presentation by a Sociology professor on multi-national companies in third world countries, specifically oil companies operating in Nigeria, has obvious connections to the Earth resources and the Environment, Economics of Population and Environment, Environmental and Natural Resource Economics, Environmental History, Contemporary Moral Problems, Environmental Ethics, and Public Policy Analysis courses.

I found it difficult to categorize our concentration in question 5. The concentrations are more than minors, but different from majors in that they emphasis pre-professional skills through internships and some specialized courseware. They draw on both the depth of a major and the breadth of our general education requirement.

2a) Philosophical Perspectives on Environment & Community
b) M.A. in Environment & community

3) M.A. in Environment & community
4) "Other": M.A. in Environment & community
10) We explore and promote:
*ecological economics and sustainable business principles
*sustainable food and agriculture systems
*ecological design and sustainable community development methodologies
*social and natural science literacy
*qualitative and quantitative research methods
*interdisciplinary approaches to environmental stewardship

2a) Heritage of Western Culture (Scientific models) b) Interdisciplinary core

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2a) Environmental Science I and II
4) "Other": Environmental Biology

2a) People and the Environment; Ecology

2a) ES 150 - Intro to Environmental Studies
EC 440 - Economics of Natural Resources & the Environment
PL 307 - Environmental Ethics
BI 105 - Population & Ecosystems
BI 311 - General Ecology
BI 414 - Conservation Biology
PS 250 - Public Policy Process
PY 220 - Environment & Behavior
b) THESE COURSES ARE HOUSED IN THE ACADEMIC DISCIPLINES OF BIOLOGY, ECONOMICS, PHILOSOPHY, AND POLITICAL SCIENCE.
4) "Other": WE PARTICIPATE IN AN ENVIRONMENTAL STUDIES DUAL DEGREE PROGRAM WITH DUKE UNIVERSITY - THREE YEARS HERE, TWO THERE.
5) Master's is in dual degree program
10) DURING OUR JANUARY INTERIM TERM, STUDENTS TAKE ONLY ONE PROJECT. MANY OF THESE
HAVE A FOCUS ON THE ENVIRONMENT.

2a) Environmental Studies 101

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9) Bad question--its important that our students know something about environmental issues. A course in environmental literacy is not the way to go.

10) We have developed an Environmental Science program for students in geology, biology, and anthropology. Independent of this program we have supported new course development in other departments--new courses which concern themselves with ecological issues: political science, economics, English, sociology.

2a) INTRODUCTION TO ENVIRONMENTAL STUDIES
4) CIVIL AND ENVIRONMENTAL ENGINEERING; STRONG EMPHASIS IN THE LATTER BUT DEGREE AND ACCREDITATION ARE UNDER "CIVIL ENGINEERING"
5) "Other": Geology
10) WE ARE LOOKING TO ESTABLISH A BROAD INTERDISCIPLINARY "CENTER" TO ENCOMPASS ALL THE VARIOUS PIECES OF ENVIRONMENTAL TEACHING, RESEARCH, AND OUTREACH THAT IS DONE ON CAMPUS.

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10) ***** COLLEGE IS A MEMBER OF THE ASSOCIATED COLLEGES OF THE SOUTH. THE ACS HAS A GRANT FROM THE RASMUSSEN FOUNDATION TO ENCOURAGE CONSORTIAL PATRNERSHIPS THAT WILLINCREASE ENVORONMENTAL AWARENESS AND ACTIVITY. PLEASE VISIT THE ACS HOME PAGE (WWW.COLLEGES.ORG) FOR INFORMATION ON THIS GRANT, OR CONTACT *****, THE DIRECTOR OF THE PROJECT.

2a) Biology 62: Environmental Biology b) Joint science dept.
4) "Other": Students may major in "Environment, Economics and Politics" and Science and Management: Environmental track."

2a) Ecology, Ethics and Wilderness
Ecology and the Quality of the Environment
Introduction to Environmental Chemistry
b) Liberal Arts Core Curriculum: Scientific Perspectives component
4) "Other": 4 interdisciplinary environmental studies majors with specializations in biology, geography, geology, and economics

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2a) INTRODUCTION TO ENVIRONMENTAL SCIENCE, TOPICS IN ENVIRONMENTAL SCIENCE, ENERGY SYSTEMS IN A TECHNOLOGICAL SOCIETY, METEOROLOGY, ENVIRONMENTAL GEOLOGY, ENVIRONMENTAL LAW, INTRODUCTION TO ENVIRONMENTAL CHEMISTRY, SELECTED TOPICS IN BIOLOGY ENVIRONMENTAL SOCIOLOGY, ENVIRONMENTAL PHILOSOPHY, ENVIRONMENTAL JUSTICE AND ENVIRONMENTAL HISTORY ARE ALL ENTRY LEVEL COURSES TAKEN TO MEET GENERAL EDUCATION REQUIREMENTS. SOME ADDITIONAL EXAMPLES EXIST OCCASIONALLY.

2b) AS CAN BE SEEN BY THE COURSE TITLES, MANY DEPTS. BESIDES ENVIRONMENTAL SCIENCE OFFER ENVIRONMENTAL COURSES.

10) WE FIND COUPLING THE COURSES WITH (1) FIELD TRIPS AND (2) ADVOCACY AND/OR COMMUNITY ACTION (SUCH AS ENACT) INCREASES THE SUCCESS RATE IN THE LEARNING PROCESS. WE ALSO FEEL THAT FOR THOSE PLANNING CAREERS IN THE FIELD, AN INTERNSHIP IS INVALUABLE, AND THAT EVEN NON-MAJORS MAY FIND RESEARCH A VALUABLE EXPERIENCE (ALTHOUGH THIS IS MORE MIXED IN ITS EFFICACY). FINALLY, USEFUL APPROACHES WITHIN THE CLASSROOM THAT IMPROVE THE MANY "VOICES" THAT ARE INVOLVED IN ENVIRONMENTAL ISSUES INCLUDE HAVING THE COURSES TEAM TAUGHT BY TWO OR MORE PROFESSORS FROM DIFFERENT DISCIPLINES, HAVING THE STUDENTS INVOLVED IN GROUP LEARNING PROJECTS THAT TEAM THEM WITH STUDENTS FROM DIFFERENT DISCIPLINES, AND USING CASE-STUDY TECHNIQUES IN INTRODUCING SOME OF THE TOPICS. I THINK THE ITEMS MENTIONED IN THE LAST PARAGRAPH ARE EXAMPLES OF OUR "BEST PRACTICES". IF MORE DETAIL IS NEEDED AND SEEMS WORTHWHILE PLEASE CONTACT US FOR MORE INFORMATION ABOUT SOME SPECIFIC. TWO OTHER INSTITUTIONS WITH COMPLETE PROGRAMS THAT ARE EXEMPLARY (IN PART BECAUSE OF THE SUCCESS OF THEIR MAJOR) ARE ***** AND *****.

2a) Environmental Studies (Environmental Studies)
Ecosystems and Human Influence (Environmental Studies)
Weather, Climate and Global Survival (Earth Science/Physics)
Socioeconomics of Human Populations (Sociology)
Energy, Environment and Economics (Economics)
Global Issues (Political Science)
b) Each course listed above is part of our Environmental Studies program and counts for liberal arts core credit. I listed the "home" department beside each course.

2a) Ecology (introductory and advanced) -- BIOLOGY
Behavioral Ecology -- BIOLOGY
Geochemistry -- GEOLOGY
Geology of America's National Parks -- GEOLOGY
Environmental Geophysics -- GEOLOGY
Applied Hydrogeology -- GEOLOGY
Physical Geography -- GEOLOGY AND GEOGRAPHY
The Global Environment -- GEOLOGY AND GEOGRAPHY
Geography of Anglo-America -- "
Geography of Lantin America -- "
Economic Geography -- "
Land Use Planning and Urban Geography

Global Issues -- POLITICAL SCIENCE
Environmental Anthropology -- ANTRHOPOLOGY
Urban Anthropology – ANTHROPOLOGY

b) See department in caps above

7) ***We are considering implementing a proposal under discussion for 2 years of a social science and science combination in environmental studies spanning sociology history economics geology geography biology and chemistry. This would expand our introductory and intermediate offerings in this area.

2a) There is no ONE course which serves this function, and the one course which does best serve the function cannot be counted toward our GE requirements.

b) The most relevant course is offered through Environmental Studies.

However, courses which involve such issues are offered through Biology, Economics, English, Geology/Geography, History, Philosophy, Physics, Political Science, Psychology, Religion, and Sociology/Anthropology. Many of these do meet particular GEs, and most are cross-listed with Env. Studies as well.

3) As you can see above, we fall between your categories. Our campus has many disciplines where environmental literacy is taught.

4) ES -- students can major in this by creating their own major: 2 students have done this in 6 yrs.

6) I am not speaking for the institution as a whole here, but some elements of the Env. Studies Program are contemplating this idea. Others (such as the Program Director) are not in favor of pushing a course of this type for general consumption (or GE status).

10) One aspect of our instition which is significant in this regard is our alternative living option called the "Homestead" - a set of three cabins that are not connected to the utility, have only a nearby emergency telephone, and supply their own heat (with wood). This setting (about a mile from campus) is exceedingly unusual and quite valuable in providing environmental literacy across the board. Though it only provides housing for 12 students, its existence is well known across campus, and it provides a learning tool for many people who might not otherwise be aware of the issues involved. For instance, the Homestead runs on solar power, and grows some of its own food on an adjacent organic garden.

Another unique feature on our campus is an academic building that underwent a dramatic green renovation in 1998, now housing both the English Dept. and Env. Studies Program. This is featured on our web site and has gained national attention for its innovative design.

2a) Ecological Biology
Environmental Chemistry
Several geology courses
Intro to Environmental Science

5) Our ES program consiste of 3 tracks which can be chosen, in addition to the intro course. These are Conservation Biology, Environmental Chemistry, Environ. Geology. Offered as concentrations within and by those departments (i.e. Bio, Chem, Geo).

1a) Students must take one from a list of courses designated as "Environmental Perspective" courses.
10) We are very proud of our environmental studies program which we consider to be a model. It is interdisciplinary with two tracks: one in policy and one in ethics and aesthetics (humanities). In addition we have an unusual array of environmental perspective courses from a variety of disciplines. Completing one of these is a required part of our general education program.

1a) Environmental Studies
b) General Education program; staffed mainly by biologists, but also faculty from other departments
10) Please feel free to contact ***** for information about this course.

2b) Earth and Environmental Science
4) "Other": Concentration in Est (ready for vote by faculty)
10) A University Task Force regularly sponsors events to heighten awareness on campus.

2a) Biological World
b) the Natural Science department (a range of courses for non-science majors)
10) Our students are required to attend regular convocations and/or chapel services. (3 every 2 weeks) We make sure that several of these each year are devoted to environmental topics.
We have a large nature preserve that primarily serves local K-12 students, but many of our students help with the K-12 programs and several of our biology and environmental studies courses are taught onsite at the nature preserve.

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10) Many science and policy courses within traditional disciplines offer environmental components.

2a) BIO 108-Environmental Biology; BIO 158-Lab in Environmental Biology; BIO 251-Bioecology; BIO 376-Aquatic Ecology; CHEM 103-Chemical Concepts in a Technological Society; CHEM 105-Toxic Chemicals in Society; PHYSICS 110-Energy and Power; PHYSICS 150-Lab for Energy and Power; ENGLISH 204-American Nature Writing

b) ***** College is a 4-year BA/BS degree liberal arts college. These courses are available to all students.
10) ***** College has a chapter of SEAC (Student Environmental Action Committee) and a community-based, college-supported recycling effort.

I suggest getting in touch with *****. ***** specializes in environmental issues and offers degrees only in Human Ecology.

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10) We have courses in various majors (biology, economics, theology, philosophy) which touch on these issues in ways which are consistent with their discipline and the perspective of the instructor. Students with this interest are able to pursue independent research or directed studies as well with a number of qualified faculty members.

ES&P web page: http://www.hartwick.edu/envirsci
2a) Environmental Science

- Environmental Geology
- The Global Environment
- Ecology and the Environment
- Earth Cycles
- The Chemistry of the Atmoshpere, and
- the Biosphere.

b) These courses are offered through a variety of departments including, biology, geology, as well as through interdisciplinary course sequences not associated with a specific department.
10) One of the clubs supported by the college is called Grassroots and it is a club which sponsors environmental activities including attempts to increase the environmental awareness of all students on campus.

2a) Concepts of Science, Physical Geography, Elements of Geography
10) Many of our students are involved in the Cahaba River Society - they learn the history, uses, and importance of the river as well as participate in canoe trips, etc.

Last year students participated in an effort to develop a local area into a park. Their efforts paid off and the park will be established.

We offer courses in Piscatology and Ornithology available to students as electives.

An annual trip is made with students to Dolphin Island to study marine life

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2a) Introduction to Environmental Science and Studies (ESS200) (fulfills the Natural Science core requirement)
b) Environmental Science and Studies Department
5) "Other": Biology Department [Ecology], Geology Department [Environmental Geology], Chemistry Department [Environmental Chemistry]

10) We are designing an immersion experience at our Field Station that would be appropriate for non-science, non-environmental studies students. In this experience they would gain an appreciation for the natural world that the usual curriculum would not provide.

We are also designing an environmental management system for the College that might involve all buildings (including the dormitories) in activities relating to energy or water conservation; these would certainly add env literacy outside of the usual curriculum.

2a) Certain biology courses focus on topics that would fall under the heading of environmental literacy; however they are advanced level, with prerequisites and most often not elected to fulfill our distribution requirement. However, Environmental Studies 101, Introduction to Environmental Studies, has no prerequisites.
5) Env. Studies is now being proposed as a major.
10) TWO ON-GOING PROJECTS MAY BE OF RELEVANCE HERE. FIRST, OUR ENVIRONMENTAL STUDIES CONCENTRATION (INTERDISCIPLINARY MAJOR) HAS BEEN STAFFED BY A COMMITTEE OF FACULTY WITH APPOINTMENTS IN OTHER PROGRAMS; SEVERAL YEARS AGO WE DECIDED TO CREATE A DEDICATED ENVS POSITION, WHICH WAS FILLED IN FALL 1998. WE ARE NOW MOVING FORWARD TO CREATE A FULL MAJOR IN ENVIRONMENTAL STUDIES.

AT THE SAME TIME, THE FACULTY HAS BEGUN A REVIEW OF OUR GRADUATION REQUIREMENTS. WE CURRENTLY USE DIVISIONAL DISTRIBUTION REQUIREMENTS TO ENSURE BREADTH, BUT THERE IS SERIOUS CONSIDERATION TO REPLACE THESE WITH A DIFFERENT SET OF CRITERIA/CATEGORIES--IT IS POSSIBLE THAT ENVIRONMENTAL KNOWLEDGE MAY EMERGE IN THIS NEW SYSTEM AS A CATEGORY--TOO SOON TO TELL!

2a) 1. WATER AND SOCIETY
2. OIL, POLITICS, AND THE ENVIRONMENT
3. TECHNOLOGY, ECONOMICS, AND THE ENVIRONMENT
4. THE GREEN REVOLUTION: A STUDY OF ENVIRONMENTAL ACTIVISM
5. TRANSPORTATION AND SOCIETY
6. NATURAL FORCES, HUMAN CHOICES SUSTAINABLE USE OF NATURAL RESOURCES
7. ENERGY, ENVIRONMENT, SOCIETY
8. PLASTICS IN OUR WORLD
b) Values and Science/Technology (core, with topic options)

2a) Environmental Conservation	Biology
Environmental Geology	Physics

Environmental Chemistry	Chemistry
Environmental Philosophy	Philosophy

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10) We have an environmental issues committee of faculty, students and staff. The environmental studies program runs a weekly seminar on environmental issues open to the wider community. Our environmental studies program is an interdisciplinary program with contributions from 9 departments – thus students majoring in other areas can take a course with an environmental component (e.g. Environmental Anthropology, Environmental Ethics, Environmental Economics, Russian Environmental Literature in Translation, etc.)

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3) We have no core curriculum.
10) ***** COLLEGE IS QUITE SMALL, 280 STUDENTS/38 FACULTY. WE HAVE AN ENVIRONMENTAL STUDIES PROGRAM THAT DRAWS IN MANY STUDENTS. THAT PROGRAM INCLUDES 4 FACULTY IN NATURAL SCIENCES, 2 IN SOCIAL SCIENCES, AND 1 IN LANGUAGES (18% OF THE FACULTY). WE HAVE A TITLE 6 GRANT FROM THE DEPT. OF ED. TO INTERNATIONALIZE THE ENV. STUDIES CURR.

WE DO NOT HAVE CORE REQUIREMENTS (EXCEPT THAT ALL STUDENTS MUST DEMONSTRATE THE ABILITY TO WRITE WELL). WE OFFER SEVERAL COURSES EACH YEAR THAT ADDRESS ENVIRONMENTAL LITERACY CONCERNS. THOUGH WE STRONGLY URGE STUDENTS TO STUDY IN ENV. COURSES, THIS FACULTY WOULD NOT INSTITUTE THIS AS A REQUIREMENT, GIVEN THAT THERE ARE NO OTHER COLLEGE-WIDE REQUIREMENTS (ONLY DISCIPLINARY REQS.).

WE ARE EMBARKING ON AN INTERNATIONAL ENVIRONMENTAL BIOLOGY PROGRAM THAT HAS AS A GOAL PROVIDING ON-SITE RESEARCH EXPERIENCE IN AFRICA OR CENTRAL AMERICA FOR EVERY STUDENT IN THE PROGRAM. THE MAIN FOCUS IS ECOLOGY AND CONSERVATION BIOLOGY. WE ARE IN THE PLANNING STAGE AND EXPECT TO HAVE IT ON LINE IN TWO YEARS. STUDENTS FROM OTHER AREAS OF THE CURRICULUM WILL BE ABLE TO TAKE ADVANTAGE OF THE RESEARCH SITES, THE INTRODUCTORY COURSES, FILED TRIPS AND OTHER PROGRAM ELEMENTS.

2a) Environmental Topics of the 20th (21st) Century
b) Geology
10) We have a student-led environmental organization active on campus. We participate in several environmental initiatives under the auspices of ACS (Associated Colleges and Universities of the South). One such initiative is the annual appointment of an

Environmental (faculty) fellow to encourage and coordinate faculty, staff and students activities and Environmental Interns to support the Fellow.

2a) Energy Resources Environmental Ethics
b) general education issues and ideas courses

2a) Intro to Environmental Studies (plus a number of others)

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10) THIS FALL WE OFFERED WHAT WE EXPECT TO BE THE FIRST OF ANNUAL SYMPOSIA ON ECOLOGY AND THE ENVIRONMENT. FOR DETAILS, PLEASE VISIT OUR WEB PAGE AT http://www.oglethorpe.edu/ecotalk/

Our symposium, described on the Web Page listed above included participation by all of our own students as well as students invited from other campuses in the area. If you would like to know more about it, I would be glad to put you in touch with one of the planners of the event.

2a) there are many courses in this category offered by many faculty members, both at ***** and at the other ***** Colleges. The faculty member at ***** College who is most energetic in leading environmental studies efforts is *****.
10) service-learning projects; internships. I strongly suggest you contact *****. Eight members of the faculty teaching in the environmental studies program at the College. At *****, Environmental Studies is an interdisciplinary program focusing on the interaction between the human and non-human components of the biosphere. The concentration (i.e. major) consists of course work in human ecology, policy, science, and environmental fieldwork.

2a) BIOL 105: Conservation of Natural Resources
PHIL 214: Bioethics
b) Courses are offered in separate departments, not currently part of Environmental studies program. We are in the process of creating an Environmental Studies Program.
10) Part of our general education requirements is a lab science course. Many of our students choose to take BIOL 105: Conservation of Natural Resources because the topic seems the most attractive to them.

***** College does not currently have an environmental literacy requirement. We offer students a systematic and intensive education in the traditional liberal arts and sciences. Within this context, there are opportunities to take courses that deal with matters pertaining to the environment, for example, in biology, economics, and political science. Our focus, however, is on teaching students how to think critically and analytically rather than on some predetermined set of problem areas. Thus, for example, we require all students to engage in humanistic inquiry, but we don't have a "diversity" requirement per se. Similarly, all students must take one year of laboratory science, but do not have to meet an environmental literacy requirement.

***** ASKED ME, AS ASSOCIATE DEAN FOR INTERDISCIPLINARY AND GENRAL STUDIES, TO COMPLETE THIS SURVEY ON HIS BEHALF. I GAVE THE RESPONSES BELOW IN CONSULTATION WITH *****, OUR ACTING DIRECTOR OF ENVIRONMENTAL STUDIES. IF YOU HAVE ANY QUESTIONS, DO NOT HESITATE TO CONTACT ***** OR ME. SEE MY ADDRESS AND NUMBERS BELOW. GOOD LUCK WITH YOUR WORK.

2a) ENVIRONMENTAL POLICY AND REGULATION
INTRO. TO ENVIRONMENTAL STUDIES
SAVING WILD PLACES
GLOBAL CLIMATE CHANGE
CULTURE OF NATURE
5) "Other": NOTE: WE OFFER AN "INTERDISCIPLINARY CONCENTRATION" IN ENVIRONMENTAL STUDIES; OUR COLLEGE HAS NO "MINORS"
10) IN ADDITION TO OUR COURSE OFFERINGS -- WHICH ARE OPEN TO ALL STUDENTS – WE OFFER THE INTERDISCIPLINARY CONCENTRATION (6 COURSES) WHICH STUDENTS CAN TAKE IN CONNECTION WITH ALMOST ANY LIBERAL ARTS MAJOR. WE ARE ALSO DEVELOPING A NATURAL LANDS AREA -- PRAIRIE, FOREST, WETLANDS -- WHICH IS AVAILABLE FOR STUDENTS IN ALL DISCIPLINES FOR THEIR WORK IN ART, LITERATURE, WRITING, ETC. IN ADDITION TO MAJORS IN SCIENCES. AS JOHN ELDER, MIDDLEBURY COLLEGE, SAID WHEN HE VISITED OUR CAMPUS -- "IF YOU HAVE A PRAIRIE, FLAUNT IT!"

2a) Principles of Ecology
Biological Diversity
Earth Science
Energy & Environment
Environmental Science
b) all taught in Environmental Studies Department

2a) Introduction to Environmental Studies
b) Division of Natural Science and Mathematics

2a) ES 100 Environmental Concerns in Perspective
LS2 146 Environmental Issues

LS2 160 A Green World
LS2 166 Human Land Interactions
LS2 137 Business and the Natural Environment
b) These courses are offered as "liberal studies" courses and so count as part of the students core but are also Environmental Studies courses.
10) We have initiated a college wide program for increasing international environmental literacy. This program provides lecture open to the entire community and workshops open to faculty. This program also pays faculty to develop courses which have as at least part of their focus international environmental literacy. It is our experience that student will fill as many of these courses as we can motivate faculty to offer. This project has been funded by a DOE Title VI grant.

1a) St. Andrews General Education (SAGE) 253-254

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3) The program in Environmental Studies
10) WE HAD ONE OF THE EARLY INTERDISCIPLINARY PROGRAMS IN ENVIRONMENTAL STUDIES. ITS ON-GOING POPULARITY AS A COMBINED MAJOR HAS LED TO INCREASED STAFFING THE PAST TWO YEARS. WE INTEND TO KEEP IT AS A NON-MANDATORY, VERY POPULAR ELECTIVE COURSE AND MAJOR. THE FACULTY THIS FALL HAS VOTED TO ESTABLISH AN AUTONOMOUS MAJOR IN ENVS AS WELL.

OUR COMBINED MAJOR APPROACH GRAFTS AN ENVS ONTO A LARGE RANGE OF OTHER MAJORS IN THE NATURAL SCIENCES, SOCIAL SCIENCES, AND HUMANITIES, A CONCEPTION THAT HAS SERVED US VERY WELL AND SERVED AS A MODEL FOR OTHERS. FULL INFORMATION ON THIS IS AVAILABLE AT OUR WEBSITE: http://www.stlawu.edu

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2a) Chemistry 001 "Chemistry in the Human Environment" b) Chemistry Dept.
10) We offer a concentration in Environmental Studies, which is an interdisciplinary minor (six courses taken in addition to the student's regular major). The committee that oversees this concentration routinely brings to campus outside speakers and sponsors events to make all students aware of environmental issues. Please see our website at http://www.swarthmore.edu/es for more information.

We feel that requiring environmental literacy courses is a heavyhanded strategy likely to backfire. Instead, we offer a rich program that students can sample and sponsor many on-campus events to raise the general level of environmental understanding. Is this a model? Perhaps so, but may not be exportable to, say, large land-grant universities from our small liberal arts college with a Quaker heritage.

2a) The following courses can be used to fulfill general education requirements, though none is a "literacy" course: Environmental Geology,

Environmental Chemistry
Human Ecology (Biology).
4) None offered, though students can and do design their own majors in environmental biology or environmental studies.
10) Our scientists believe that students are better served by a biology, chemistry, or geology major than an environmental studies program if they are interested in environmental issues. Many of our students complete major research projects on environmental issues (all are required to complete an independent study project, representing a quarter of the senior year courseload).
I'm sure you realize that there are non-curricular ways to increase environmental literacy. We have a very active student environmental group on campus which, among other things, runs a very effect recycling program. There is environmental consciousness in our speakers', lectures, and other co-curricular programs.

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3) WE HAVE AN INTERDISCIPLINARY MINOR PROGRAM, WITH COURSES FROM SEVERAL PROGRAMS IN THE HUMANITIES, THE SOCIAL SCIENCES, THE FINE ARTS, AND THE NATURAL SCIENCES. THE FIRST COURSE IS TEAM-TAUGHT BY FACULTY FROM VARIOUS PROGRAMS, THE REMAINDER ARE HOUSED IN PARTICULAR PROGRAMS
4) "Other": Interdisciplinary
10) WE INTRODUCE STUDENTS TO ENVIRONMENTAL ISSUES IN A TWO-SEMESTER, WRITING INTENSIVE, INTERDISCIPLINARY, COMMON CURRICULUM COURSE, CALLED "FOUNDATIONS OF THE LIBERAL ARTS," THAT ALL FIRST-YEAR STUDENTS ARE REQUIRED TO TAKE

2a) Environmental Ethics
Environmental Economics
Environmental Anthropology
Environmental Policy
Natural Resource Issues and Policies

2a) Earth, Environment and Humanity
Geology and Society
Earth System Science and Environmental Justice
The Environmental Imagination in Literature and Science

2a) Environmental Ethics, Rocky Mountain Ecology, The American Wilderness, Global Environmental Issues, Physical Geography, Environmental Geology, Energy and the Environment, Geology of the Appalachians, Humans and the Environment, Environmental Science, Plants and Man, General Ecology, Marine Ecology

3) Social Ecology Major, Biology Major, Chemistry Major, Natural Sciences divisional Major
4) "Other": Social ecology, Biology, PORTfolio Project, Geology
9) I believe it is very important
10) New PORTfolio program emphasizes college's and student's relationship to the environment. Part of orientation program and part of first semester deals with increasing environmental literacy of students.
The PORTfolio Project hopes to increase the environmental literacy of its students through --
--partnerships with Chesapeake Bay Foundation, YMCA, etc.
--an orientation to the college which includes an introduction to its "place" within the local, regional, and national environments.
--a first year seminar structured around Howard Gardner's Theory of Multiple Intelligence which includes his most recent work on a "naturalistic intelligence."
--externships and internships available for students that connect them with environmental organizations, issues, etc.

Ms. Wolfe, I am responding to your questionnaire on environmental literacy that was sent to Dean ***** at ***** College. Since ***** has neither requirements, programs or courses in enviromental literacy, Question 9 is the only question that I could respond to. Answering this personally, which is what you seem to be asking, I would mark a 2. There has never been, to my knowledge, any discussion or suggestion of adding this component to our very traditional liberal arts curriculum. We do, however, have a currently active student environmental group on campus.

2a) Humanity and the Environment b) Interdisciplinary

2a) Environmental Science, and/or Environmental ethics, and/or Earth Resources and Environment
b) Biology Department
Geology and Environmental Science
4) ES is (actually "Geology and Env. Sci."
10) The General Education requirements of our college require students to take either an introductory Biology or Geology course as part of their core courses. While some of these courses are not "specifically intended to increase [students'] "environmental literacy."", all of them are taught in such a way as to promote appreciation of, and a need to care for the environment.
As a Christian institution, Wheaton does specifically design courses so that the information taught is related to one's Christian duties. Care for the Creation is one of those duties.

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3) We have several "Environmental Studies/....." combined major programs, e.g., Environmental Studies/Politics or Environmental Studies/Biology. All of these programs have a full-year course in Environmental Studies as a prerequisite.

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10) We offer a concentration, not a minor. We have no minors. Though we have no courses designed specifically for the indicated purpose, we do have an increasing number of courses that include a significant environmental studies component.

2a) Assessing Human Impacts on the Environment b) Environmental Studies Program
10) The following is excerpted from a past grant proposal - as we have implemented the course described herein, the future tense can be changed to present tense.

The laboratory portion of the course will emphasize the techniques and methodologies used by environmental scientists to recognize, assess, or predict human impacts on the natural environment. These will be integrated with problem-oriented exercises in a workbook designed to introduce the student in a step-wise fashion to many of the elements involved in an environmental assessment. As described earlier, techniques and methodologies will be specific to the disciplines of the instructors teaching the two lab sections, in this case biology and geology. Following a series of introductory experiences associated with use of pertinent materials (e.g., maps and aerial photographs), instruments (e.g., pH meter or plankton net), and facilities (e.g., computer imaging lab), students will systematically measure various parameters of environmental quality in a disturbed setting (e.g., Myers Hollow, a green space on campus) and compare them with those of an analogous undisturbed setting (e.g., Davy Woods or Hueston Woods). Ultimately, students in Envs 101 will develop their own sense of the natural environment and the potential changes resulting from human activity.

The focus of the lab, and perhaps the course in general, will be a group project involving assessment of the impact of a proposed activity on the natural environment. Students from the two lab sections will assemble into "interdisciplinary" work groups of 4-6 students each to develop the different components of an Environmental Impact Statement modeled after the requirements of NEPA. By combining students from the different lab sections and community roles we shall create a learning community through which the students will be responsible for teaching each other the important methodologies and analyses of the respective sections and disciplines; more importantly, the groups will reflect the interdisciplinary teamwork and communication involved in developing an impact statement. Examples of activities that could be assessed may include the proposed Clark County incinerator, the proposed shopping center in the Mad River valley northwest of town, the damming of Buck Creek, and the Tremont City landfill. One example of this course model might be an assessment of the proposed northwest transportation corridor around Springfield recently announced to the public. Classroom lectures and discussions would be used to develop the scope of the proposed activity and organize teams. One team could work closely with local governmental agencies on planning and road construction while another might contact the Ohio Department of Natural Resources concerning endangered species. Other teams could work with the local business group or developer promoting corridor development or a citizens group opposing the planned corridor.

Interdisciplinary teams would also assess the current environmental conditions of the site. Teams would work closely together, passing information and contacts back and forth while the class independently evaluated the claims and data of the interested parties. Finally a report would be drafted and circulated to all involved parties. The students would be encouraged to participate actively in the local decision-making process as interested and informed, independent citizens, possibly by presenting their results in the appropriate public forums.

2a) Chemistry 104
b) Science for non-science students—concepts and methods of environmental science (introductory level course)

We have courses in ecology, economics, global issues which treat environmental issues. They are electives, but may be applied to certain majors. Appropriate for increasing literacy of non-environmental majors.

2a) Environment and Society b) Environmental Studies

UNFORTUNATELY, WE HAVE MANY CURRICULAR ISSUES THAT PREVENT US AT THIS TIME FROM DEVOTING AS MUCH ATTENTION/RESOURCES TO THIS AS A FEW DEVOTED INDIVIDUALS WOULD LIKE.
PLEASE CHECK OUR WEB PAGE AT WWW.ACOFI.EDU--THE ENVIRONMENTAL STUDIES FOLKS ARE DEVELOPING A HOME PAGE TO DESCRIBE OUR OFFERINGS AND APPROACH--IT ISN'T COMPLETED YET.

2a) Env. Science

2a) 1) Intro to Env. Science 2) Ecology
2b) Biology dept.

4)"Other": Part of Gen Ed

1a) Biological Science

"***** has not used env. literacy as part of General Education nor does it have any courses at this time."

2a) Introduction to Environmental Sciences
Biological Diversity
The Great Neglected Diseases
Physical Geology

b) Introduction to Environmental Sciences (Environ. Sci. Program)
Biological Diversity (Department of Biology)
The Great Neglected Diseases (Department of Biology)
Physical Geology (Department of Physics, Astronomy and Geology)

10) A. Annual Poster Session: In April of each year, we invite all members of campus to a poster session highlighting the scientific research of our students. Each year, the majority of these posters are on environmental research.

B. Annual Ag Week: Each October we dedicate a full week of campus-wide activities to celebrating agriculture. The primary focus of our agricultural programs is environmental in nature.

C. Study Abroad Programs: We are striving to incorporate environmental science components and courses into all of our study abroad programs. For example, all students in our new Costa Rica Semester program will be required to take a full course in Latin American Environmental Studies. We also have special programs in environmental fields offered abroad. For example, we have a Coral Reef Ecology program in Belize, and a Tropical Ecology program in
Costa Rica, and an Environmental Agriculture program in Cost Rica.

D. Multidisciplinary Major: Our multidisciplinary major in environmental sciences includes faculty and courses from all of our four academic schools.

E. Biodiversity Database: We maintain a web-based "Biodiversity Database" on which we post continually changing inventory information on the species and habitats on Berry College's vast 28,000-acre campus.

F. Land Management Program: *****'s 28,000 contiguous acres of land constitutes perhaps the largest college campus in the country. The land includes a wildlife management area, managed pine and hardwood forests, clay and limestone mining operations, a 55-acre reservoir that furnishes the college's water, agricultural lands with beef, dairy, equine, and horticultural operations, 2 historical public gardens, miles of hiking, biking and horseback riding trails, other recreational facilities (e.g. an adventure ropes course), some historical and archaeological sites, as well as the basic campus. We manage the land as an academic resource for environmental sciences, among other things.

G. Environmental Sciences Summer Research Scholarships: We have a special program that provides summer employment for students, who work in teams with faculty from various departments to do research related to the environment.

H. Annual River Cleanup Day: Each fall, we dedicate a Saturday to cleaning up a section of the Oostanaula River, which flows through our campus. Students from across campus participate in this well-publicized event.

I. Additional Elective Courses: We offer numerous elective courses across the curriculum, including Environmental Geology and Environmental Ethics. We are developing a new course in Environmental Economics. We have just hired a full-time faculty member in Environmental Chemistry. Our education school offers a popular course for school teachers titled, Workshop in Environmental Science.

!!!! ***** College emphasizes

2a) Environment and Humanity
Human Ecology; Natural Resources: Use Them but Don't Lose Them
Transforming Technology: Environmental Perspectives
b) Environmental Studies
Biology

2a) Earth and Space Science
2b) Biology

2a) Earth & Env. Science
2b) Dept. of Chemistry/Physics

2a) Environmental Issues and Huma Survival
Biotechnology and Human Affairs b) General Education Program's Science Requirement
4) "Other": Biology major/Environmental Studies Concentration

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10) We offer an environmental course for biology majors.

1a) Christian Values in the Global Community
b) Gen Ed

2a) Bio110: Introduction to Env. Science
2b) Biology

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2) We had one---taken out of last catalog. With proposed new major in environmental science, the plan is to resurrect a similar course. This could be as early as 2000-2001.
a) was BIOL 101 ENVIRONMENTAL SCIENCE
WOULD BE ESCE 110 ENVIRONMENTAL SCIENCE
b) WAS BIOLOGY
WOULD BE ENVIRONMENTAL SCIENCE

4) ES is proposed new major for 2000-2001.

5) Course APPROPRIATE for increasing the environmental literacy of non-environmental majors, although not designed for that purpose WILL BE PROPOSED. THE COURSE IS A REQUIRED COURSE FOR THE ENVIROMMENTAL SCIENCE MAJOR [IF APPROVED FOR GEN ED, IT WOULD ALSO SERVE THE NON-ENVIRONMENTAL MAJORS]
[X] Course DESIGNED to increase the environmental literacy of non-environmental majors SAME COURSE AS ABOVE. IF IT BECOMES A GEN ED COURSE IT WILL SERVE ALL STUDENTS WHO ELECT TO TAKE IT TO FULFILL REQUIREMENT

To quickly answer your questions.
1) We had a course (Biology 101) which fulfilled a general education foundation for non-majors which would fit your definition of "environmental literacy".
2) It was dropped from the catalog last year.
3) We hope to resurrect a similar course with a new program in Environmental Science.

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3) Biology major in the Division of Arts and Sciences

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2) Environmental Science, Wilderness Skills and Ethics

2a) Biology 103 Environment and Man
10) We are in the process of developing and Environmental Science minor.

2a) Any course in the Environmental Studies major will satisfy the science requirement, and Environmental Ethics applies toward the humanities requirement.
b) Environmental Ethics is taught by Religion & Philosophy

1a) The Human Agenda: Environment

b) The Biological Sciences
10) Contact Dr. ***** for a full syllabus and course outline.

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2) Intro to Environmental Science

2a) Issues in Human Ecology

1a) There are several options available
b) Out of the Division of Science and Mathematics

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4) We have Env. Science courses and are developing and Env. Science major.

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3) College of Education

2a)Introduction to Environmental Science
Conservation Biology
Planet Earth I: Physical Features
Environmental Toxicology
[Introduction to Environmental Sciences seems to qualify as your definition of "environmental literacy." It is an option in this institution's core curriculum, but it is not a requirement in an academic units.]

*The Environmental Studies Program offers only a **specialization** for the following degree programs:
BA in History and Government with Specialization in Environmental Studies;
BS in biology with Specialization in Environmental Studies; and
BS in Natural Science with Specialization in Chemistry and Environmental Studies.

1a) Biology and Introduction to Earth Science, both core courses, include units on the environment; we also have an upper-level Environmental Biology class available for science majors or as general elective credit.
b) Biology major offered in the Department of Natural Sciences and Mathematics, in the Division of Arts and Sciences.
10) As indicated in my answer to Question 6, we "plan to consider" the addition of an environmental literacy course to our core, however, "when" is the question. We are a developing institution currently involved in the acquisition of a new campus. This consideration is currently not a high priority.

We have a section of the general biology course which virtually all of our students take which includes sections on population, ecology, and so on. We also have an elective course in biology which is offered once every other year which strives to increase awareness and knowledge in environmental issues.

2a) Environmental Science   Biology Dept.

2a) Food & Population   Biology Dept.
3) Bioscience

2a) Ecology I, II
b) Arts and Science Division of the College
10) Since our campus is on the ocean, we are exploring marine science courses for future development.

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3) Biology major – environmental concentration

2a) SENIOR LIBERAL ARTS SEMINAR: ECOLOGY AND CULTURE
b) INTEGRATED CORE CURRICULUM
3) ENVIRONMENTAL STUDIES PROGRAM IN NATURAL SCIENCES DIVISION
10) WE HAVE AN ON-CAMPUS INSTITUTE - THE MONADNOCK INSTITUTE FOR NATURE, PLACE, AND CULTURE - THAT IS INVOLVED IN ONGOING EFFORTS TO ENHANCE ENVIRONMENTAL LITERACY AMONG STUDENTS, FACULTY, AND IN THE SURROUNDING COMMUNITY.

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3) Natural Sciences

2a) Environmental Science   Biology Dept.

1a)All students take 39-41 credits designed to increase environmental literacy. 3 of those courses, Images of Nature, Dimensions of Nature, and A Delicate Balance are required of all students. The others courses are selected from a menu. I refer you to our catalog for further details.

4)The entire General Education program of the College plus:
Art, Literature and the Environment

Human Sciences, Policy and the Environment
Recreation and the Environment
Business-Environmental Management

5) My response to the above was based on the Gen Ed program. We offer majors and minors in each of the above listed programs. We do not offer graduate degrees of any type.

10) Please contact me for more details. We are one of a handful of environmental liberal arts colleges in the country. That list includes Northland, Warren Wilson, College of the Atlantic, and Prescott. They are all part of a recently formed organization called North American Association of Green Education (NAAGE).

2a) BIO 134 Fundamentals of Environmental Ecology Biology

2a) Environmental Science Biology Dept.

153 Inter Amer U PR Barranquitas
1a) Environmental Problems
b) General Education from the Science and Technology Program

4) "Other": Biology with specialization in Environmental Sciences

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1a) Environmental Science b) Core curriculum – all students take it.
10) THIS COURSE ADDRESSES THE IMPACT OF HUMANS ON THE GLOBAL ENVIRONMENT. TOPICS COVERED INCLUDE ECOSYSTEMS, POPULATION DYNAMICS, RESOURCES, CONSERVATION, ENERGY POLLUTION, PESTICIDES, ECONOMICS AND ETHICS.

1a) Environmental Problems
b) General Education Program
10) I WILL BE SENDING A MORE DETAILED INFORMATION OF ONE OF OUR STRATEGIES TO INCREASE THE ENVIRONMENTAL LITERACY IN ALL STUDENTS AS SOON AS POSSIBLE. JUST TO GIVE A LITTLE BRIEF OF WHAT WE DO, WE HAVE A STUDENT ORGANIZATION CALLED "INTERBIO", INTER BECAUSE IS PART OF THE NAME OF OUR INSTITUTION, BIO BECAUSE IT WAS ORIGINATED IN THE SCIECE DEPARTMENT BY FACULTY AND BIOLOGY MAJORS. TO BELONG TO THIS ORGANIZATION, THE STUDENT DON'T NEED TO BE FROM THE DEPARTMENT. THEIR MAJOR GOAL IS TO PROVIDE ORIENTATION TO THE INTERNAL AND EXTERNAL COMUNITY ABOUT ENVIROMENTAL ISSUES, TO RECOMEND SOLUTIONS TO

ENVIRONMENTAL PROBLEMS IN OUR COMMUNITY. THEY ALSO HAVE A RECYCLING PROJECT.

2a) Ecology and Man
b) Biology

2a) Technology and Scoiety
b) Taught by professors in the Division of Engineering
10) Our core curriculum includes courses in Technology and Society, Basic Economics, and Biological Science, all of which address environmental issues. The Tech & Soc course comes closest to a course that might be considered an "environmental literacy" course.

At ***** University, we would answer yes to question #2. In our "Liberal Studies Program," students are required to take courses in several categories. Environmental studies are under category 6: "Upon completion of the Liberal Studies Program, students will be able to: 6. Demonstrate an understanding of the relationship between human beings and their environment. (3-4 credit hours) The student will complete one of the following courses: **Environmental Awareness** (3), **Global Demography and Economic Studies** (3), Macroeconomics (3), Community Nursing (3) (for nursing students only), or **Ecology** (4).

For Question #9, I would answer "very important" or 5.

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10) We are trying to increase the Scientific Literacy of our students through our required courses in the Core Curriculum. Many of the instructors use environmental issues as vehicles to help students learn about the applications and principles of science. We especially want to reach our elementary education majors with environmental issues to be used as examples in science instructor for their future classrooms.

I would recommend that you contact Project Kaleidoscope, Director Ms. Jeanne Narum, in Washington D.C., phone 202.232.1300. This reform effort is focused on introductory science and mathematics courses and programs, and I know that Environmental Literacy is part of some of the efforts. Certainly, Scientific Literacy and Science for Citizens are parts of the PKAL concerns.

2a) Environmental Science   Environmental Chemistry
b) Biology   Chemistry

2a) Environmental Science

b) It is one of the core lab science courses, so it isn't part of a program, but we also have an emphasis in Environmental Science and Biodiversity. Understanding Contemporary Society is required of all students and includes a unit on environmental issues.
10) We include an Environmental Science course in our freshman honors core. We also have an active Lee Environmental Action Force (LEAF) which recycles and is in the process of developing an arboretum. This committee involves faculty, administrators, staff and students and is active in increasing environmental awareness on campus.

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10) We are working toward establishment of a major in Environmental Science. Doing so is essential to creating the expertise needed on campus so that we might then consider options in the core program.

2a) Earth Science 103-104
Chemistry and Physics Dept.

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3) College of Professional Studies
5) "Other": Agriculture, Biology, Chemistry

Sorry. Your questionnaire does not become interactive on my email. We would check box 2 - no requirement.

Students have two lab sciences in the core. They may take them in the same department. That means they may take and count in the general ed core the following: **Biology 220 Environmental Biology**. I suspect a few do, but not many. It is not a required course in our Bio major.

We have an **Environmental Studies minor in the Bio Department.**

We have in the planning stages a "Clean Water Institute" which will be an environmental program and will eventually (we hope) offer a major in environmental studies. We are about two years away from this getting into the catalogue (hopeful)

I think environmental studies/literacy is in the 5-6 range of importance. That is why we are moving in that direction.

2a) Introduction to Environmental Studies b) Biology
10) WE USE OUR ENVIRONMENTAL STATION TO EDUCATE AREA ELEMENTARY/SECONDARY STUDENTS ABOUT ENVIRONMENTAL ISSUES, AND STUDENTS FROM THE COLLEGE DO MUCH OF THAT TEACHING. IN ADDITION, SELECTED STUDENTS HAVE WORKED TO DEVELOP A

RECYCLING CURRICULUM FOR COUNTY PUBLIC SCHOOLS IN COLLABORATION WITH THE SOLID WASTE MANAGEMENT DISTRICT. FINALLY, WE HAVE NUMEROUS CO-CURRICULAR ACTIVITIES ON CAMPUS THAT ARE DESIGNED TO RAISE STUDENTS' AWARENESS OF ENVIRONMENTAL ISSUES -- RECYCLING, SPEAKERS ON ENVIRONMENTAL POLITICS, ENVIRONMENTAL LAW, ETC.

2a) Humans and the Environment
3) Dept. of Biology, concentration in Environmental Studies

2a) Environmental Science   b) Natural Sciences

2a) Environmental Science Technology and Law
Environmental Biology
Environmental Chemistry
Geology
b) First Year Seminar - Environmental Science Technology and Law Science and Math Distribution Requirements - Environmental Biology and Chemistry (pending)

10) The Chemistry, Biology, Physics and Civil Engineering Departments offer or require courses on environmental topics for their majors as well as for Environmental Science majors and incorporate environmental issues into other major courses.

We are studying the feasibility/desirability of expanding our "environmental" majors to include not only Environmental Science but also Environmental Studies (a liberal arts major) and a business major with environmental emphasis. Courses introduced for these programs would also be available as electives for students in other majors and may fulfill distribution requirements, making them attractive options.

2a) General Biology II, Global Ecology,Principles of Biology, Earth Science, and Principles of Botany
3) Biology
Liberal Studies-Natural Science
5) "Other": Biology
It is a portion of their science required courses for the core courses.
1) I believe the best approach is to have the campus demonstrate environmentally sound and friendly policies and practices in their daily work.

2a) Environmental Biology

(We also have Topics in Biology which may deal with enviromental issues depending upon the instructor; finally we have required Freshmen and Senior Seminars which may contain environmental literacy issues depending upon the instructor.)
b) Biology
10) We have decided to focus on issues of reading, writing, research, oral communication and quantitative reasoning, US pluralism, non-western culture/language, and Global Studies in our Gen. Ed. program. Enviornmental Literacy as a topic is always a faculty option for Gen. Ed. courses, but not required.

2a) BIOL 354 Environmental Science and Conservation b) Biology

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2a) Fundamentals of Air Pollution
Topics in Environmental Science
b) Professional Studies – Math, Science, Computer Science track

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2a) BIOLOGY OF HUMAN CONCERN AS TAUGHT BY ONE PROFESSOR, BUT NOT THE OTHER TWO.IT IS ONE COMPONENET OF THE COURSE, HOWEVER
b) Biology
10) OUR BIOLOGY MAJOR HAS A TRACT WHICH ENVIRONMENTAL STUDIES STUDENTS CAN PURSUE, BUT IT IS NOT A SEPARATE DEGREE. BIOLOGY CLUB IS OFTEN INVOLVED IN COMMUNITY SERVICE PROJECTS THAT RELATE TO THE ENVIRONMENT

2a) CONSERVATION SCIENCE Conservation Science
CONSERVATION BIOLOGY
FIELD ECOLOGY Biology
U.S. ENVIRONMENTAL HISTORY History
ENVIRONMENTAL SOCIOLOGY Sociology
ENVIRONMENTAL ETHICS Philosophy
4) "Other": Conservation Science

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3) Environmental Science minor in Department of Biology and Chemistry

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2a) BIO 101 (life science—includes a section on ecology and environmental science)
b) Biology Dept.

1a) A variety of courses are available that meet this requirement.
b) Environmental Studies

2a) Environmental Chemistry
Ecology
Northwest Ecology
Urban Area Ecology
Introduction to Aquaculture

Biology 101 - Introduction to Environmental Science
4) Through our Biology Department we have a major in Environmental Science
10) We have a professor, Dr. *****, who is very active in working for more environmental awareness among our students and will work for more. He has co-authored a book on the subject and currently has a contract with MCGraw Hill to write a text in the area. I suggest that you get in touch with Dr. *****. He has many ideas.

2a) Environmental Science b) Biology major

2a) Ecology b) Science
10) The students in our Ecology class typically clean up streams and the beach, paint storm sewer signs, etc. For my info contact *****.

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10) Environmental issues are addressed in various courses by professors who have a special interest in this area. However, there is no systematic method to insure that all students deal with these issues.

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2) ENVIRONMENTAL LITERACY IS NOT A STAND-ALONE COURSE FOR US, BUT IN OUR EARTH SCIENCE COURSE, WHICH IS ONE OF THE CORE CURRICULUM OPTIONS, THERE IS A sUBSTANTIAL COMPONENT HAVING TO DO WITH ENVIRONMENTAL ISSUES.
a) Earth Science
4) WE OFFER THIS PROGRAM ONLY AT OUR BRANCH CAMPUS IN *****.
6) WE ARE CONSIDERING ADDING MORE EMPHASIS ON ENVIRONMENTAL LITERACY IN OUR CORE CURRICULUM BIOLOGY SEQUENCE.

2a) Environmental Science b) Division of Natural Science

1a) Natural Sciences 110 and 111 b) Core Curriculum

2a) Bio 103 -- Problems in the Environment b) Division of Science and Mathematics, Biology Curriculum
4) "Other": B.S. Biology--Environmental Track
10) Established Institute for Franciscan Environmental Studies; mission and goals available at http://www.quincy.edu/~edmisja/ifes.html

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4"Other": Earth and Environmental Science program, which offers majors in
Env. Science
Env. Biology
Env. Geology
Env. Chemistry
5) Minor in Env. Science or Env. Studies.

2a) (Concepts of Ecology); Marine
Ecology; Freshwater and Estuarine Ecology
b) Biology and Marine
Biology
4) "Other": 1. Environmental Chemistry
2. Biology with a Environmental Tack
3. Marine Biology
5) "Other": Chemistry
6) well this is my opinion

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10) While we have no plans to require an environmental studies course (I don't like your construct "environmental literacy" as it is asserting a great deal more than it should) we do have several courses in the curriculum (e.g. in philosophy, natural sciences, and political sciences) which are open to students and the courses are very well enrolled.

2a) Ecology & the Environmental Challenge

2a) Interdisciplinary Sciences

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10) I couldn't find an option above to provide the following information. We have a Master's in Earth Literacy. It is a graduate program, not a part of a college department. It is interdisciplinary, incorporating environmental science/biology, social scince and theology.

2a) INTRODUCTION TO ENVIRONMENTAL SCIENCE, ENVIRONMENTAL ADMINISTRATION
b) CHEMISTRY AND BUSINESS ADMINISTRATION
4) "Other": Environmental Chemistry (Chem Dept.)
Environmental Administration (Business Dept.)
10) WE OFFER A WIDE VARIETY OF ENVIRONMENTAL COURSES IN THE SOCIAL SCIENCES (ENV. LAW, ENV. ECONOMICS, ENV. POLITICS, ENV. ADMINISTRATION) AND IN THE HUMANITIES (LITERATURE AND HISTORY) AND SCIENCE (INTRO. TO ENV. SCIENCE). ALL OF THESE COURSES MEET CORE CURRICULUM REQUIREMENTS. WE ALSO COVER A SUBSTANTIAL AMOUNT OF ENV. TOPICS IN THE EDUCATION DEPARTMENT OFFERING. THEREFORE, MANY OF OUR STUDENTS TAKE AT LEAST ONE OF THESE COURSES DURING THEIR COLLEGE CAREER. WE ALSO HAVE OPPORTUNITIES FOR STUDENTS TO BECOME INVOLVED IN SEVERAL ENVIRONMENTAL PROJECTS IN THE AREA THROUGH THE ENVIRONMENTAL CLUB.

2a) Phil 2312 Environmental Ethics (meets philosophy requirement for all but business majors)
ESCI 1401 (science requirement for non-science majors)

2a) Introduction to Natural Resources b) Math and Science Division
4) "Other": Math and Science Division

1a) Environmental Science b) Science and Technology
10) The Environmental Science course is one in which all students are required to use notebook computers. Presentations make extensive use of the web. For further information, contact Steve Ellsworth or chuck levitan at sierranevada.edu or look at their web-site for the course at the above web-site, following the path: Academics/science/coursework

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1a) Environmental Issues

2a) BIOL 1073 (4) Environmental Science b) Division of Science

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Ms. Wolfe, below are my responses to your inqury. The Chairperson of *****'s Division of Natural Sciences and Mathematics is Dr. *****. Dr. ***** is very much involed in

environmental issues and is Involved with a variety of environmental projects at the College. He may provide additional information that you may find helpful.
2a) IHS 100 Environmental Health & Lab
B) It is offered as an option (1 of 2) to satisfy General Education requirement which applies to all students by the Division of Natural Sciences and Mathematics.

1a) PHY 131 Physical Science b) General Education

We do not have a environmental science major or any courses in environmental science. If I can be of any further assistance please do not hesitate to contact me.

2a) Environmental Science

2a) Environment and Society ENS
200 and Introduction to Environmental Science ENS 231
b) Department of Earth & Environmental Science
4) "Other": Environmental Chemistry
Environmental Biology
Math / Environmental Science
10) While the degree granting programs in Earth and Environment Science are unusually strong, the ability to require environmental literacy within an already crowded general education core is problematic. Thus, as with many school that offer environmental science degrees, Taylor University places "environmental literacy" as a option within the required core.

Our general course content (a la Miller, Charis, etc.) is supplemented by a strong ethics/stewardship component that stresses personal responsibility and the ability to respond individually and collectively.

---

3) Natural Science

2a) LS336 Ecology b) Biological and Physical Sciences
4) "Other": Natural History/Environmental Biology

2a) Science and Our Global Heritage b) Integrative Core Curriculum

---

1) A SCIENCE COURSE IS A PART OF OUR GENERAL EDUCATION REQUIREMENTS.

a) SEVERAL COURSES ARE POSSIBLE FROM EITHER SCIENCE OR ENGINEERING. THERE ARE OVER A DOZEN POSSIBLE.
4) "Other": BIOLOGY, CHEMISTRY, SCIENCE EDUCATION, PHYSICAL SCIENCE, ENGINEERING PROGRAMS

2a) IC 1113 PERSPECTIVES ON NATURE
IC 1223 PERSPECTIVES ON CONSERVATION
IC 21113 HUMAN ECOLOGY I
IC 3113 HUMAN ECOLOGY II
IC 4123 ENVIRONMENTAL STEWARDSHIP
b) THE UNITY ENVIRONMENTAL STEWARDSHIP CURRICULUM
4) "Other": ENVIRONMENTAL POLICY
PARK MANAGEMENT
ENVIRONMENTAL ANALYSIS
OUTDOOR RECREATION
URBAN AND COMMUNITY FORESTRY
FISHERIES
ECOLOGY
AQUACULTURE
CONSERVATION LAW ENFORCEMENT
ENVIRONMENTAL BIOLOGY
10) ***** COLLEGE HAS INTRODUCED AN ENVIRONMENTAL STEWARDSHIP CORE CURRICULUM WITH FIVE CORE COURSES THAT CONTRIBUTE TO ENVIRONMENTAL LITERACY FOR ALL STUDENTS. WE WOULD BE DELIGHTED TO SHARE OUR PROCESS AND OUR ENVIRONMENTAL LITERACY ASSESSMENT STRATEGIES WITH OTHERS.

***** COLLEGE IN MAINE HAS ADOPTED AN ENVIRONMENTAL STEWARDSHIP CORE CURRICULUM (SEE COURSES IDENTIFIED ABOVE) WHICH WE ARE IMPLEMENTING WITH THE SUPPORT OF THE DAVIS FOUNDATION, NEH, AND STRONG INSTITUTIONAL COMMITMENT. WE WOULD BE MOST PLEASED TO HAVE OUR WORK CONSIDERED AS YOU EXAMINE POSSIBLE MODELS OF ENHANCING ENVIRONMENTAL LITERACY FOR OTHER INSTITUTIONS. PLEASE CALL UPON US IF WE MIGHT BE OF ASSISTANCE TO YOU.

3a) School of Sciences in the College of Liberal Arts & Sciences
7) possible

2a) Intro to Environmental Studies

2a) BIO 227 Humans and their Environment

3) Science major, ES emphasis

2a) Human Ecology and Society Biology
Earth and the Environment Geology

2a) Introduction to Environmental Science
4) ES is a concentration within Biology program

---

6) Course: Environmental Science. Dept.: Biology. currently in the proposal stage and would count toward core requirements when approved.

2a) BIO 117 Environmental Biology for non-majors
BIO 305 Ecology
3) Biology
5) "Other": Biology

2a) BIO 205
Introduction to Environmental Sciences
BI220, Field Studies of the Caribbean
BIO 235, Delaware Coastal Studies
B) Biology (in collaboration with Environmental Sciences)
10) We've begun a curricular planning/assessment process with the question "what qualities do we want a ***** education to produce in our graduates?" Alongside the more traditional department-focused planning and assessment processes, the responses to this question have provided an over-arching set of student learning outcomes that we can begin using as a basis for assessment. Assessment results will show gaps--and I expect one of those gaps to reveal the need for greater attention to environmental responsibility. Meanwhile our Environmental Sciences program, that has for decades been making good use of our location that includes coastal ecosystems and complex freshwater ecosystems and watersheds, is expanding into a new Master of Science level that will allow graduate assistants in ES to contribute to the learning situation in all of our sciences.

---

10) Nothing to add other than we have an environmental studies major under consideration; as currently envisioned it would be a broad based interdisciplinary sequence with a reasonably firm basis in the sciences.

It is my understanding the Earlham College in Indiana introduces non-majors to environment issues and topics in an interesting way although I have no first hand familiarity with the program there.

1a) SEMINAR IN GLOBAL ISSUES AND AWARENESS
b) THIS IS AN INTERDISCIPLINARY COURSE, OFFERED BY FACULTY IN THE SOCIAL SCIENCES AND THE NATURAL SCIENCES.
10) ALL FRESHMEN AT ***** COLLEGE ARE REQUIRED TO TAKE THE GLOBAL ISSUES COURSE. THE CLASS INCLUDES A UNIT ON INTERNATIONAL DEVELOPMENT AND THE ENVIRONMENTAL IMPLICATIONS OF ECONOMIC DEVELOPMENT WORLDWIDE.

Appendix D

The Talloires Declaration

We, the presidents, rectors, and vice chancellors of universities from all regions of the world are deeply concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources. Local, regional, and global air pollution; accumulation and distribution of toxic wastes; destruction and depletion of forests, soil, and water; depletion of the ozone layer and emission of "green house" gases threaten the survival of humans and thousands of other living species, the integrity of the earth and its biodiversity, the security of nations, and the heritage of future generations. These environmental changes are caused by inequitable and unsustainable production and consumption patterns that aggravate poverty in many regions of the world.

We believe that urgent actions are needed to address these fundamental problems and reverse the trends. Stabilization of human population, adoption of environmentally sound industrial and agricultural technologies, reforestation, and ecological restoration are crucial elements in creating an equitable and sustainable future for all humankind in harmony with nature. Universities have a major role in the education, research, policy formation, and information exchange necessary to make these goals possible.

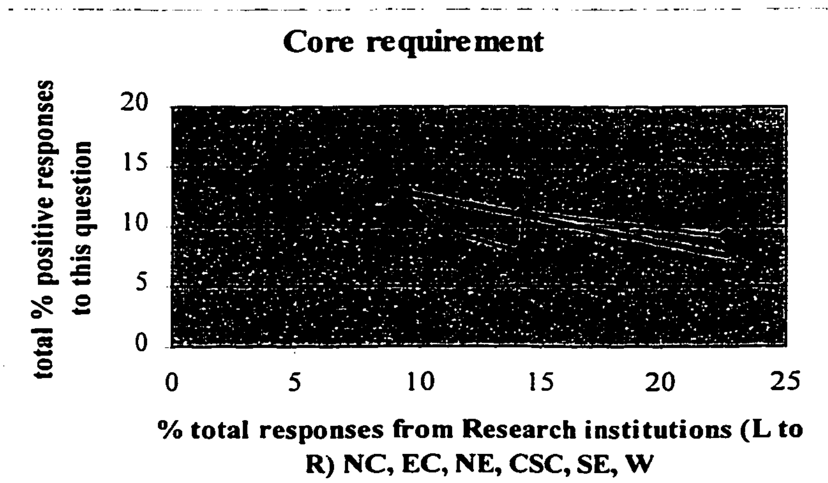
The university heads must provide the leadership and support to mobilize internal and external resources so that their institutions respond to this urgent challenge. We, therefore, agree to take the following actions:

1. Use every opportunity to raise public, government, industry, foundation, and university awareness by publicly addressing the urgent need to move toward an environmentally sustainable future.
2. Encourage all universities to engage in education, research, policy formation, and information exchange on population, environment, and development to move toward a sustainable future.
3. Establish programs to produce expertise in environmental management, sustainable economic development, population, and related fields to ensure that all university graduates are environmentally literate and responsible citizens.
4. Create programs to develop the capability of university faculty to teach environmental literacy to all undergraduate, graduate, and professional school students.
5. Set an example of environmental responsibility by establishing programs of resource conservation, recycling, and waste reduction at the universities.
6. Encourage the involvement of government (at all levels), foundations, and industry in supporting university research, education, policy formation, and information exchange in environmentally sustainable development. Expand work with nongovernmental organizations to assist in finding solutions to environmental problems.
7. Convene school deans and environmental practitioners to develop research, policy, information exchange programs, and curricula for an environmentally sustainable future.

8. Establish partnerships with primary and secondary schools to help develop the capability of their faculty to teach about population, environment, and sustainable development issues.
9. Work with the U.N. Conference on Environmental and Development, the U.N. Environment Programme, and other national and international organizations to promote a worldwide university effort toward a sustainable future.
10. Establish a steering committee and a secretariat to continue this momentum and inform and support each other's efforts in carrying out this declaration.

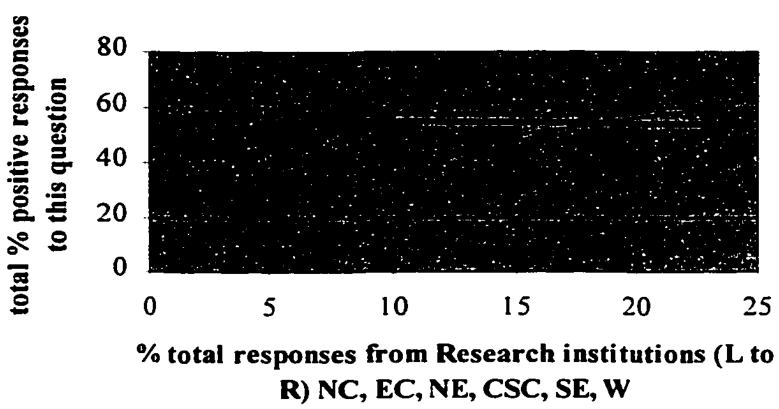
Appendix E

Regression Analysis of Correlation Between Proportions of Total Institutions Comprised by Research Institutions and Positive Responses to Survey Questions



Regression Output:	
Constant	16.45992
Std Err of Y Est	2.93669
R Squared	0.364099
No. of Observations	6
Degrees of Freedom	4
Slope	-0.93167

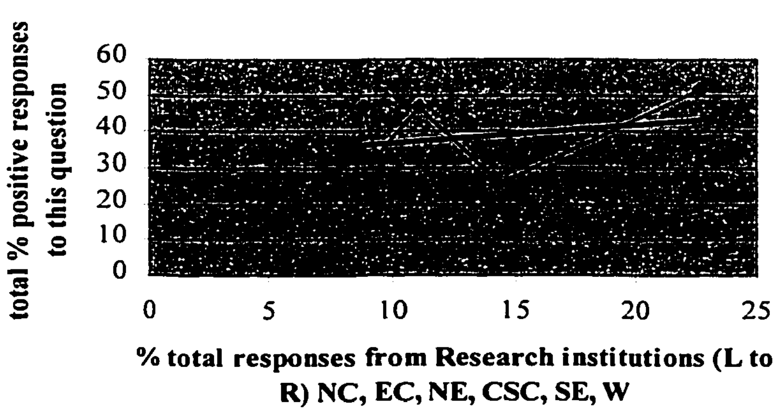
Core option



Regression Output:

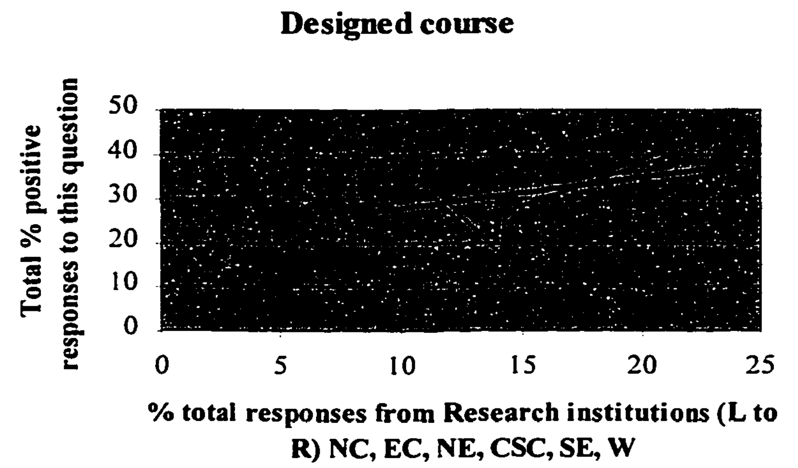
Constant	55.90977
Std Err of Y Est	8.192333
R Squared	0.004805
No. of Observations	6
Degrees of Freedom	4
Slope	-0.04799

Appropriate course



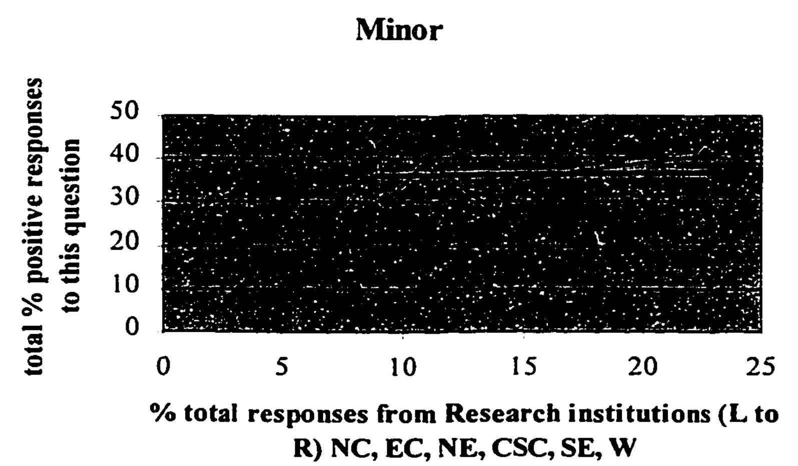
Regression Output:

Constant	31.47497
Std Err of Y Est	12.2497
R Squared	0.055031
No. of Observations	6
Degrees of Freedom	4
Slope	0.105853



Regression Output:

Constant	20.85165
Std Err of Y Est	8.629952
R Squared	0.173563
No. of Observations	6
Degrees of Freedom	4
Slope	0.249541



Regression Output:

Constant	35.4478
Std Err of Y Est	8.022026
R Squared	0.001868
No. of Observations	6
Degrees of Freedom	4
Slope	0.030607

Appendix F

Primary World Wide Web Sources Used in Chapter 2

The Pilot Program

A pilot program was launched in September 1996 to test the Watershed Education approach in local schools. In consorton with five Lorain County Schools, the program was implemented in three phases and concluded with the establishment of teacher-student projects at each site.

Rick Walton, Eighth grade teacher at Eastern Heights Jr. High School waters the plants for the garden with two students.

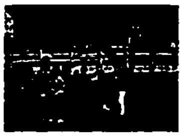
The 1996-97 pilot program was executed in three phases:

Watershed Research
During the fall semester, ten Oberlin students became familiar with the watershed through a combination of applied research, presentations by community organizations and field trips in the watershed. Independent projects focusing on local ecosystems, wetland restoration, and Black River monitoring were pursued by students.

Watershed Education Development
During the month of January, twelve students went through intensive education development which consisted of tours, discussions with local community leaders and teachers, and meetings with education specialists.

Watershed Education Outreach
At the start of the 1997 Spring semester, college students paired with participating teachers from five Lorain County schools to test watershed education approaches in their classrooms. Each classroom received a $600 grant from the Orion Society.

Oberlin Students explore Carlisle Visitors Center over winter term



Oberlin Students are trained in QHEI by Seventh Generation Staff along Plum Creek

Student-Teacher Projects:

A **litter clean up project** was initiated in Pat Foreman's Elyria High School class. The students focused on the portion of the Black River that runs adjacent to the school property.

A **bio-monitoring project** was established by John Katko's sixth grade classroom at Sheffield Middle School. The students were responsible for monitoring French Creek, which runs through the school yard, to determine the impacts of sewage effluent discharged into the creek.

Students from Tess Wearsch's biology class are conducting a **survey of a local wetland** that was recently preserved from development. Oberlin College students worked with the Avon High School students on basic tree and plant identification and wetland ecology.

A **community garden** project was initiated with Rick Walton's eighth grade class at Eastern Heights Jr. High School. Students designed the garden, planted seeds indoors, learned about organic food production and worked outdoors to start the garden. The project has continued into the summer, bringing children and senior citizens together.

Oberlin High School students from Gloria Kreischer's class applied basic environmental principles to the design of a **model ecological house** as well as a model sustainable farm.

Participants

A variety of community groups have partnered to develop the Black River Watershed Education Project. The participants include:

Common Ground
Common Ground is a non-profit retreat and conferencing center whose mission is to design programs that support community-building and leadership through an understanding of the natural environment. Common Groundwill provide staff-support and teacher training for the project.
Oberlin College Environmental Studies Program (ESP)
The ESP provides student-teachers, sponsors watershed research, participates in teachaer training and maintains a watershed education resource library.
Ohio Environmental Education Fund
A generous grant from OEEF has made possible a current projectto create a local land use issues focusing on issues in the Black River Watershed.
The Orion Society
This national organization promotes environmental literacy and place-based nature education. Oberlin College was selected by the Orion Society as one of five sites in the country to pilot the "watershed education" partnership program.

Other organizations include:

Lorain County Schools
Oberlin College Center for Service and Learning
Lorain County Center for Leadership in Education
Black River Remedial Action Plan (RAP) Coordinating Committee

"Throughout the semester I had a chance to help the students study French Creek which flows right across the street from the school. During the colder months, we facilitated indoor activities about watersheds, stream quality monitoring, macro-invertebrate identification and stream dynamics."
-Maya Thompson, Oberlin College Student

Fundamentals	Pilot Program	Participants	Into 2002	Teacher Resources	Photographs

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EFS Profiles

The Black River Watershed Education Project

Oberlin College
Oberlin, Ohio

Purpose: Community Involvement, Curriculum Change

The Watershed Education Project was conceived by the Orion Society in a unique partnership with Oberlin College and Seventh Generation, a Lorain County environmental organization. During the 1996-97 school year, watershed education was successfully introduced into the Lorain County School system through the collaborative efforts of ten Oberlin College students and five local teachers.

Watershed Education is an innovative approach to learning that encourages environmental awareness by engaging both college and secondary school students with their local places in the Black River Watershed. The watershed comprises the drainage basin of the area that drains into the Black River which includes 80% of Lorain County and a portion of Medina County. The Black River and its tributaries, woodlands, farmlands, and wetlands all provide the basis for a living curriculum that brings together a variety of disciplines and extends learning beyond the walls of the classroom. Watershed education is based upon place, interdisciplinary perspective, experiential learning and community problem solving.

The Pilot Program in 1996-1997

A watershed education pilot program was launched in September 1996 to test the watershed education approach in local schools. Working with five Lorain County schools, the program was implemented in three phases and concluded with the establishment of teacher-student projects at each site.

Before working with classrooms, ten students conducted independent studies on the watershed, focusing on such diverse topics as wetlands, water quality monitoring, watershed education, oral histories, and literature. The individual projects were supplemented by field trips and presentations by community members.

During Winter Term, a group of fifteen students toured the watershed and prepared sample watershed education lesson plans. Finally, during the Spring semester, the students were paired with five local teachers to begin testing watershed lesson plans and activities in the classrooms.

Student-Teacher Projects

Each of the students who participated in the project initiated a special project with each school. Here are some of the highlights for the projects:

- Katrina Hoffman and Anne Burnett worked with Pat Foremen's Elyria High School class to develop a litter clean-up project along the portion of the Black River that runs adjacent to the school.
- John Katko, a 1972 Oberlin College graduate, worked with Mya Thompson and Malaika Edwards to begin a biomonitoring project for his sixth grade classroom at Sheffield Middle School. The students were responsible for monitoring French Creek, which runs through the schoolyard, to determine the impacts of sewage effluent discharged into the creek.
- Students from Tess Wearch's biology class began conducting a survey of a local wetland that was recently saved from development. Nel Hanssen and Monika Hanneman worked with the Avon High School students on basic tree and plant identification and wetland ecology.
- A community garden project was initiated with Rick Walton's eighth grade class at Eastern Heights Jr. High School in Elyria by Sadhu Johnston and Sarah Kotok. Students designed the garden, planted seeds indoors, learned about organic food production, and worked outdoors to start the garden. The project has continued in to the summer, bringing children and adults together.
- Doug Chapman and Rosie Heriter worked with Oberlin High School students from Gloria Kreischer's class to apply environmental principles to the design of a model ecological house.

Watershed Education Into 1998

With a $50,000 grant received from the Ohio Environmental Education Fund (OEEF), the 1997-98 year will involve an expansion of the watershed education project. In August of 1997, Seventh Generation hired David Cornicelli to coordinate the development of the watershed education partnership between Seventh Generation and the college. Cornicelli, formerly a Project Manager for the Center for the Environment at Case Western Reserve University, will establish crucial linkages between college students, local school, and the array of organizations an agencies concerned with the environmental quality of the Black River.

To prepare college students for work with local schools in the watershed, a full-year course sequence was approved last Spring. The course features three sequences. During the first module of the Fall 1997 semester, seven faculty members will each give a lecture on a different aspect of the watershed, including Biology, English, Geology, Economics, Anthropology and Politics. Following this course, students during the second module will receive basic curriculum trainings and begin working with local teachers to refine the watershed education approach. During Winter Term, a group project focusing on place-based education will provide further preparation for the development of curricula focusing on the watershed. Finally, in the Spring semester, students will be paired with a local classroom and they will test and evaluate watershed lesson plans. This information will be compiled into a comprehensive K-12 curriculum, which will be developed over the next several years.

To supplement the development of this curriculum, students in David Orr's upper level seminar, Oberlin and the Biosphere, will conduct intensive research projects on the Black River Watershed next Spring. this information will be compiled during the summer of 1998 into a "State of the Watershed Report." A bioregional equivalent of the Worldwatch Institute's State of the World Report, this publication will feature literary expressions of the watershed, samples of public school student projects, a detailed natural history of the watershed, and a summary of current issues and potential solutions. This information will be formatted for the Environmental Studies Program's (ESP) site on the World Wide Web. Additionally, the ESP is working with the Office for Technology-Enhanced Teaching to consider the feasibility of producing a CD-ROM for high school on the watershed.

Greater teacher support for watershed education will be another priority for the partnership in 1998. In a teacher survey issued by Seventh Generation in 1994, teachers indicated a need for support for environmental education. Through OEEF funding, Seventh Generation will be establishing resources for teachers in the county interested in environmental education, including:

- Professional development for teachers that will enable them to receive graduate credit in environmental education.
- A network of teachers that are introducing watershed-based environmental education into their classrooms.
- A comprehensive watershed curriculum that is being developed by Oberlin College and Seventh Generation

to provide lesson plans and activities related to the Black River Watershed.

- An environmental education resource library that will be based at Seventh Generation and will contain materials and equipment that teachers can use in their classroom.

- Publication of "Stories of the Land" which included submissions from students and faculty participating in an intensive Winter Term project. A regular bioregional publication on the local watershed is scheduled to launch next Fall, with submissions from students, faculty, local school children and community members.

- A partnership with Seventh Generation and the Center for Leadership in Education to begin to develop a tele-community grant on the local watershed that would include a website accessible to local schools and a video conferencing service operated through the Environmental Studies Center.

For additional information:
Oberlin College Environmental Studies Program

Excerpted with permission from an article written by Manda Gillespie, '98 appearing in the Oberlin College Environmental Studies Program annual newsletter, September 30, 1997.

Related Second Nature database entries:
The Adam Joseph Lewis Center for Environmental Studies (EFS Profiles)

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Watershed Curriculum Teacher Resources

The Watershed Education project establishes partnerships between Common Ground, Oberlin College students and teachers, and offers many other resource opportunities. This year, as part of the project, a variety of programs are being established to help teachers gain access to an expanded repertoire of educational tools.

Professional Development for Teachers

Through an arrangement with Ashland University, Common Ground has established a professional development program that will enable teachers to receive graduate credit in environmental education.

Teacher's Network

A network of interested teachers (K-12) in the Black River Watershed, who are introducing watershed-based environmental education in their classrooms, is being formed. This network will give teachers an opportunity to provide input to the watershed curriculum that is developed and the educational resources that are acquired.

Comprehensive Watershed/Local Land Use Curriculum

Through the collaboration of the teacher's network, Oberlin College, and Common Ground, a comprehensive K-12 curriculum will be developed with lesson plans and activities related to the Black River Watershed and local land use issues. This effort is being funded by a generous grant from the Ohio Environmental Education Fund. The curriculum will include the geological, ecological, and social history of the river, contemporary issues that it faces, and solution-oriented projects, simulations, and activities. This curricula material will be available to all interested teachers.

Environmental Education Resource Library

This library will be held by Oberlin College and will contain curriculum materials that teachers can use in their classrooms.

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EFS Profiles

HERE@UW (Health and Environmental Resources for Educators)

University of Washington
Seattle, Washington

Purpose: Community Involvement
Please note that the copyright for this profile is retained by the institution.

HERE@UW stands for Health and Environmental Resources for Educators at the University of Washington. Their mission is to prepare future generations to make informed decisions about potential health risks from chemicals in the environment. The HERE@UW Program is part of the Center for Ecogentics in the University of Washington's Department of Environmental Health. Major funding is provided by the National Institute of Environmental Health Sciences, with additional funding from the Boeing Company and Rohm & Haas.

The HERE@UW program was created to design educational materials on environmental health and toxicology for the K-12 classroom. In July 1994, Dr. David Eaton and colleagues received a three-year grant from the the National Institute of Environmental Health Sciences (NIEHS) to develop an environmental health sciences curriculum for the high school grade level. That project, "Risky Business: Living in a Chemical World," consisted of a computer curriculum, a newsletter, and a consortium of project reviewers and supporters. Essentials of Cell Biology, the CD-ROM, is now in final revision and prepared for distribution. Feedback from reviewers of the 1,000 beta copies has been enthusiastic. The program provides a self-directed and animated overview of cell biology with numerous "Toxic Connections," examples of how chemicals can interact with biological systems to produce adverse effects. Topics covered in the program include: structure and function of organelles, DNA, RNA, protein, the cell cycle, mitosis, and meiosis.

In 1996, the program received another NIEHS grant, this time to develop and implement an Environmental Health Sciences Workshop for Educators. This provided an opportunity to further evaluate the "Risky Business" curriculum and distribute their newsletter, as well as expand their efforts to "train the trainers" to incorporate environmental health sciences concepts into their current curricula. It also gave them first hand experience with the workshop design process. Using a group of teachers as consultants, they tested the idea that teachers know best what works for teachers. The interaction of project staff with researchers and teachers has proven to be a fortuitous one, and the workshop design that resulted from this collaboration was met with overwhelming approval by participants. Richard Rohrbacher, a teacher from Chief Ivan Blunka School in New Stuyahok, Alaska wrote the following after attending the 1997-98 Environmental Health for Educators workshop: "I will never go back to teaching wellness the same way after taking this course. Using environmental health sciences as a theme is just a better way. Finally after all these years, kids got it!"

As the HERE@UW program completed Essentials of Cell Biology and began working on organizing their teacher workshops, they decided to take advantage of the rapidly evolving Internet and design a completely new set of materials that reflected recent developments in the fields of educational psychology, instructional design, and constructivist pedagogy. Work on their web-based curriculum, Project Greenskate, began in the summer of 1996. Those materials have been fully developed, tested and revised and are now ready for dissemination and elaboration. Use the link at the bottom of this page to go directly to Greenskate.

The HERE@UW program continues to grow and expand in new and exciting directions. In addition to their teacher workshops and curriculum projects, they are also organizing department Lab Tours, compiling a Speakers Bureau, and developing a resource kit, called Tox-in-a-Box, to inspire toxicologists to visit K-12 classrooms.

For additional information:
HERE@UW
Project Greenskate

Related Second Nature database entries:
Center for Environment, Education and Design Studies (EFS Profiles)

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Second Nature

Courses

Interpreting the History, Geology and Ecology of Monterey Bay

California State University at Monterey Bay
Seaside, California

Instructor(s): Moore, Steve
Subject area: Education
Department: Earth Systems Science and Policy; Service Learning Institute
Course number: ESSP 195 SL
Year taught: 1997
Level: Undergraduate

Interpreting the History, Geology and Ecology of Monterey Bay
ESSP 195 SL

Course Description

This is a 2-unit Service Learning option associated with ESSP 195: "Special Topics: The History, Geology and Ecology of Monterey Bay." Students will learn about Monterey Bay in the special topics course and will share their knowledge with K-12 grade children at local schools by participating in the Virtual Canyon Project. This project is an ongoing effort to develop an interactive, educational website to help school children learn about Monterey Bay, its deep underwater canyon, and the research process through which scientists learn about the bay and its inhabitants. Students in this service learning class will team up with students in another service learning class ("Tech Tutors") and go to the schools, where they will work with children to create fun and informative webpages that will become part of the Virtual Canyon website. In addition to the weekly class meetings, student will be required to do approximately 50 hours of service in the schools and will be required to participate in planning, contribute to group discussions, and write essays reflecting on their service learning experiences. This course is open to all CSUMB students, but is designed for non-science majors, especially those interested in teaching science at the K-12 level.

Course Prerequisites

Concurrent enrollment in ESSP 195: "Special Topics: History, Geology and Ecology of Monterey Bay."

Instructor

Dr. Steve Moore
Assistant Professor of Earth Systems Science and Policy (ESSP)
Email: steve_moore@monterey.edu (QuickMail)
Tel. 582-3775

Instructor Office Hours:
Tu 12-2 and W 3-5
Bldg 13 (the "purple pipe" science lab building), room 104

Course Time and Place

The regular meeting time for this class will be Tuesday afternoons, 4:00-4:50 pm, in Building 18 (Media Learning Complex), Room 118 (Distance Learning Room).

There will also be four mandatory Service Learning Breakfast Seminars from 8:30-10:30 am on Fridays: February 14, March 7, April 11, and May 9.

In addition, each student will be required to spend approximately 50 hours during the semester at one or more local schools assisting them with their part of the Virtual Canyon Project. The times and locations for these meetings will be arranged early in the semester based on student and school schedules.

Learning Goals

This course will enable each dedicated student to:

- Explain the scientific method fully and accurately.
- Help children understand and explain how scientists study and learn about the natural world.
- Explain one or more aspects of the history, geology, and/or ecology of Monterey Bay in sufficient detail to fill an informative webpage.
- Teach local school children about some of the natural and/or historic features of their very special Monterey Bay.
- Discuss the social and cultural implications and importance of inspiring children to explore nature through science.
- Explain the benefits of a collaborative project where

different individuals contribute different skills and knowledge to the benefit of everyone in the group.

Service Opportunities

Students in this course will assist children and teachers in local K-12 schools as they design and create their unique contributions to the Virtual Canyon Project. Specifically, the service learning students will serve as "content experts", providing inspiration, guidance, and "quality control" for the science information content in the webpages being developed by the school children. The school children will also be assisted by CSUMB students from the "Tech Tutors" Service Learning course, who will help with the technical aspects of setting up the webpages. Students will meet with their assigned school teachers and children at one (or more) of the local schools for about 4 hours each week of the semester, beginning in the third week.

Service Objectives

Teaching is one of the most effective ways to learn. Students in this course will have their learning in the parent course (History, Geology and Ecology of Monterey Bay) reinforced as they learn to explain it clearly to school children.

Students will become particularly versed in whatever specialized topic(s) their school kids are working on, since they will need to learn and teach the answers to all of the children's questions.

Through direct experience with teaching children, students will learn how to work with kids and will learn what some of the challenges of K-12 teaching are, and how to overcome them.

Students will experience, first hand, the joys and frustrations of teaching children about the wonders of the world they live in.

Students will reflect on the larger meaning and impact of this type of collaborative, service-oriented education, and of science education in general. Is science education at this young age important? Is this an effective method for doing science education? What is the impact on the children, teachers, schools, community, and service-learning student? Who benefits and why? Is anyone negatively impacted by this educational approach?

Grading

Your grade in this course will be based on the following:

Assignment	Number of times	Points each time	Subtotal
Dr. Moore's evaluation of your weekly reflection essays	10	4	40
Dr. Moore's evaluation of your Summary Reflection Piece	1	10	10
School Teacher's Evaluation of your contributions to the children's Virtual Canyon educational experience	2	10	20
School Children's evaluation of how friendly and helpful you were to them	2	5	10
Peer evaluation of your contributions to the class	2	5	10
Self evaluation of your contributions to the class	2	5	10
TOTAL	--	--	100

Grading will be Credit / No Credit. To pass this course you must do ALL of the following:

- Score a total of at least 60 points.
- Score at least 5 points on your summary reflection essay.
- Score at least 2 points on each of at least 9 regular reflection essays.

Attendance is required both in our classroom and at the school Service site. Although attendance is not listed explicitly as a criterion for grading, I will not accept a reflection essay about an experience or group discussion that you did not participate in.

All written assignments are due in the "IN" box beside my office door by 5:00 pm Friday of the week they are assigned. Absolutely no late work will be accepted unless you have received prior permission from me to turn the work in at a later date.

Tentative Schedule

Date	Activities to do at CSUMB	Activities to do in the K-12 school(s) that week (but maybe not on the	Assignments (Due in Steve's office mailbox Friday of same week!)

		date shown)	
Feb. 4	The Meaning of Service	.	Reflection #1: "On Service"
Feb. 11	To Reflect or Not to Reflect	..	Reflection #2: "On Reflection"
Feb. 14	Breakfast Seminar	.	.
Feb. 18	Intro. to the Virtual Canyon, kids and teachers	Meet the kids and teachers	Reflection #3: "First Impressions: Opportunities and Challenges"
Feb. 25	What are we doing here?: Learning from the kids	Hear what the teachers and kids need/want from us	Reflection #4: "Our Mission: What?, Why?, and How?"
Mar. 4	Group analysis of goals/resources/needs	To be determined by group	Prepare for seminar
Mar. 7	Breakfast Seminar	.	.
Mar. 11	Developing a group task list and timeline	To be determined by group	Reflection #5: "Individual Priority List and Timeline"
Mar. 18	Fine-tune group timeline	To be determined by group	Reflection #6: (Open)
Mar. 25	To be determined by group	To be determined by group	Reflection #7: "Evaluation of Direction and Progress to Date Relative to Timeline"
Apr. 1	Spring Break	.	.
Apr. 8	Discussion of direction and development of revised timeline	To be determined by group	Prepare for seminar
Apr. 11	Breakfast Seminar	..	.
Apr. 15	Fine-tune group timeline	To be determined by group	Reflection #8: (Open)
Apr. 22	To be determined by group	To be determined by group	Reflection #9: (Open)
Apr. 29	To be determined by group	To be determined	Reflection #10:

		by group	"Evaluation of Progress to Date Relative to Timeline"
May 6	Group reflection on challenges, progress to date, and implications of that progress; plan closure	To be determined by group	Prepare for seminar
May 9	Breakfast Seminar	-	-
May 13	Wrap-up discussion	To be determined by group	Summary Reflection Piece; Bake cookies for Ceremony!
May 20	Closing Ceremonies	-	-

Related Second Nature database entries:
Culture and Cultural Diversity (Courses)
Introduction to Service in Multicultural Communities: Education (Courses)
Introduction to Service in Multicultural Communities: Varied Issues (Courses)
French Creek Environmental Education Project (Methods)
Service-Learning Outreach (Methods)

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Northern Arizona Environmental Education Resources Center

Northern Arizona University
Flagstaff, Arizona

Purpose: Community Involvement

The community outreach programs at NAU include the following at the Northern Arizona Environmental Education Resources Center:

- The Wildlife Speaker Series: state, regional and national speakers are brought to the campus to provide information on wildlife topics to the community. Advertisements in the local newspaper and with local sportsmen's groups invite the community to participate. According to the mailing list about 100 members of the community do participate.
- The Wildlife After School Program: Beginning Environmental Education (WASP-BEE) Weekly activities are provided to children grades 3-6 after school. The program is staffed by undergraduate NAU students who organize activities and field trips for the children.
- A series of teacher training workshops have been held for local and state teachers.
- The resources center provides a collection of over 1000 environmental education materials to the public, especially teachers and non-formal environmental educators.
- The center also participates in a variety of community functions providing materials and activities for children.

Related Second Nature database entries:

Center for Sustainable Environments (EFS Profiles)
Critical Reading and Writing in the University Community: The Environment (EFS Profiles)
Northern Arizona University Environmental Education Resources Center (EFS Profiles)
Ponderosa Project: Faculty and Curriculum Development (EFS Profiles)
HBCU/MI Education for an Environmentally Sustainable Future Program (EFS Profiles)
Faculty Development for Environmental Sustainability in Higher Education (Biblio)
Partnership Work with Second Nature

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Environmental outreach programs to local elementary school

Clark Atlanta University
Atlanta, Georgia

Purpose: Community Involvement
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Clark Atlanta University has included community outreach as one of three major efforts in its EFS movement. As part of their outreach work, some faculty and staff conducted a "Trip to the Rainforest" with Oglethorpe Elementary School students in Atlanta. These students took a "journey" to Brazil's Amazon Rainforest. They were introduced to the culture, food, language and history of Brazil. The students also learned about the importance and critical need to preserve the rainforest. Computer simulated adventures, a replication of an airline trip, and an expedition down the Amazon river were also conducted.

Collette Hopkins reported recently that this rainforest program has expanded considerably thanks to extra funding from the EPA and Department of Energy. The program now focuses on bringing public school teachers to actual Central and South American rainforests in an effort to educate them to be able to run workshops for their colleagues. They market this trip and the workshops on Public Science Day. They eventually hope to open this trip to a small group of elementary students.

Other outreach programs included a Young Environmental Scientists (YES) Program which provided 4th and 5th grade students at Oglethorpe Elementary School with a series of intensive and exciting experiences in environmental sciences integrated with computer-based technological applications. Oglethorpe students were also involved in a "Hands-On Science Program" which exposed the students to simple engineering concepts from every day experiences. The goal of this program was to allow students to perform experiments that introduced them to various engineering disciplines such as Civil, Environmental, Electrical and Chemical.

For additional information:
Collette Hopkins, Ph.D.
Director
HBCU/MI Education for Environmental Sustainability Project
Clark Atlanta University
Email: chopkins@cau.edu

Related Second Nature database entries:
HBCU/MI Education for an Environmentally Sustainable Future Program (EFS Profiles)
Partnership Work with Second Nature

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Courses

Theory and Practice in Environmental Education

Pitzer College
Claremont, California

Instructor(s): Faulstich, Paul
Subject area: Education
Department: Environmental Studies
Course number: 146
Level: Undergraduate

Overview: This course will provide an exciting opportunity for you to assist in teaching elementary school children from diverse backgrounds about environmental concerns in our community. It is a component of the Leadership in Environmental Education Partnership (LEEP) designed to provide hands-on lessons in ecological issues, including habitat restoration, pollution prevention, and environmental justice. We examine innovative approaches to outdoor learning, and explore the theory and implementation of effective environmental education.

INTRODUCTION TO THE COURSE: PURPOSE AND CONTENT

Theory and Practice in Environmental Education is a service learning course in that you will learn not only through classroom instruction, but in your service to the community. The rewards and the demands of this course will be great: as both a student and an instructor, you will have a significant voice in the direction of your learning, the opportunity to make a positive difference in the community, and the empowerment to increase ecological literacy. And you will have fun! You also will be expected to work hard, to challenge yourself, to strive for excellence, effectively teach kids about nature, and to critically evaluate the goals of education. This course is designed to be a significant component of Pitzer's Social Responsibility Guideline, which requires each Pitzer student to participate in a service learning activity.

As David Orr (the author of one of our texts) points out, our ecological crisis cannot be solved with the same kind of education that helped create the problems in the first place. The way education occurs is as important as its content, and in this course you will be exploring effective alternatives to classroom learning. You will become a significant person in the education of a group of elementary school children; you will guide them in self-discovery, and help them make their own connections between things in the world and themselves.

Leadership in Environmental Education Program (LEEP)

This semester, LEEP will enable approximately 130 children from four elementary schools in Pomona and Claremont to study ecological and environmental issues at the Claremont Colleges' Bernard Biological Field Station. During eight-week units held over the semester, classes of children will visit the field station to study local ecosystems. Working under your guidance, the children will conduct environmental science projects at the station's outdoor laboratory and will learn about regional ecological concerns. They also will engage in cooperative problem solving and activities that build environmental responsibility.

The field station, used primarily by Claremont Colleges' students for field research, is an 85 acre parcel where the ecological interactions of plants and animals can be studied under natural conditions. The station harbors a variety of ecosystems including an aquatic habitat, a riparian zone, coastal oak woodlands, vernal pools, and coastal sage scrublands and includes a number of threatened Southern California native species. LEEP will enable school children, many of whom have limited access to natural landscapes, to learn about the ecology and biology of Southern California ecosystems. By working you, students will develop values and skills that will enable them to become successful stewards of the land and leaders in their communities. Participant schools have been selected, partly, on the basis of the ethnic diversity of students they serve.

In addition to providing school children with much needed environmental education, you will expose them to the college endeavor and serve as a role model and mentor. Heightened self-esteem, leadership, and the ability to see themselves in the college setting are among the positive impacts of the program. As you can see, your role is this course is decidedly an active one, and your engaged, passionate participation is vital to the success of this project.

At the end of the semester the participating schools will share the results of their learning with the larger community through an exhibition of their journals, photographs, art, and experiments in connection with the project. Along with community leaders, parents, and educators we will celebrate the learning and community impact of our collaborative effort.

AIMS OF THE COURSE

You will be expected to gain mastery in environmental education. You are expected to develop, through this course:

- comprehension of environmental education principles,
- a broad understanding of the local ecology,
- awareness of economic, social, and ecological interdependence,
- an ability to engage elementary school students in innovative environmental education activities,
- discernment of how Nature teaches,
- the skills to make earth education more effective, and
- the ability to encourage responsible patterns of behavior toward the environment.

COURSE REQUIREMENTS

One of the best ways to learn a subject is to teach it. Hence, you will immerse yourself in designing and implementing an outdoor, environmental education program. Your learning will be cooperative as well as self-driven, and your motivation, passion, sense of responsibility, and engaged, active mind are critical to the success of this course.

Students work in teams to develop and implement an environmental curriculum. Since you will be not only **taking** this course, but **teaching** as well, you must be prepared to devote significant time to LEEP. You will work in small groups on semester-long projects to develop outdoor education programs at the field station. In addition to our weekly class meetings, you will need to coordinate meeting times with your team members, and be available to lead weekly excursions at the field station. (The schedules for these will be worked out early in the semester.)

You are asked to fulfill a number of objectives, including:

- identify and/or create effective environmental education activities,
- organize these activities into a suitable environmental education curriculum, and
- teach this curriculum to an elementary school class through an eight week unit at the Bernard Biological Field Station.

You are expected, also, to keep a journal of your experiences and a portfolio of your activities. This will be a place to reflect on the successes and failings of your projects, to play with ideas, to develop activities, to collect class notes, and to be candid and self-reflective.

Your final grade will be based on your engagement in class and contribution to your team (we will ask for peer evaluations of your involvement in the group project). Participation will count for 50% of your grade. A mid-term paper and final group presentation and report will constitute the remaining 50%. Since the ability to effectively teach others is an expression of mastery in this course, your effectiveness as an educator and the originality of your curriculum are also bases for evaluation. We will base final grades on a comprehensive assessment of your engagement in this course.

FINAL THOUGHTS

We are unlikely to succeed in appreciating and restoring the natural environment if we lack the knowledge and passion to restore human communities. Together with the participating elementary schools, this course will address both of these critical concerns. Revitalizing communities is key to ecological health and social harmony. The Leadership in Environmental Education Partnership will foster values of community involvement and land stewardship among children, college students, and educators. Your participation in this partnership will be a gift to the community and challenge to yourself.

THE COURSE:

Required Texts:

- Earth in Mind, David Orr
- The Geography of Childhood, Gary Paul Nabhan & Stephen Trimble
- Project Learning Tree Environmental Education Activity Guide
- Reading Packet

SCHEDULE

DATE	TOPIC	READINGS
Jan. 25	Introduction to the Course; Field Station Walk-Through	.
Feb. 1	Lorrae Fuentes; Project Learning Tree Workshop Climate Geology	Earth in Mind, Part One Reading Packet, "Education in a Changing World" & "Getting to Know your Students"
Feb. 8	Pedagogy Workshop Sharing the Joy of Nature Pond Life Coastal Sage Scrub	Reading Packet, "What is Interpretation?" & "Practicing Interpretation" Geography of Childhood, "A Child's Sense"

Feb. 15	Preparation for Classroom Visits Teaching Techniques Learning Theory Cognitive Development	Reading Packet, "How to Prepare and Present A Guided Tour," "Teaching Tips," & "Planning for Outdoor Learning"
Feb. 22	What is Education For? Ecology Animal Behavior	Earth in Mind, Part Two Reading Packet, "Educational Reform" & "Beyond Ecophobia"
March 1	Teacher's Perspectives Watersheds Ethnobotany	Earth in Mind, Part Three
March 8	Cultural History Nature Awareness Team Conferences	Earth in Mind, Part Four Reading Packet, "Earth Education" & "Ed. Models of Community"
March 15	Spring Break; no class	.
March 22	Environmental Restoration **Mid-Term Paper Due**	Reading Packet, "Education in Change" Geography of Childhood, "The Scripture"
March 29	Childhood Experiences Using Narratives Tracking & the Art of Seeing	Reading Packet, "The Primary Years" Geography of Childhood, "Going Truant"
April 5	Team Reports Ecological Art	Reading Packet, "Toward an Ecological View of Intelligence"
April 12	Class Hike	Geography of Childhood, "Land of One's Own"
April 19	Environmental Education; What are the Pieces?	Geography of Childhood, "Children in Touch" & "A Wilderness, with Crows"
April 26	Student Presentations	Geography of Childhood, "Learning Herps" & "Sing Me Down"
May 3	Student Literacy	.

Related Second Nature database entries:
The Leadership in Environmental Education Partnership
(EFS Profiles)

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The Center for Environmental Education and Environmental Service-Learning

Washington State University
Pullman, Washington

Purpose: Community Involvement, Curriculum Change

The Center for Environmental Education's mission is to:

- foster public education and participate in environmental problem-solving; and
- sponsor action-based teaching and research, using our own regional problems as concrete case studies in environmental education.

Our success will be determined not only by how many students participate in and learn from environmental education projects, but also in terms of our progressive problem-solving in participating communities: improving water quality, reducing erosion, increasing environmental awareness, creating stronger organizational alliances and enhancing the quality of life.

The Center for Environmental Education has been proposed as part of the Thomas S. Foley Institute for Public Policy and Public Service. The Center operates as an outreach conduit, focusing WSU resources and educational activities on studying and addressing regional problems.

Watershed Projects

The watershed projects mission is to provide resources for K-12 students, educators and the area communities. It is also for those interested in restoration of these particular regions and as a resource for future restoration projects. We hope, with your help, to make available all the information anyone would need to set up and run a restoration project, to run environmental education activities and to link with resources for environmental education in the region. We are also attempting to post information otherwise inaccessible to the general public. Most studies and reports written about watersheds are buried in library archives and the storage rooms of government agency offices. No general release of water quality information or of other information pertinent to understanding the ecological state of the region has occurred in a form generally accessible to the public. We are attempting to synthesize and popularize all sources of information -- government reports, WSU databases, graduate student theses, etc. -- for release on the Center's website.

Environmental Project Program

Over the past three years the Center for Environmental Education and the Community Service-Learning Center at Washington State University have been developing an environmental service-learning program -- the Environmental Project Program -- as a field-based environmental education program involving both K-12 and university students. This program involves students in stream, prairie and wetlands restoration projects as educational activities. In the last four semesters over 2200 WSU students and several hundred elementary age students have participated in environmental service-learning projects that have planted over 30,000 trees and shrubs into local creeks and wetlands, restored acres of grasslands, and built bioengineering structures to stabilize eroding stream banks. These projects have transformed the local landscape, with ever increasing impact as the trees and shrubs continue to grow, and they have proved to be effective in teaching about environmental problems, environmental knowledge and in changing attitudes and promoting active participation in solving problems. Our experience has found environmental service learning to be a powerful tool to transform both the land and the culture as part of a broader environmental education initiative involving every age of student, from preschooler to graduate student.

Choosing a Problem: Poor Water Quality, Habitat Loss and Cultural Misunderstanding

We started the Environmental Projects Program by identifying a community environmental problem. The problems that we initially have focused on include poor water quality, a continuous decline in habitat for both land and aquatic species and a general cultural lack of connection, understanding or concern about the region -- which for us, is the Palouse River watershed in Eastern Washington and Northern Idaho, and more generally, the Columbia Basin.

The most significant water quality problem in our area of the Columbia Basin is sediment load. The Palouse River dumps millions of tons of soil into the Snake River each year. For months at a time the water runs muddy, and during storms the water often runs a deep chocolate brown, and has a texture closer to mud than water. The muddy water reflects a combination of factors: lack of stream side plants -- trees and shrubs especially, which act like filters to reduce the amount of soil that erodes into the stream. Stream side plants also stabilize stream banks, reducing channel erosion. The muddy water also reflects the level of erosion occurring in agricultural fields, construction sites, during road construction, and other disturbances and human land uses in the watershed...

Habitat losses have been continual and comprehensive in the Palouse River watershed. With 83% of the 2.1 million acres watershed in agricultural production and most of the remainder in buildings and pavement, little remains of the once vast grasslands and shrub and tree lined streams of the area.

Despite over a decade of the South Fork of the Palouse River being designated the most polluted river in Washington State, and despite the obvious, ubiquitous evidence of its degradation, little public concern has been expressed. A 1990 survey of 246 farmers in the area found that only 28% thought that erosion was causing pollution problems in streams, and only 21% thought that silting up of rivers was a serious problem (Carlson, et al., 495). If people don't perceive a problem, they are not going to take efforts to address the problem. This lack of concern and knowledge about the environmental conditions of the watershed indicate the need for a broad educational initiative.

Creating Partnerships

After identifying the problems, we joined forces with local groups, such as the Palouse Conservation District, to pool resources and expertise. As the program has developed these partnerships have only become more extensive. Community partners provide a grounding to the program, helping identify short-term and long-term projects and providing resources otherwise unattainable. Community partners also can provide help by setting up and running projects, by directing locally focused research, and by helping with educational components of the projects. Through partnerships, students gain access to non academic viewpoints and see various professions and orientations towards issues in action.

Planting, Bioengineering and Environmental Education

The tried and true standard for environmental service projects is the planting project. Almost everyone enjoys a planting project. Planting is a very tangible process that leaves a visible result which grows with each passing season. We have planted a variety of types of projects: wetlands, streams, uplands, and prairie, and in a variety of locations from in the mountains, to out on the Palouse. On some of these projects we salvage native plants from sites where future disturbances will destroy the plants...

Most of our projects have focused on planting trees and shrubs into the flood plains and on stabilizing eroding slopes. Trees and shrubs stabilize stream banks, and they provide a filtering function to slow down and filter storm runoff. Many crucial water quality parameters --

temperature, dissolved oxygen, pH, and turbidity, for example -- will never significantly improve without at least partially rebuilding a canopy over the rivers and streams in the watershed.

We also have focused on building bioengineering structures to stabilize collapsing stream banks. Bioengineering involves the use of living materials for structural purposes rather than materials such as concrete or riprap... Last year we received a Department of Ecology 319 Grant to build and demonstrate a variety of bioengineering structures over a three year period. We have experimented with revetments, brush mattresses, fascines, live stakes and posts, and vertical bundles. Our largest projects have been to build revetments. In our approach, we anchor large pieces of trees and shrubs into the toe of a collapsing stream bank. The branches deflect and slow down the water, breaking the force of the current before it eats into the bank, and allowing sediment to filter out to rebuild the toe of the bank. After the revetment has been built, we auger holes throughout the area and plant dogwood and coyote willow throughout the structure. As the brush weakens and decomposes the planted shrubs grow to stabilize the bank vegetatively... These projects have always been accompanied by extensive planting projects to revegetate the entire stretch of stream...

These projects provide excellent environmental education opportunities to discuss environmental science issues such as hydrology, watershed functions and ecological systems; and they provide a concrete situation within which to discuss cultural issues such as different understandings of flood plains, the political and cultural siting of projects, the need for volunteerism, and the land use and environmental history of the area.

Structural to all of these projects is the environmental education focus. These projects are usually preceded by a presentation in the classroom that covers the history of the area, and of specific problems, and that explains the strategies of the projects. Presentations focus on discussing land use, economic and cultural aspects of problems, or other topics as adapted to the particular course which is participating. We also begin each project with a 15-30 minute presentation or discussion, depending upon group size, to discuss the ecological and cultural aspects of the projects. Our crew usually has 5 to 9 leaders on a project, and 30-60 student volunteers. We encourage one-on-one and small group discussions while we work, to further discuss and process the service experience and the cultural and environmental context within which the project is situated. The content of these presentations and discussions varies according to the specific context of the site and volunteer interest.

Reflection

Reflection is also an important part of service experiences.

Through reflection students process and complicate their experiences. Often, learning experiences will not be processed thoroughly by the students unless reflection is encouraged. Reflection is incorporated in a variety of ways, both in the activities themselves, and in the classroom. Informal discussions during projects are one arena where students synthesize information and process their experiences conceptually. Additionally, many instructors require reflective essays about the experiences. These range from one page hand-written responses/evaluations in an Environmental Sciences Course, to extensive research and writing projects in Writing courses. Probably most common is the short personal reflective essay. Providing opportunities for reflection increases the impact of the field experiences and brings the experience into the classroom to deepen the interaction of student with academic content.

Service-learning experiences often work as capstone experiences in which students realize why particular skills or knowledge is important, and in which they reconceptualize abstract knowledge by contextualizing it with hands-on experience. Barbara Milton, Eliza Cleveland and Dianne Bennett-Gates assessed the impact of environmental service activities on K-12 students. They found that these experiences improved the students' ability to understand science back in the school classroom. These projects also raised self-esteem, which resulted in the students putting more effort into learning all subject areas. The teachers noted that the children behaved better in school. They found that their effort to instill responsible behavior led to positive attitudes, a sense of responsibility and personal efficacy.

Our own assessment efforts have shown that many students experience environmental service learning activities as synthesis activities that bring together and create meaning for their academic experiences. These synthesis experiences range from students who express that for the first time they understand why environmental issues are relevant to students who describe being better able to understand content in sciences courses because they now have an authentic context within which to understand what they are learning. For other students the experience does not have such a deep impact. Instead, the activities broaden student learning experience, providing a new type of data in their understanding of the world, without necessarily impacting their frame of reference.

Other Types of Activities

Community service learning is not just one type of activity; it includes a variety of strategies, not all of which include physically laboring to improve a situation. Carol Kinsley describes how one group of students researched the environmental effects of Styrofoam and then presented their research to the school committee. As a result of their presentation paper products were substituted for Styrofoam in the school cafeteria. Research, if it is applied to local problems and is presented or available to the public, is service learning. Another approach that we have developed is to involve the students in publicly presenting their work on the Internet, and so making their research projects available to the public as a resource. Crucial to making this type of project successful is connecting the students to actual research needs. We have set up opportunities for students to meet with community groups and others to ask them about their needs. Projects then focus on solving a problem through research. This context of generating research for an actual need rather than simply to demonstrate knowledge changes the ways many students approach their projects. They become more engaged in the projects because they know people in the community will read and use the project they develop rather than simply putting it in a file folder and saving it for the recycling bin after graduation.

Environmental service learning is not the end all of environmental education, and the classroom will always be an important location for teaching. But, as a teaching method that is integrated into a broader educational initiative, it offers opportunities for students to synthesize learning and to engage in meaningful problem-solving. In our experience, it is also a powerful means of directly engaging and impacting individual understandings and behaviors. As such environmental service learning provides the means to reach many commonly held goals for environmental education which traditional teaching methods have been unable to meet. Its benefits can be measured not only in educational objectives, but in cleaner water and air as students not only learn about environmental problems, but address them throughout the learning process.

For additional information:
Center for Environmental Education
Service-Learning for Environmental Education and Cultural Change

Related Second Nature database entries:
Center for Multiphase Environmental Research (EFS Profiles)

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Forest Watch: Education Outreach and White Pine Research

University of New Hampshire
Durham, New Hampshire

Purpose: Community Involvement
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Forest Watch has been an innovative and highly successful education outreach program for the study of white pine health in New England. Researchers at the Complex Systems Research Center at the University of New Hampshire (UNH) initiated this program to involve primary and secondary students in the collection and processing of data relating to air pollution damage in forest stands. Students participate in three types of authentic science activities in Forest Watch:

1. forest stand assessment,
2. laboratory-based assessment of damage symptoms, and
3. image processing/data analysis of Thematic Mapper data for the area around their school.

Participating schools select a permanent sampling plot in a pine stand and conduct several ecological and biophysical measurements using specific scientific protocols developed at UNH. Results to date show that students can collect valuable data from a scientific standpoint and that the program is educationally beneficial -- students learn science and mathematics by doing research in their local area.

Forest Watch currently includes over one hundred K-12 schools and study plots across New England, allowing UNH to conduct a regional analysis of white pine health. Student data are compared to spectral data collected from samples sent to UNH, and the student and spectral data are compared to tropospheric ozone data collected from state and Environmental Protection Agency (EPA) air quality monitoring sites throughout New England.

The Forest Watch program consists of many objectives. These objectives are both educational and science oriented. They have been set to provide the guidelines for what Forest Watch should provide for educators, students and the scientific community.

Educational Objectives

1. Engage K-12 students in authentic science by participation in a Student-Scientist Partnership.
2. Provide hands-on measurement activities which use scientific and technological tools in the classroom to contribute meaningful data to research scientists.
3. Enhance higher-order thinking skills by introducing students to local, regional and global science issues.
4. Develop data analysis and communication skills.
5. Provide integrated activities which encourage a team-work environment.
6. Offer pedagogical strategies to meet state and national standards in science and mathematics.
7. Affect a positive change in student attitudes and aptitudes for science and mathematics.

Science Objectives

1. Determine parameters needed to assess white pine health at both the local and regional level.
2. Correlate student physical measurements with spectral measurements made of needles.
3. Compare physical/site parameters and spectral measurements with regional tropospheric ozone data on both a spatial and temporal basis.
4. Document the use of white pine as a bio-indicator for use in future research studies of the health of New England forests.
5. Develop a long-term database of ecologically important variables for use in future research studies of the health of New England forests.
6. Assess health using a site index.

For additional information:
The Forest Watch Program

Related Second Nature database entries:
Sustainable Living Class (EFS Profiles)

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Research : Outreach : Schoolyard LTER

The Schoolyard LTER Program with the Sevilleta Long-Term Ecological Research Program

Program Director: Prof. Clifford S. Crawford
Department of Biology, 167 Castetter Hall
University of New Mexico
Albuquerque, NM 87131-1091
ccbosque@unm.edu
Phone: 505-277-3412
FAX: 505-277-0304

Schoolyard LTER Program Description

The Sevilleta's Schoolyard LTER Program is directed by Dr. Clifford S. Crawford, who has established our educational outreach program known locally as the "Bosque Ecosystem Monitoring Program" (BEMP). The major focus of this educational program is on the Rio Grande riparian cottonwood-forest ("bosque") corridor through central New Mexico (including the Sevilleta National Wildlife Refuge). The project report for BEMP for 1997-2000 describes activities in detail and reports some results of the study.

Program Overview:

The Sevilleta LTER Program has conducted a number of research studies in the Rio Grande bosque at Sevilleta NWR and other local sites, and due to its popularity with, and importance to, New Mexican populations (particularly schoolteachers and K-12 students), we have chosen this particular ecosystem in which to develop the Schoolyard LTER.

The BEMP has four main educational goals. These are to:

1. involve students and citizen volunteers of all ages in the coordinated monitoring of key processes and populations of the endangered Middle Rio Grande riparian forest ecosystem;
2. enable these participants to "learn by doing" about the natural history and ecology of the bosque near their communities;
3. use these students and volunteers to convey to their communities an appreciation of the scientific and social significance of long-term environmental research;
4. give the students and informed citizens an opportunity to become involved in the management of a critical environmental resource.

The BEMP uses mainly secondary school teachers and their students to collect data relevant to the long-term management of bosque functioning. Data collection occurs synchronously and according to a predetermined schedule.

Thus, a given set of variables is sampled on the same date at all four current BEMP sites. The sites are identical in layout and located between northern Albuquerque and the smaller city of Belen, NM, near the Sevilleta NWR.

Site specific, abiotic data collected include soil and air temperature, precipitation and groundwater depth. Biotic data include litter production, plant diversity and indicator arthropod activity. Years of restoration related research on the bosque by UNM biologists have demonstrated the value of such data types and the relative ease of collecting them in the field.

In addition to the Director, the program is staffed by two coordinators and a data manager. The coordinators are biologists and educators associated with Bosque Preparatory School in Albuquerque, which pays the release time salary of one of them.

Program interns have recently become an essential part of the BEMP. The 1998 Schoolyard supplement grant made it possible to award stipends to two of the most experienced interns. Another intern has an Undergraduate Mentorship Experience in Environmental Biology stipend awarded through the Sevilleta LTER.

Each BEMP intern is assigned to work with site representatives (usually secondary school teachers) and individuals (usually their students) who collect the monitoring data following a brief period of training.

Interns are responsible for supervising data sampling and for bringing sample material and field data records to UNM, where some additional sample treatment is performed by specially trained interns.

The data manager then enters the data in a UNIX system operated by the Sevilleta LTER. Following data analysis, the data manager, in consultation with the director, will disseminate pertinent results to school classes, as well as government agencies that have managerial responsibility for the bosque and the Rio Grande; hence, the data from the Schoolyard LTER program actually is applied to real-world management issues.

NOTE: Web sites external to the Sevilleta LTER will appear in another browser window.

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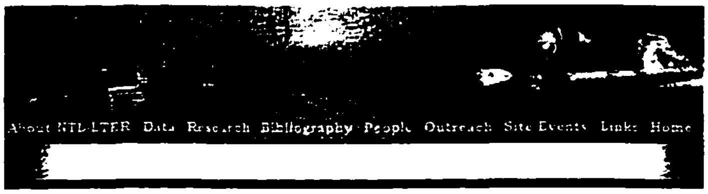


North Temperate Lakes Schoolyard LTER Project

Mission

Effectively connecting university research with K-12 teachers and students is an exciting and challenging opportunity with considerable potential mutual benefit. This is at the very heart of the Wisconsin Idea. SchoolYard LTER Limnology Explorers was designed to develop the infrastructure and human resources of the UW-Madison necessary to effectively transfer resources, tools, and technologies from an internationally recognized research program to K-12 teachers and students in Wisconsin.

History

In 1998, University of Wisconsin-Madison's Center for Limnology (CFL), North Temperate Lakes LTER (NTL-LTER), and Center for Biology Education (CBE) developed an NSF supplement proposal as part of a new initiative within the NSF to develop educational activities at LTER sites around the country. Our strategy was to begin with a small pilot, to carefully evaluate activities and outcomes, to gradually increase the funding base, and then to expand the project, as funding permitted, based on formative feedback from participants.

Activities

The SchoolYard LTER (SYLTER) project has steadily developed from the pilot we began with elementary school teachers at two schools in 1998. Initially staff worked with a small group of interested teachers (6) at one elementary school in northern WI (Arbor Vitae-Woodruff) and one in southern WI (Country View Elementary, in Verona, WI). Staff and teachers developed strategies, materials, and protocols to help students begin ecological measurements of lakes or ponds near their schools. We expanded the project in 1999 to include middle school teachers and students in both professional development and enrichment activities. Activities include research at or near their school and winter limnology field experiences at the Trout Lake Station in northern WI and at the Center for Limnology and Lake Mendota in southern WI.

In 1998, UW-Madison's Center for Limnology (CFL), North Temperate Lakes LTER (NTL-LTER), and Center for Biology Education (CBE) faculty, staff, and students provided science enrichment opportunities for 60+ students in Arbor Vitae-Woodruff, near the Trout Lake Station, and 40+ students from Country View in Verona, WI, near the Center for Limnology. In subsequent years, we have continued to provide enrichment opportunities such as these for students and have expanded our outreach activities to include professional development opportunities for teachers.

We have expanded activities in northern Wisconsin to include middle school students and teachers while continuing to provide enrichment for elementary school students. Activities in 1999 and 2000 involved approximately 100 students and 9 teachers (grades 3-7). Middle school students participated in hands-on activities as part of the NTL-LTER Limnology Explorers. This program included field experiences at the Trout Lake station combined with small group and independent student research investigation mentored by NTL-LTER scientists.

In 1999, CBE staff and NTL-LTER staff developed a Saturday

Enrichment Program for students in grades 5-8 in partnership with the UW-Madison School of Education (SOE) Outreach. Activities used winter limnology research techniques and protocols in a series of science enrichment experiences for students from Dane Co., WI. CBE staff, NTL-LTER staff and UW-Madison undergraduate science majors led activities. This program was repeated for a new group of students in 2000. Additionally, the program was expanded in northern WI, to include middle school students and teachers from 5 schools. Activities include winter limnology field experiences as well as science clubs at each of the schools.

We have leveraged previous NSF supplement funds in two successful **Dwight D. Eisenhower Professional Development Program** grants, closely allied with our SYLTER, awarded to Dr. Robert Bohanan at the Center for Biology Education. The first, **SchoolYard Science: Inquiry-Based Workshops and Research Experiences for Middle School Teachers (SYS) 2000-2002** has provided summer research experiences, curriculum development, and pedagogy workshops for teams (1 learning coordinator, 2 science/math teachers, and an education major) from 5 middle schools in the Madison Metropolitan School District. SYS was recently renewed and will work with teams from 5 new middle schools in 2001. Approximately 150 students, 14 teachers, 5 learning coordinators, and 5 education students participated in SYLTER from the Madison-area in 2000. As part of the SYS professional development activities, we have created a web resource, **School Yard Science**, for teachers and students to share their ideas and have assembled several educational links and resources.

The second recently funded project, **Teacher Leadership Professional Development Project: Creating School-Based Leadership Cadres to Adapt Exemplary Science Curriculum to Foster Student Inquiry (TLPDP) 2002-2004,** builds upon the professional development model and long-term ecological student inquiry pedagogy and engages middle school science teachers, administrators, university faculty, staff, and students in a 2 year project to create cases for student investigation based upon local and regional LTER data.

SYLTER activities included a 4-week Winter Limnology workshop for 15 students grades 5-8 conducted at the Center for Limnology. The course was led by Center for Limnology and CBE staff and students in partnership with the UW-Madison School of Education Outreach Saturday Enrichment Program. Participant evaluation surveys collected from parents and students were excellent. A similar program is planned for 2002.

Some specific outcomes and findings from SYLTER activities include:

- a year-long field and laboratory investigation in one school developed around the theme of understanding ecosystem dynamics and processes of a pond in an urban watershed
- professional development workshops and seminars that combine science content (biodiversity, ecosystem service, population dynamics), research design (quadrats, subsampling, mark-recapture), and inquiry-based teaching
- student generated research projects that established baseline data; including presence/absence, distribution, and phenology at habitats near their schools
- student research reflected an iterative cycle of posing questions, collecting data, evaluating evidence, and posing more sophisticated questions
- student research included observational and empirical approaches
- cross-grade collaboration occurred among teachers within a school and across the district
- student research was more sophisticated and iterative when it was imbedded throughout the year rather than in isolated units of instruction
- student research questions were more sophisticated when classroom design included discourse among students and also with content experts (e.g. ecologists, botanists, etc)
- teachers developed rubrics for assessing student investigations
- rubrics emphasized two developmental aspects
- the first emphasized the nature and types of questions (e.g. appropriate terminology, intelligent and communicable, testable)
- the second emphasized conceptual understanding of scientific evidence (e.g. data related to the question, empirical, reproducible)

Future Directions

Near-term plans include the continuation of the activities described above. We will focus our efforts to work with teachers and NTL-LTER staff to produce instructional materials or cases modeled after the Ecoscenarios developed by the Lawrence Hall of Science Full Option Science Systems

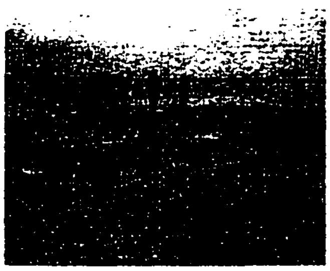
(FOSS) for our school yard-based student investigations. Materials will be disseminated primarily through our web site and linked to K-12 educational resources on the Center for Biology Education web site. Project activities and results will be presented at the Ecological Society meetings in 2002 and state and regional teacher conferences (Wisconsin Society of Science Teachers, the Madison Area Science Forum, BioNet, and the regional National Science Teachers Association conference).

Surveys and interviews with several focus groups which included middle and high school teachers and administrators, faculty and staff from the biological sciences, curriculum and instruction, and education psychology stressed the importance of integrating student inquiry into the middle school science curriculum.

'Cases' or ecological scenarios modeled after FOSS materials that are based on lter research and data will be excellent models for real-world ecological problems. We think that students will learn best to understand complex scientific phenomena such as changes in the diversity of life if they study them in the context of local examples and build an understanding from their own observations and research of habitats near their school. Participants in our planning suggested that cases such as those we propose would effectively engage students in problem-solving and critical-thinking using scientific data and research to help students understand complex phenomena such ecosystem structure and function, nutrient dynamics, and biological diversity. Participants felt that it was equally important to help teachers and their students develop competence with the underlying mathematics associated with ecology (logistic versus exponential growth, survivorship, trophic models) and with basic statistics (graphical analysis, distributions, measures of central tendency, and deviation).

SYLTER activities will also emphasize developing tools and strategies for using NTL-LTER lake data from archives and from the Buoy project in classrooms. The Buoy project is a remote underwater sensing system that can capture real-time data for a number of biological and chemical attributes of lakes. The Buoy project affords interesting opportunities for students and teachers to access and use both real-time and archived data on 2 lakes in northern Wisconsin. SYLTER staff will work closely with NTL-LTER staff to develop effective tools for K-8 students and teachers to access and use data. Currently, few teachers make use of the extensive LTER databases. SYLTER staff will develop instructional guides for using real-time data from the Buoy project. We will develop these in collaboration with a small focus group of teachers (2-4) selected from the larger group that we work with in SYLTER. A focus group such as this will help us determine what specific resources are necessary for teachers to effectively use these data and recommend additional probes to measure other parameters of interest to K-8 teachers.

Ecologists (faculty, staff, and students) in NTL-LTER will partner with staff in the Center for Biology Education, K-12 teachers and administrators, and faculty, staff, and students from the UW Madison School of Education in the departments of Education Psychology and Curriculum and Instruction on the development and assessment of cases for student investigation that are based on LTER research and data. These will include both real time data such as that from the BUOY project and current research as well as archived data.


It was a frosty morning when forty students from Country View School came to learn about winter limnology through the ice of Lake Mendota.


At one of five different activity stations, students used electronic equipment to measure water temperatures and oxygen levels at depths from just under the ice to just above the sediment.


In March, fifty six students at Arbor Vitae -Woodruff School tackled winter limnology on Trout Lake. Here some students take zooplankton samples through the ice.

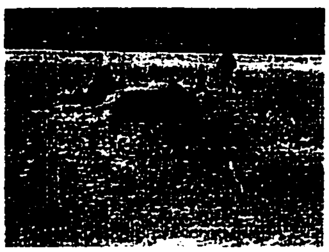
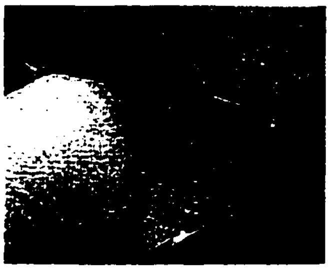

Students had fun at the "sliding station" on Trout Lake: how far can you slide? Notice that there was a lot more snow on Trout Lake than there had been earlier on Lake Mendota.

Photo Gallery





Merry Lea Homepage

Merry Lea
Environmental Learning Center
of Goshen College

Useful Information

about Merry Lea

Merry Lea Environmental Learning Center of Goshen College, Box 263 Wolf Lake, IN 46796

Phone: 260 799 5869.
merrylea@goshen.edu

Trails are open daily from 9 a.m. to 5 p.m.

How do I get to Merry Lea
Activities for You at Merry Lea
Weather Forecast for Merry Lea and Vicinity
Facilities at Merry Lea
The Staff at Merry Lea
Uniqueness of Merry Lea
Friends of Merry Lea
Board of Trustees
Mission Statement
Guidelines for Your Visit

Answers to Frequently Asked Questions

How do I Enter and Pay Fees?

Enter via the south gate at the Learning Center or the east gate at the Farmstetad. Trail maps are available at those locations. There is no admission fee for occasional use of trails, but contributions are welcome. Collection boxes are located at the south and east parking areas. We encourage frequent visitors to become contributing members through the Friends of Merry Lea.

- There is a fee for educational programs and many of the public events.

What is the Merry Lea State Nature Preserve?

Within Merry Lea is a tract on the west side of High Lake that has been dedicated as a state nature preserve. Such preserves are established where unusual biological or geological features exist. The Merry Lea preserve features a large esker (a gravel ridge formed by channels in the glacial ice), and a variety of bog plants growing in its lowland areas. Once an area is dedicated, it is protected forever from development that would harm its character. Most preserves are owned by the state, but colleges and universities, park boards, or conservation organizations can also be owners. The Merry Lea preserve is owned by Goshen College.

Who owns Merry Lea?

Merry Lea represents one of the largest privately owned natural areas in Indiana. Presently Goshen College owns about half of the acreage and the remainder is leased from Mary Jane Rieth who, with her late husband Lee A. Rieth, established Merry Lea in the mid-1960s. The Rieths started the center because of their great interest in preserving natural habitat and providing environmental-education opportunities for people of all ages. In 1980 the Rieths began a gradual transfer of ownership to Goshen College with the assistance of The Nature Conservancy. Land presently leased is scheduled for eventual transfer to the college, and the entire area is managed as one unit.

What is the relationship between Merry Lea and The Nature Conservancy?

The Nature Conservancy, is an international, membership organization whose mission is to preserve plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. To date the Conservancy has protected more than 7.9 million acres, 23,000 of which are in Indiana. Some of the land protected by the Conservancy is transferred to other institutions which act as owner-stewards.

This is the case for Merry Lea, where ownership was transferred first to The Nature Conservancy and then by restrictive deed to Goshen College. The college manages Merry Lea for educational and scientific purposes, but its natural character will never be disturbed.

What is Goshen College?

Goshen College is a four-year liberal arts college founded by the Mennonite Church. The 1,000 students on the Goshen campus study the liberal arts with majors that include the fine arts, education, business and the sciences. Some select the minor in environmental studies. Although tuition is higher than at a state university, both Mennonite and non-Mennonite students choose to attend Goshen in order to study and make friends within a setting that has the teachings of Jesus as a central focus. The cultural tradition of Mennonites as farmers and careful stewards of the land makes it appropriate for Goshen College to care for and nurture Merry Lea in the coming years. Visitors are always welcome on our campus, and we would be happy to discuss study at Goshen College with you.

How is Merry Lea financed?

Although Goshen College owns and operates Merry Lea Environmental Learning Center, the annual operating budget is separate from the rest of the college, so grants, endowment, program fees and contributions are used to meet expenses. Goshen College and the communities it serves supply the human energy and enthusiasm, and financial support comes from the many who consider environmental education a major priority.

Who is on the staff at Merry Lea?

All staff members are employees of Goshen College. Several hold faculty appointments at the college. They are experienced professionals in management or education.

How can I help Goshen College with its work at Merry Lea?

Pitch in. Merry Lea volunteers participate as trailside instructors, receptionists, maintenance assistants and festival volunteers. Opportunities abound for many skills and talents. Join the Friends of Merry Lea. Tax-deductible contributions make things happen. They also qualify for the Indiana Tax Credit for support of Hoosier colleges and universities.

Administrative Organization

Goshen College operates Merry Lea through a volunteer Board of Trustees appointed by the College.

Appendix G

Ecology Issue Attitude Instrument

1) Sometimes I get tired of hearing about ecological issues. (egocentric)
2) When I vote, I look for candidates who will protect the environment. (ecocentric)
3) I use spray cans only if they say "safe for the ozone." (ecocentric)
4) Some people get carried away worrying about air pollution. (egocentric)
5) Private citizens should not be allowed to burn rubbish and trash in outdoor incinerators because of their contributions to air pollution. (ecocentric)
6) It is more important to prevent air pollution than to promote economic growth. (ecocentric)
7) It is too difficult to grow food organically. (egocentric)
8) We have to use pesticides because buggy food is disgusting. (egocentric)
9) I am willing to pay more for better recycling of my solid waste. (ecocentric)
10) People should have free choice about recycling. (egocentric)
11) If I can't recycle a plastic container I have to throw it away. (egocentric)
12) I feel strongly that people should be forced to recycle. (ecocentric)
13) If you can afford them, convenience and sanitary concerns make disposable diapers a better choice than cloth. (egocentric)
14) Until more people get involved, I can't change pollution and waste control. (egocentric)
15) I'm not convinced that global warming is occurring. (egocentric)

16) People should be more tolerant of vehicle noise. (egocentric)

17) Families should not receive income tax exemption for more than two children. (ecocentric)

18) The population growth of the United States should be halted. (ecocentric)

19) The primary purpose of wildlife preserves is to allow people to enjoy nature. (egocentric)

20) I worry that species will become extinct because of global warming. (ecocentric)

Appendix H

The Wisconsin Environmental Survey

1) A food web consists of
   a) the animals that eat other animals in a community.
   b) All the herbivores and carnivores in an ecosystem
   c) *Many interconnected food chains
   d) all the consumers in an ecosystem.

2) When two or more species attempt to use the same limited resource in an ecosystem, their interaction is called
   a) mutualism
   b) *competition
   c) predation
   d) commensalism

3) Having sharp thorns can help a plant by keeping animals from eating it. This is an example of
   a) mutualism
   b) *adaptation
   c) competition
   d) commensalism

4) All of the individual organisms that live on the ground in a particular forest share the same
   a) niche
   b) *habitat
   c) lifestyle
   d) food source

5) The reason dead leaves and twigs don't build up in a forest from year to year is because
   a) non-living elements such as wind and rain remove them
   b) *decomposers break them down into soil
   c) animals eat them or use them to build nests
   d) none of the above

6) Wolves often eat deer. Does this interaction have any beneficial effects on the deer population as a whole?
   a) Yes, the wolves help keep the deer population size controlled.
   b) No. The deer population is only harmed.
   c) Yes, the wolves help keep the deer population strong since the fastest, most alert deer survive.
   d) *both (a) and (c)

6) The energy currently present on earth
   a) is all the energy we will ever have
   b) *can change form but is never destroyed
   c) can be used only once
   d) is most in the form of fossil fuel energy

7) Based upon major ecological principles, we should conclude that
   a) humans are a climax species that will last indefinitely
   b) the human species will soon become extinct; nothing we can do will prevent this.
   c) *the human species will last as long as there is a balanced ecosystem that will support human life
   d) there is no way of predicting what will happen to the human species; ecological principles do not apply to humans

8) The process of photosynthesis in green plants
   a) uses sunlight to burn energy in plants
   b) *changes light energy into chemical energy
   c) changes chlorophyll into sugar
   d) is a process used to burn sugar stored in plants so the plants can grow

9) Which of the following terms is used to describe all of the natural living and nonliving interacting features of a given area?
   a) habitat
   b) community
   c) biodiversity
   d) *ecosystem

10) Humans grow crops for food. Many species of these plants need certain species of insects (such as bees) to pollinate them. The pollinating insects often rely on the nectar they obtain from the plants for food. This is a good example of
   a) *how organisms, including humans, are interdependent
   b) commensalism between humans and other species
   c) how humans manipulate their environment
   d) a food web that includes humans

11) A particular aquatic ecosystem is contaminated by a chemical that tends to remain stored in body fat. The highest concentration of this chemical would most likely be found in which group of organisms in the ecosystem?
a) plant life
b) minnows
c) fish that eat insects and plants
d) *fish-eating birds

12) Which of the following phrases refers to the potential ability of a system to support population growth without harming the environment?
a) *carrying capacity
b) species loading
c) non-sustainable growth
d) all of the above

13) In a small lake, a food chain was as follows:

Sun → green algae → small crustaceans → fish

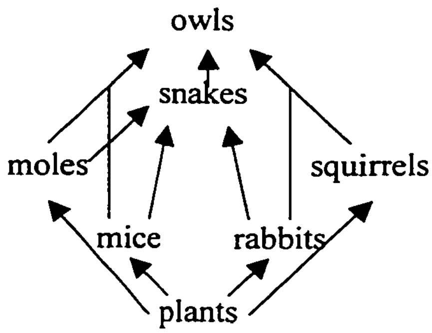
After many months of heavy snow covering the ice, most of the small crustaceans died. What is the best explanation for this?
a) *The algae population was cut off from its source of energy.
b) It was too cold for the crustaceans to survive.
c) The fish ate most of the crustaceans.
d) A disease killed most of the algae.

14) If carbon dioxide (CO_2) disappeared from the atmosphere, which of the following would be affected first?
a) *plants
b) animals that eat plants
c) animals that eat other animals
d) decomposers

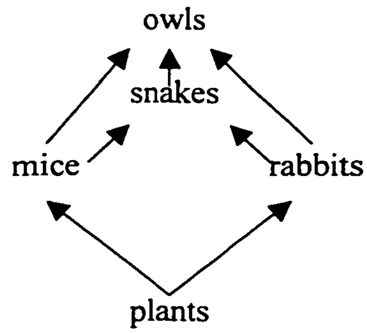
15) Each of the following food chains starts with the same amount of green plants. Assuming that the green plants are digestible by humans, which of the food chains would supply the most energy to humans?
a) *green plants to humans
b) green plants to cattle to humans
c) green plants to insects to fish to humans
d) green plants to insects to small fish to larger fish to humans

16) Some insecticides that were once effective in killing insects no longer work very well. This is because
a) new insect species develop every day
b) the wrong kind of insecticides were used
c) *insects with natural resistance survived and multiplied
d) the insects produced many more offspring than the insecticide could kill

17) Which of the food webs below would be affected the most of all the mice were removed? (Note: the arrows point to the consumer of the organism in the food web)



Food Web (A)



Food Web (B)

a) food web (A)
b) *food web (B)
c) Neither would be affected
d) They would both be affected to the same degree

18) Which of the following contributes to air pollution at the surface of the earth, and acts as a shield against ultraviolet rays in the upper atmosphere?
a) nitrous oxide
b) methane
c) *ozone
d) sulfur dioxide

19) The main source(s) of emissions that have been identified as contributing to acid deposition (acid rain) in the United States are
a) volcanoes and forest fires
b) petroleum refineries
c) *automobiles and coal burning power plants
d) aerosol sprays and refrigerant leakage

20) Which of the following is not true of the world's human population?
  a) It is expected to double within your lifetime.
  b) *It is declining in developed areas such as the United States and Canada
  c) Its increase has led to the extinction of many plant and animal species
  d) The greatest rate of population growth is occurring in developing areas such as South America and Africa.

21) The future of food production as it is currently practiced in this country is in question because
  a) soil is being depleted by erosion
  b) the use of synthetic chemical additives has become an issue
  c) agricultural land is being lost to development
  d) *all of the above

22) Which of the following would be most likely to cause groundwater pollution?
  a) organic farming practices
  b) municipal composting of yard wastes
  c) *adding too much fertilizer to fields
  d) wastewater treatment plants

23) The rate of species' extinction is higher now than at any time since the period of the dinosaurs' extinction. The main cause of this rapid decline in biodiversity is
  a) *habitat alteration by humans
  b) the illegal poaching or collecting of animals and plants
  c) changes in the Earth's atmosphere due to human activities
  d) hunting by humans for food or sport

24) Which of the following do scientists feel is the least important contributor to the greenhouse effect?
  a) destruction of the earth's rainforests
  b) burning of fossil fuels, such as gasoline and oil
  c) *increased use of hydroelectric power
  d) production of methane gas by cattle and rice paddies

25) Most municipal solid waste in the United States is presently disposed of by what method?
  a) burning it in closed incinerators
  b) recycling
  c) shipping it out to sea and dumping it
  d) *burying it in landfills

26) Which of the following is NOT a significant water pollutant?
  a) bacteria
  b) pesticides
  c) heat
  d) *all of the above are significant water pollutants

27) One suggested advantage of using nuclear power plants for energy production is that
   a) nuclear power plants are not expensive to build
   b) the waste products are fairly easy to store
   c) *they produce less air pollution
   d) they are totally safe

28) Which of the following results in the most serious waste or loss of our usable water?
   a) contamination by bacteria
   b) uncontrolled drainage
   c) *careless usage
   d) improper storage

29) Which of the following would be most likely to result in soil erosion?
   a) an increase in nutrients added to the soil
   b) *the removal of vegetation
   c) contour plowing of hillsides
   d) aeration of the soil by bacteria

30) Which of the following is considered to be a non-renewable energy source?
   a) *oil
   b) wood
   c) biomass
   d) none of the above

31) Which of the following is a naturally occurring, invisible gas which can seepout of the ground into people's homes and cause serious health problems?
   a) ethane
   b) krypton
   c) *radon
   d) chlorofluorocarbon

32) A major nuclear accident occurred in 1986 at the ________________ nuclear power plant.
   a) Belgrade
   b) Nagasaki
   c) *Chernobyl
   d) Three Mile Island

33) Which of the following offers the most potential for reducing our immediate energy problems?
   a) geothermal power
   b) *energy conservation
   c) biomass conversion
   d) tidal power

34) Having your household water tested is important if
   a) you live in an old house
   b) your water comes from a well
   c) you live in an agricultural area
   d) *all of the above

35) Which of the following is most likely to help endangered species?
   a) Outlaw the sale or possession of endangered species or products made from them (skins, furs, ivory, etc.)
   b) Create breeding programs in zoos for endangered animals
   c) Use farming methods that do not damage habitat
   d) *Maintain large protected natural areas where they live

36) In the long term, which of the following would be the best way to lessen the problem of solid waste?
   a) Incinerate waste materials
   b) *Reduce the amount of materials being consumed
   c) Reuse materials for other purposes rather than throwing them out
   d) Recycle materials that can be used again

37) Which of the following would be the most effective method to influence a large number of people to take action about an environmental problem?
   a) Advertise on the radio
   b) Write letters to the newspaper
   c) Go door to door and talk to people
   d) *Use a combination of the above

38) If your student environmental club was concerned about an environmental issue, which of the following would be the best thing to do first?
   a) Write and circulate a petition about the issue
   b) Talk to other people about what they could do to help resolve the issue
   c) Write to elected officials about your concern
   d) *Research the issue