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ABSTRACT

The first section of this document contains definitional papers prepared by three sections of the North American Association for Environmental Education (NAEE). They are: (1) "The Challenges of K-12 Environmental Education" (Harold Hungerford and Trudi Volk); (2) "'Environmental Studies': Towards a Definition" (Royal Harde); and (3) "Nonformal Environmental Education: An Overview and Methodology for Evaluation" (Edward McCrea and Glenn Weaver). The second section contains selected papers from the 1983 NAEE annual conference. They are: "An Incentive Approach to Riparian Lands Conservation: A Case of Study" (John Baldwin, Nancy Duhnkrack, and Paul Ciminello); "Forging an American Environmental Consciousness: The Historical Interplay of Technology, Politics, and Economics" (William Berberet); "Who's In Control? Development of a Perceived Environmental Control Measure" (Randall Champeau and R. Ben Peyton); "Children and Environmental Educators: Differing Views of the Urban Environment" (Augusto Medina); "A Study of the Relationship between Information and Attitude for Users and Non-Users of Computerized Water Resource Management Simulation" (Terrence Mills); "The Impact of Acidified Precipitation on Agricultural Crops" (G. Harry Stopp, Jr.); "What Do Teachers Want - In Order to Teach about a Current Environmental Issue: Acid Rain" (Harriett Stubbs); and "Merging at the Crossroads: New Vehicles for Environmental Education" (Charles Yaple). (JN)

MONOGRAPHS

in Environmental Education and Environmental Studies

Volume I

Edited by
Arthur B. Sacks

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for Environmental Education
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ERIC Clearinghouse for Science, Mathematics
and Environmental Education
The Ohio State University
College of Education and
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July, 1984

Environmental Education Information Reports

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director, ERIC/SMEAC
Environmental Education

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Preface

This volume initiates a new direction in the publication strategy of the North American Association for Environmental Education (NAEE). In the spring of 1983, on the recommendation of NAEE's Publications Committee, the NAEE Board of Directors approved the publication of a new series to be called Monographs in Environmental Education and Environmental Studies. Monographs is an evolution of the Association's long-standing publication, Current Issues in Environmental Education and Environmental Studies, which began in 1975 and ran for eight years.

Current Issues presented selected papers from NAEE's annual conferences. Over the years, Current Issues improved in quality. It included both refereed and non-refereed sections, and standards for publication in it were high. Diligent work by reviewers from within and outside NAEE's ranks, in addition to the talents of a number of editing teams, helped to make Current Issues a valuable contribution to the environmental education and environmental studies literature. Its production also provided an impetus for NAEE as a professional society to solidify its goals, direction, and mission. Still, as a set of selected papers from an annual conference, this publication could not meet all the needs of Association members.

As a selection of conference papers, Current Issues did not wholly record the transactions of each conference: many valuable ideas and program descriptions presented were lost to all but those who actually had heard and participated in workshops, symposia, and contributed paper sessions. Further, the publications guidelines were such as to prevent editors from soliciting papers and including materials that had not been presented at the conference. It became evident that there was a need for NAEE as a professional society to serve its members by providing a publication that could go beyond single conferences and promulgate new ideas, approaches, and research within the fields of environmental education and environmental studies. Monographs was born in response to this recognition.

It is envisioned that a volume in the Monographs series will be published at least once annually, with additional numbers anticipated on occasion as quality papers and resources to publish them become available. Such additional numbers will require the approval of the NAEE Board of Directors. The editor and the editorial advisory board, appointed by the Board of Directors, are given the authority to solicit papers from NAEE members and non-members, to combine these, if desired, with annual conference papers, to develop special numbers on selected themes and topics, and to publish individual papers of longer than average length as separate monographs.

To meet the needs formerly addressed by Current Issues, NAEE also decided to publish a Proceedings of the annual conference composed of abstracts of the papers presented. In this way an accurate record of the conference will be maintained, readers will be able to obtain the gist of papers and

reports heard at the conference, and those wishing more detailed information will have a means of contacting presentors. In addition, the Environmental Communicator, NAEE's newsletter, will continue to serve as a mechanism for providing an exchange of practical ideas, program descriptions, and short working papers more suitable for newsletter format than a presentation at the annual conference, and hence publication in the Proceedings, or for inclusion in Monographs. Finally, under the auspices of its Publication Committee, NAEE will continue to sponsor special publication projects such as Recent Graduate Works and Programs in Environmental Education and Communications, and Research in Environmental Education 1971-1980.

NAEE is a growing and evolving organization, and changes policies in its publications reflect this. Continued improvements and refinements in NAEE's publications are anticipated as the Association strives to enhance its services to members in Canada, Mexico, the United States, and elsewhere in North America as well as to the environmental community at large.

The maturation of NAEE is evident not only in the development of its publications. Both the recent change in its name--from the National Association for Environmental Education to the North American Association for Environmental Education--and the development of a more precise mission statement are further signs of this maturation.

The name change reflects the recognition that response to environmental problems, and education's role in this response, require more than a national perspective. NAEE has become increasingly aware that ameliorating and solving environmental problems faced by North America--acid rain is an obvious example--require the cooperation of all the nations in the region, and that educators throughout North America have much to learn from each other. This sense of participation in a larger arena--in a global, biospheric setting--has prompted NAEE to become one of the fir organizations involved in a new international environmental ed ion effort--the tandem societies of the World Council for the Biosphere (WCB) and the International Society for Environmental Education (ISEE)--organizations dedicated to "education for ecologically sustainable development." Awareness of NAEE's responsibility to work in partnership with other organizations in a global environmental education context prompted NAEE's strong leadership and participation in the first WCB/ISEE "International Workshop on Biosphere Stability" held in New Delhi and Srinagar, India, in June 1984.

The new NAEE mission statement--which immediately follows this Preface--was prepared by the NAEE Board and approved by the membership of the Association. It provides a sharper, more focused description of NAEE's goals and objectives, and details the guiding principles for environmental education to which the Association adheres. These principles will create the framework for decisions about what to include in the new Monographs series.

In keeping with NAEE's efforts to clarify the field of environmental education through its mission statement, the editorial advisory board of Monographs solicited three papers for this first volume. Each of NAEE's three sections--the Elementary and Secondary Education Section, the Environmental Studies Section, and the Non-Formal Section--was invited to prepare a paper defining environmental education from its perspective and/or outlining new directions and challenges in the field. Section I of this volume contains these three definitional papers: Hungerford and Volk, "The Challenges of K-12 Environmental Education;" Harde, "'Environmental Studies': Towards a Definition;" and McCrea and Weaver, "Nonformal Environmental Education: An Overview and Methodology for Evaluation." Each sheds light on the respective area of environmental education addressed. For this volume, it was also decided to include selected papers from the annual NAEE conference. Section II contains eight papers that were originally presented at the 12th annual conference held at Eastern Michigan University in Ypsilanti in October, 1983. All papers contained in Monographs have been refereed by peer reviewers.

The editor and the editorial advisory board believe that NAEE has taken a new direction with this publication. Future numbers will explore, in depth, relevant topics contributing to a better understanding of the issues, opportunities, and problems facing environmental education and environmental studies. Already planned is an issue of Monographs under the guest editorship of members of our sister organization, the National Association for Environmental Professionals (NAEP), which will treat the relationship of environmental education and training to the practical needs of chemists, toxicologists, engineers, lawyers, planners, environmental managers and consultants within the NAEP community. At NAEP's invitation, NAEE has already sponsored a special environmental education issue of its journal, The Environmental Professional (Sacks and Davis, Volume 5, Number 3). A special issue of Monographs devoted to international environmental education is also under consideration.

The Association is eager to hear from members about their reactions to this volume and invites suggestions for other numbers in this series. We look forward to receiving ideas that will help make Monographs a significant service to members and an important contribution to the field.

We wish to acknowledge the reviewers who assisted us in this first issue. We also wish to thank John F. Disinger, Associate Director of the ERIC Clearinghouse for Science, Mathematics, and Environmental Education, and his staff in the production of the initial volume. Finally, we also offer our appreciation to Ms. Eileen Hanneman, Departmental Secretary of the Instructional Program of the Institute for Environmental Studies of the University of Wisconsin-Madison, for her able assistance throughout this process.

Arthur B. Sacks
Editor

Institute for Environmental Studies
University of Wisconsin-Madison
July 1984

MISSION STATEMENT

The North American Association for Environmental Education (NAEE) is a professional association established to assist and support the work of individuals and groups engaged in environmental education, research, and service. In meeting the goals and needs of environmental professionals, NAEE promotes the analysis and understanding of environmental issues and questions as the basis for effective education, problem-solving, policy-making, and management.

Through its activities, NAEE seeks to foster (1) the education of skilled individuals able to understand environmental problems and possessing the expertise to devise effective solutions to them; and (2) development of a citizenry conscious of the scope and complexity of current and emerging environmental problems and supportive of solutions and policies which are ecologically sound.

NAEE is organized into three interactive sections each conducting specialized programs responsive to their members. These are:

- The Elementary and Secondary Education Section (ESES)
- The Environmental Studies Section (ESS)
- The Non-Formal Section (NFS)

Professionals within these sections address the following audiences:

- the general citizenry;
- the fellow educators at all educational levels;
- those who make or facilitate the making of major decisions affecting the environment (e.g. government officials, scientists, engineers, planners, lawyers, journalists and mass communicators); and
- environmental resources managers (e.g. foresters, water resources managers, wildlife managers, park managers)

NAEE maintains the following guiding principles. Environmental Education should:

- consider the environment in its **totality** — natural and built: biological and physical phenomena and their interrelations with social, economic, political, technological, cultural, historical, moral, and aesthetic aspects;
- **integrate knowledge** from the disciplines across the natural sciences, social sciences, and humanities;
- examine the scope and complexity of environmental problems and thus the need to develop **critical thinking** and **problem-solving** skills and the ability to synthesize data from many fields;
- develop **awareness and understanding of global problems, issues, and interdependence** — helping people to think globally and act locally;
- consider both short and long term **futures** on matters of local, national, regional and international importance;
- relate **environmental knowledge, problem-solving, values, and sensitivity** at every level;
- emphasize the role of **values, morality** and **ethics** in shaping attitudes and actions affecting the environment;
- stress the need for **active citizen participation** in solving environmental problems and preventing new ones;
- enable learners to play a role in **planning their learning experiences** and providing an opportunity for making decisions and accepting their consequences; and
- be a **life-long process** — should begin at a preschool level, continue throughout formal elementary, secondary, and post secondary levels, and utilize non-formal modes for all age and educational levels.

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Monographs in Environmental Education and Environmental Studies, Volume I

Section I:
Definitional Papers

The Challenges of K-12 Environmental Education

Harold R. Hungerford[1] and Trudi L. Volk[2]

The mission of environmental education in the K-12 schools might be reflected in the product of that endeavor - the overt behavior of the student. But, does environmental education influence the individual moving through the K-12 educational system? How would the mission of environmental education be described from the student perspective?

What appears below is a fictional student's viewpoint on what environmental education has accomplished in him or her. It is written to present an idealization of what K-12 environmental education could, and should, be.

> My education in the elementary and high schools provided me with an intense environmental commitment. By this I mean I am committed to living my life in a manner that helps solve environmental issues instead of creating them. Although I don't recall the exact sequence of events that led to this resolve on my part, I can tell you some of the things that weighed heavily on this decision.
>
> Perhaps the most important thing I got out of school was a sense of moral responsibility, as a citizen, toward the environment. I don't mean morality in the traditional sense, that is, focusing on man's relationships with man. I'm talking more about a morality which also considers man's relationships with the environment and which acknowledges the survival rights of other species--in essence, an attitude which respects the integrity of living systems in the environment. I know that this philosophy isn't necessarily man-centered, but it sure does mean a lot for man over the long haul. I feel as though there can be no real quality of life for me or my children unless there is a concomitant quality of environment. Maybe it's a matter of the way in which quality of life and quality of environment are intertwined. In any event, much of my moral posturing focuses on the way in which the human race interrelates with nature rather than on man-man relationships alone.

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Of course, as a participating citizen, I needed a firm foundation in citizenship action skills. These I started to get way back in the elementary school. And, I got more and more sophisticated with them as I progressed through the secondary school. Interestingly enough, I was never forced to apply them in social issue settings but most of us got involved in one way or another eventually. Knowing what could be done and having practiced the skills in a school setting did a lot to bring about confidence in one's ability to effect change. Gosh, when I think about some of the stuff we got involved with it makes me feel like we were all participating citizens and not just spectators on the sidelines. And, most of us are still involved in some form of environmental activism.

As I look back over my K-12 schooling I am convinced that my teachers, by and large, were themselves committed to environmental integrity. Some, in particular, acted as super role models for us. I'm certain that these teachers helped us become increasingly sensitive to the environment and concerned for the environment. What did they do as role models? Well, first and foremost, they lived an environmental ethic. Most were not radicals in the strictest sense of the term but you knew that they thought about their personal life styles in an environmental context. And, they were willing to talk to us about their perspectives. This helped a great deal. In addition, they would suggest books to read and places to go and things to do, all of which led to an increased environmental sensitivity. Heck, some of 'em even planned weekend outings or summer programs for us. We were never close to any nature centers or places like that so we had to get it all through our schooling or with our families. Unfortunately, not many kids had parents that thought too much about environmental concerns.

What else? Let's see. Oh yes, much of our instruction was issue-oriented. It was kind of like we were constantly probing environmentally-related social issues. Sometimes we would work on these as case studies and look at the problems from all possible angles. We searched for alternative positions being held on issues, the values associated with these positions, what people believed that led to these values and positions, and what the alternative solutions were for these issues. When we evaluated the possible solutions we always looked at the social, economic, and political consequences. And, of course, we never took our eyes off the ecological consequences of the alternatives. That has to be the bottom line when we are looking for solutions, doesn't it?

Sometimes, instead of looking at specific issues as case studies, we were given the opportunity to choose issues of particular concern to us as individuals and investigate these

ourselves or in small groups. That was particularly interesting and worthwhile because not all of us were interested in the same things. I never could get worked up about the preservation of wild horses or burros and yet there were kids in our class who really got excited about their management. What the teachers called autonomous investigation gave every student an opportunity to look at issues of concern to him or her in real depth. The ringer here, however, is that we had to be taught the investigation skills first. Easier said than done. But, in the end we all profited immensely from this training because we also applied some of these same skills in other classes. We were pretty good at getting information from agencies, finding sources in the library, writing questionnaires, interpreting data and the like. It sure made life in college a lot easier too.

Anyway, it's hard to point to one thing and one alone and say that it is responsible for what I am environmentally today. All of the things I have talked about here were important. In the final analysis though, it is probably a matter of perspective...a point of view if you will. I firmly believe that I am responsible, rather, that each of us is responsible, for the maintenance of an equilibrium within the environment. I guess you might call that an ethic of biospheric integrity. But alone that ethic or point of view is not enough. You have to learn what to do with it. These are things I learned in elementary and secondary schooling. These things probably made me what I am today.

Introduction

Although environmental education (EE) in the formal K-12 sector varies widely from community to community and from state to state, the year 1984 finds it, by and large, to be neither pervasive nor very persuasive in the USA. Much to the chagrin of environmental educators who want to believe that EE is having a serious educational impact across the USA, research tends to suggest that such is not the case (Childress, 1978; Volk, et al., in press). Even in states which have widely adopted programs in EE, the somewhat limited research associated with said programs tends to indicate the achievement of a level of environmental literacy far below what should be expected in a nation which should be in the forefront of a worldwide thrust geared to the development of an environmentally literate population. Environmental education, in the strictest sense of the term, remains, after a decade and a half of promotion and debate, a stepchild of educational practice in the K-12 schools of the USA.

Although this document in not being written to cast gloom and doom on the purveyors of EE in the nation's schools, it must acknowledge the shortcomings of the field in successfully engaging K-12 students and teachers in a crucial arena of social and ecological concerns. Reasons for

this shortfall are numerous and include a lack of governmental support (at both federal and state levels), inadequate preservice and inservice teacher education, inadequate curricula at all levels, and continuing confusion concerning the parameters of EE and its integration into instructional programs.

Resolving all of these problems--most of which are crucial to the EE endeavor--is a task of enormous proportions. This particular paper cannot address all of them nor, probably, should it. It does, however, address those problems which directly impinge upon policy related to practice in the K-12 classrooms--those problems focused on or intimately related to direct instruction.

The First Challenge: Making and Focusing on the Big Decision

One of the major problems in EE has been and continues to be associated with an appropriate instructional implementation of what "environmental literacy" is all about. Environmental educators such as Stapp, Caldwell, Roth, McKenna, Tanner, and others, appear to agree that the ultimate goal of EE is to provide an education which results in environmentally-affirmative citizenship. Or, as paraphrased from Harvey (1977):

> ...to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

This goal statement certainly infers that students must not only be knowledgeable about the environment, but must also have a set of skills which will permit them to function as change agents in society. Even so, curricular programs for EE which focus on citizenship action skills are almost nonexistent. The words of Childress (1978) are as pertinent to this discussion today as they were six years ago:

> ...objectives focused on helping students become knowledgeable about their environment and its associated problems, and developing an appreciation of environmental resources, were considered of more importance in a majority of programs and projects than were those objectives focused on helping students actually solve environmental problems and develop problem-solving skills.

This means that the ultimate goal of EE is either being ignored by practitioners or perceived as something that can be met through awareness education.

It is unlikely that most professional environmental educators are ignoring the goal out-of-hand. And, although a number of environmental educators might be prohibited from addressing EE's ultimate goal by their entrapment in instructional settings dictated by others or in settings not susceptible to change, this is hardly a plausible explanation for such a widespread situation. Rather, the relative inattention to EE's ultimate goal is more likely a situation governed by a lack of understanding about what it takes to achieve environmental literacy. The majority of EE programs focus on environmental awareness. Research, however, clearly indicates that awareness per se is not a good predictor of citizen involvement regardless of how important awareness may be (Horsley, 1977; Klingler, 1980; Ramsey. et al., 1981; Winston, 1974).

On the other hand, research conducted by Ramsey, et al. (1981) indicates that training in environmental action strategy is important in the development of environmentally active individuals. In a discussion of their findings, these researchers concluded that:

> ...a specific knowledge of and competency with environmental action strategies and techniques foster environmental action behavior...conversely, environmental awareness instruction fails to develop effectively the ability to initiate environmental action. Overall, it would seem that specific training in and application of environmental problem-solving skills constitute a unique instructional component which, when combined with environmental information and values, tends to encourage successfully independent overt environmental behavior. Thus, curricular incorporation of environmental action instruction would seem more likely to achieve the goal of citizen participation in environmental issue remediation.

Their research, then, seems to indicate that there are certain instructional components, crucial to the development of such citizens, that should be a part of every individual's educational experiences. This takes us directly to Challenge Number Two.

The Second Challenge: Operationalizing Environmental Literacy - Selecting Appropriate Curricular Goals

What are the curricular goals which must be brought into focus in order to achieve "environmental literacy" as defined in the previous section? Although research is gradually providing us with an identification of variables which influence behavior, the findings have by no means presented us with a complete and comprehensive description of those factors.[3] Researchers have investigated such variables as environmental sensitivity, knowledge of issues, beliefs, values, locus of control, and a number of population demographics. In none of the studies conducted thus far, however, have they been able to account for a substantial majority of the variance associated with behavior in a manner that is generalizable to

large segments of the population overall. There simply appears to be no single variable associated with the achievement of overt citizenship action. That is not to infer that said research is without merit--it is simply a matter of noting that a great deal remains to be done with respect to identifying variables or groups of variables which will predict behavior. Be that as it may, research is beginning to tease out variables which should be seriously considered as important to the overall process of changing behavior. Through this research we have learned enough about environmental behavior to be able to predict at least some of the elements which must be incorporated into instructional programs in order to make them successful.

Among the variables associated with behavior, in one form or another, are elements such as knowledge of and ability to apply citizen action strategies, knowledge of ecological principles, human values, belief systems, knowledge of issues, attitudes, locus of control, and environmental sensitivity. Most certainly, interactions exist between these variables but, unfortunately, we do not know exactly what the precise relationships are. Indeed, whatever the interrelationships are, they may well be dynamic, i.e., they may not be stable over time or from one situation to another.

Given the paucity of our knowledge concerning environmental behavior, it might seem presumptuous to recommend instructional goals which are written for the precise purpose of achieving "literacy." However, we must begin somewhere and enough evidence exists to guide us in generating goals for instructional decision-making which permit us to predict outcomes with a high degree of confidence.

What follows is a slightly modified set of EE goal statements developed by the senior author with R. B. Peyton and R. J. Wilke (1980). These goal statements are subordinate to Harvey's (1977) overall goal statement (provided earlier) and have been validated against the 1977 Tbilisi Intergovernmental Conference on Environmental Education objectives and by a panel of distinguished North American environmental educators (R. S. Cook, J. Disinger, R. George, H. McKenna, and R. T. Tanner). The goals are designed to guide the development of instructional materials for EE, i.e., to provide a framework from which specific instructional objectives could be written.

The Goals for Curriculum Development

Level I. Ecological Foundations

This level seeks to provide the learner with sufficient ecological knowledge to permit him/her to make ecologically sound decisions with respect to environmental issues.

The Ecological Foundations Level would minimally include the following conceptual components:

A. Individuals and populations.
B. Interaction and interdependence.
C. Environmental influences and limiting factors.
D. Energy flow and materials (biogeochemical cycling).
E. The community and ecosystem concepts.
F. Homeostasis.
G. Succession.
H. Man as an ecosystem component.
I. The ecological implications of man's activities and his communities.

Level II. Conceptual Awareness--Issues and Values

This level seeks to develop a conceptual awareness of how individual and collective actions may influence the relationship between quality of life and quality of the environment and, also, how these actions result in environmental issues which must be resolved through investigation, evaluation, values clarification, decision-making, and finally, citizenship action.

Goals at this level are to provide opportunities for learners to conceptualize:

A. how man's cultural activities (e.g., religious, economic, political, social, etc.) influence the environment from an ecological perspective.
B. how individual behaviors impact on the environment from an ecological perspective.
C. a wide variety of environmental issues and the ecological and cultural implications of these issues.
D. the viable alternative solutions available for remediating discrete environmental issues and the ecological and cultural implications of these alternative solutions.
E. the need for environmental issue investigation and evaluation as a prerequisite to sound decision-making.
F. the roles played by differing human beliefs and values in environmental issues and the need for personal values clarification as an integral part of environmental decision-making.
G. the need for responsible citizenship action (i.e., persuasion, consumerism, legal action, political action, ecomanagement) in the remediation of environmental issues.

Level III. Issue Investigation and Evaluation

This level provides for the development of the knowledge and skills necessary to permit learners to investigate environmental issues and evaluate alternative solutions for remediating these issues. Similarly, values are clarified with respect to these issues and alternative solutions. Goals at this level are presented in two components.

Component A: Goals for Component A are to develop in learners:

A. the knowledge and skills needed to identify and investigate issues (using both primary and secondary sources of information) and to synthesize the data gathered.
B. the ability to analyze environmental issues and the associated value perspectives with respect to their ecological and cultural implications.
C. the ability to identify alternative solutions for discrete issues and the value perspectives associated with these solutions.
D. the ability to autonomously evaluate alternative solutions and associated value perspectives for discrete environmental issues with respect to their cultural and ecological implications.
E. the ability to identify and clarify their own value positions related to discrete environmental issues and their associated solutions.
F. the ability to evaluate, clarify, and change their own value positions in light of new information.

Component B: Goals for Component B are to provide learners with opportunities to:

G. participate in environmental issue investigation and evaluation.
H. participate in the valuing process in a manner as to permit the learner to evaluate the extent to which his/her values are consistent with the goal of achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

Level IV: Environmental Action Skills--Training and Application

This level seeks to guide the development of those skills necessary for learners to take positive environmental action for the purpose of achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment. Goals at this level are presented in two components.

Component A: The goal for Component A is to develop in learners:

A. those skills which will permit them to effectively work toward ends which are consistent with their values and take either individual or group action when appropriate, i.e., persuasion, consumerism, political action, legal action, or ecomanagement.

Component B: The goals for Component B are to provide learners with opportunities to:

B. make decisions concerning environmental action strategies to be used with respect to particular environmental issues.
C. apply environmental action skills to specific issues, i.e., to take citizen action on one or more issues.
D. evaluate the actions taken with respect to their influence on achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

Whether or not this set of goal statements is "the definitive set of goals" is largely a moot issue. The writers predict that the developers of these goals would, in fact, write them a bit differently in 1984 than was done in 1980. For example, it is felt that the goals would contain more emphasis on beliefs, locus of control, and sensitivity. Even so, this set of goals or a similar one should--may, must--be used by instructional planners now and in the future. To fail to do so will, in fact, guarantee the continuation of an environmental education which falls far too short in its achievement of the goal of developing a responsive and skilled citizenry.

The Third Challenge: Taking the Goals to the Classroom

The writers have long observed that there is a very real difference between establishing goals for instruction on one hand and seeing those goals implemented on the other. The reasons for this discrepancy are many and frustrating and will not be discussed here. Let it be said simply that very real challenges are faced by environmental educators in seeing appropriate goals translated into educational practice. The third challenge addresses some of these variables.

Regardless of the logic which can be brought to bear on arguments associated with appropriate goals for instructional practices in environmental education, there must exist a consensus of opinion in favor of such practice before much can be accomplished. Whether such a consensus exists is a situation that has long been in need of clarification. Beyond consensus, with respect to goals for EE, lie questions related to the need for goal-oriented curricula, the potential for seeing said curricula accepted by the educational community, and the need for teacher preparation should these innovations be implemented.

In a recent national needs assessment conducted by Volk, et al. (in press), answers to the questions raised above were vigorously pursued. Using data collected from 99 professional environmental educators (chosen at random from membership lists provided by the Conservation Education Association and the North American Association for Environmental Education), Volk answered five questions which focused on the goal statements found in the previous section. These questions were:

1. To what extent is this goal important?
2. To what extent do existing curricula accomplish this goal?
3. To what extent is there need for new curricula addressing this goal?
4. To what extent would new curricula addressing this goal be used by teachers?
5. To what extent would inservice teacher education be needed for new curricula addressing this goal?

Respondents were also asked to consider these five questions at each of four academic levels: elementary, middle school/junior high school, secondary, and college/university. In each instance, they were asked to respond to a rating scale which ranged from "to no extent" to "a complete extent" with the midpoint being "a moderate extent." Each respondent could also choose to respond that he/she did not have sufficient knowledge to rate a particular item at a particular academic level.

The collapsed data from the Volk, et al. (in press) study can be seen in Figure 1. The data indicate a sharp discrepancy between how important the goals are regarded and the level of accomplishment at each academic level. Results not only indicate a substantial consensus concerning the importance of goals per se but also considerable support for the development of curricular materials which meet these goals. Further, it was perceived that the materials would, in fact, find more than moderate acceptance in classrooms at three of the four academic levels. Moreover, respondents appeared to be quite certain that there is a substantial need for inservice teacher education at all academic levels.

Interestingly, an earlier study reported by Champeau, et al. (1980) tends to support the Volk findings. In the Champeau study, 129 central Wisconsin K-12 teachers responded to a mailed questionnaire which focused directly on the goals presented in the previous section. Using a strongly disagree to a strongly agree Likert-type questioning strategy, Champeau assessed, among other things, whether teachers felt there was a need for curriculum materials addressing the goals, whether teacher workshops were needed to provide educators with the knowledge and skills necessary for accomplishing the goals, and whether the achievement of "environmental literacy" should be an important component of every student's education.

Over 80 percent of the respondents in the Champeau study responded with agreement or strong agreement when asked whether curriculum materials needed to be developed (at all goal levels). Nearly as many responded in the same manner when asked whether teacher workshops were needed regarding

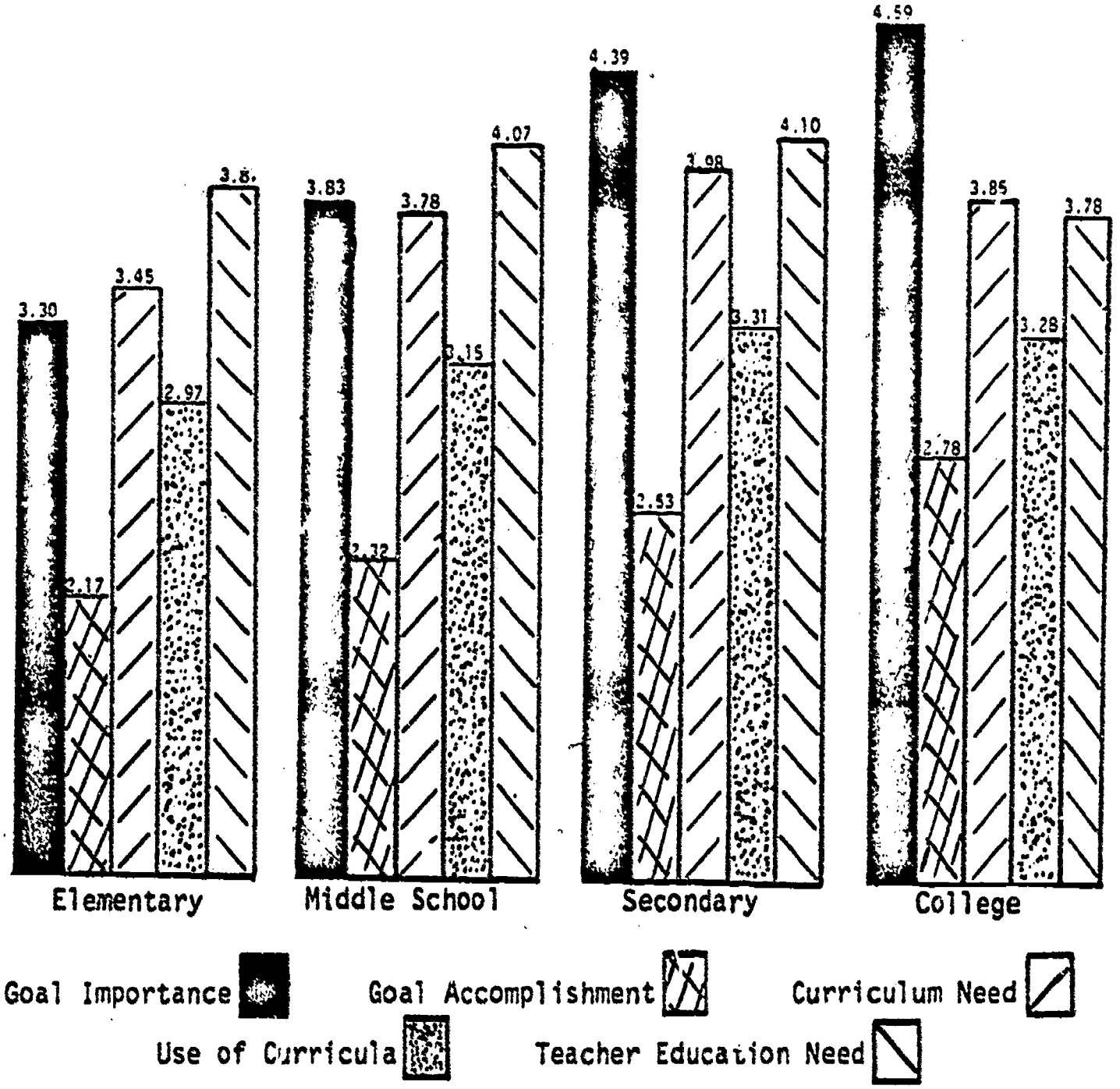

Figure 1. Weighted (in terms of the number of subjects responding to each item) grand means of the responses to each of the five major needs assessment questions portrayed at each of four academic levels (where means of 2.0 = to a very little extent, 3.0 = to a moderate extent, 4.0 = to a considerable extent, and 5.0 = to a complete extent). (Volk et al., in press)

the goals. With respect to the need for students to achieve environmental literacy, an overwhelming 93 percent responded agree or strongly agree.

One might suspect significant bias on the parts of professional environmental educators concerning the importance of the goals, the need for curriculum development, and the need for teacher education. However, when classroom teachers respond similarly, the validity of the Volk research findings is substantially strengthened. Thus, there appears to be sufficient evidence available to support a demand for the acceptance of the goals, curricular development designed to meet the goals, and inservice teacher education addressing knowledge of and skills for meeting the goals.

It seems obvious that, unless developers of instructional materials and teacher trainers accept the goals and the research findings associated with the goals, not much will be accomplished. Unfortunately, both developers of curricula and professional educators have a propensity for making educational decisions on an intuitive rather than on an empirical basis--persuasive arguments to the contrary aside. Of course, where commercial variables are concerned, curricular decisions are most likely to be made on the basis of perceptions concerning sales potential rather than on hard research data. The question that remains, of course, is "what can be done?"

Aligning Theory and Practice

Although environmental educators heartily endorse the ultimate goal of environmental literacy as a group, it appears that on an individual basis, they tend to focus on specific components of environmental literacy and to expend their effort in limited areas. While not questioning the dedication and commitment of environmental educators, one need only observe the preponderance of awareness-oriented curricula (Bottinelli, 1976; Childress, 1978; NEA, 1970; Pettus & Schwab, 1978; Tewksbury & Harris, 1982) and of awareness-oriented EE research (Hungerford, et al., 1983) to find evidence of these narrow foci.

Thus, inherent in the challenge of taking EE goals to the classroom is the alignment of theory and practice. If, in theory, environmental educators accept the environmental literacy goal and its attendant subgoals (as both EE literature and research seem to indicate they do), then that acceptance of the total structure should be reflected in practice.

The set of EE goals described earlier are hierarchical in nature. Few environmental educators would condone the practice of asking learners to evaluate issues and solutions with respect to ecological and cultural implications (Level III, Goal D) without first attempting to provide them with sufficient ecological knowledge to permit ecologically sound decision-making (Level I).

Similarly, it appears educationally and environmentally irresponsible to address only the lower level EE goals. That those lower goal levels are important and, indeed, critical cannot be denied. But, to provide learners with a foundational knowledge of ecology and to develop in them an awareness of environmental issues and human values is simply not enough. Without teaching individuals how to apply ecological concepts and principles in the investigation and evaluation of issues and solutions and how to participate as citizens in environmental decision-making, there is little reason to believe that learners will autonomously develop into the "citizenry educated in environmental problem-solving" which Hawkins and Vinton (1973) regard as "the solution to the environmental crisis" (p. 108).

Applying the Goals - An Instructional Model

Once environmental literacy has been consciously accepted as the ultimate goal in EE (with its attendant subgoals), the challenge of taking the goal(s) to the classroom takes on additional meaning. Concern then focuses on how to ensure the outcome prescribed by environmental literacy, i.e., environmentally responsive and skilled citizens.

The vehicle by which environmental literacy is translated into classroom practice is the EE curriculum. There is no doubt that EE curricula abound. The fact that those curricula are predominantly focused on the lower level goals does not and must not indicate a wholesale condemnation of existing curricula. Instead, environmental educators are faced with the tasks of examining existing EE programs and projects, and of critically analyzing them as to the goal level(s) which are addressed. After thorough analyses, educators can then embark on supplementing and strengthening EE curricula to adequately reflect the overall literacy thrust.

In all probability, a number of these evaluative efforts will result in the acknowledged need for EE curriculum development. Numerous models exist to guide practitioners in curriculum development and instructional planning. The following several pages present one such model (see Figure 2) which has lent itself well to designing effective instruction. Additionally, this model has proven particularly appropriate and beneficial for use by practitioners, i.e., by classroom teachers, and therefore is extremely useful in developing instructional packages at the school district level, as well as at the state, regional, or national level. The model, if applied rigorously, can result in organized, internally consistent, and valid EE materials for any receiver group, grade level, or content area.

As explained by Hungerford and Peyton (1980), the heart of the model incorporates instructional objectives (A), pretesting (B_1), instruction (B), and posttesting (C). Curricular goals (A_1) and curriculum evaluation (D) have also been included in the model to show their relationship to instruction as such. A brief discussion of the four major components is provided below.

Curriculum Development and the Instructional Process

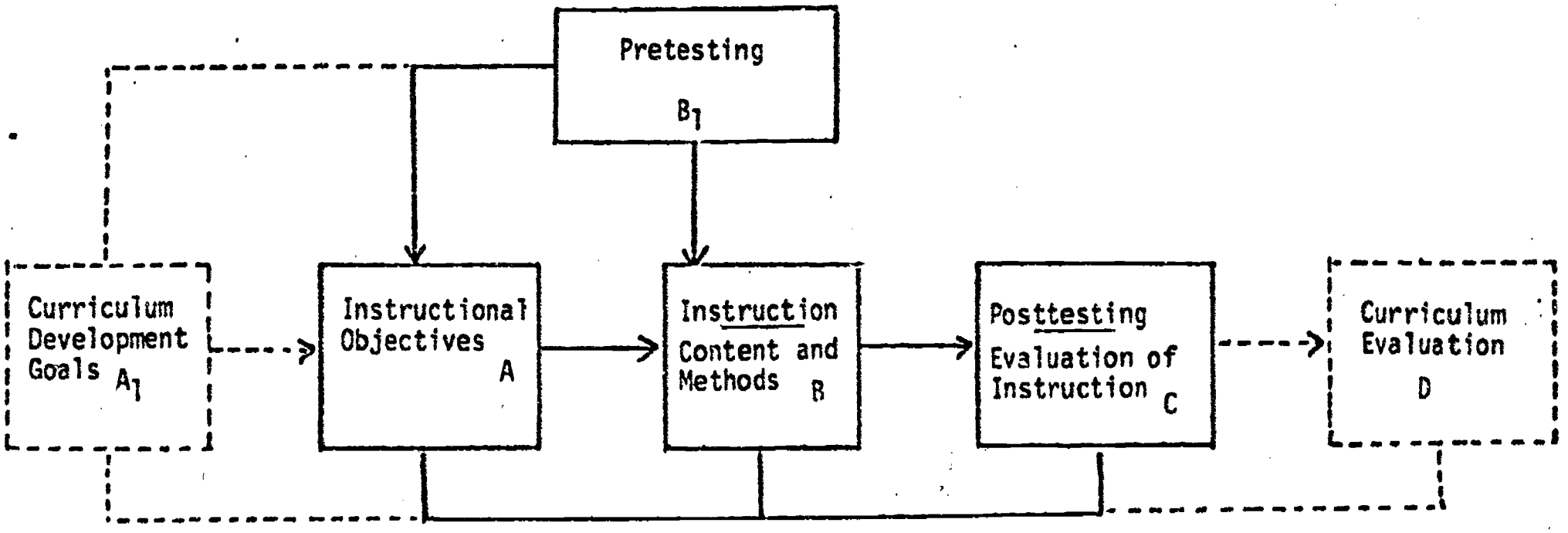

Figure 2. Schematic diagram reflecting components of the instructional process plus original curriculum development goals and subsequent curriculum evaluation. A, B, and C constitute the critical components of instruction, i.e., instructional objectives, content and methods, and posttesting. Pretesting (B_1) must also be considered as an integral component when needed in the instructional process. Note the interrelatedness of all components. These relationships must be constantly respected in any curriculum development and instructional effort in order to maintain any semblance of validity. (Hungerford and Peyton, 1980)

Instructional objectives (A) are critical to the entire process of curriculum development and instruction. This component establishes what the learner is to learn, i.e., what the instructor is to teach.

The selection of instructional objectives should be based on: (1) the curriculum goals being used, (2) the scope and sequence of the curriculum under development, (3) what behaviors the students are expected to demonstrate subsequent to instruction, (4) what the students' capacities are at the beginning of instruction, and (5) the resources available to the instructor (school).

Once the instructional objective is selected it should be inspected for consistency with the goals being used. It should also probably be stated in performance terms in order to permit the instructor to measure its acquisition during or subsequent to instruction. Several examples of performance objectives appropriate for the goals used in this document are stated in the following list:

Goals	Objective
Level I Part G	(1) Subsequent to the unit on homeostasis, the students will be able to write an appropriate definition for the term.
Level I Part G	(2) Subsequent to the unit on homeostasis, the students will visit a local, stable ecosystem and cite at least three (3) variables that contribute to the homeostatic nature of that ecosystem.
Level II Part A	(3) Following a unit on man's cultural activities and the environmental implications of these activities, students will be able to state two (2) ways in which regional ecosystems are threatened by man's activities. Similarly, students will be able to explain why these activities threaten said ecosystem.
Level III Part A	(4) After completing the module on investigation using secondary sources, the students will draw an issue (from a set of issues prepared by the instructor) from a container and locate at least six (6) current references dealing with that issue from the card catalog and/or the Readers' Guide (or any other appropriate sources assigned by the instructor).

Level IV Part A	(5) Students completing the module on environmental action will be able to write a suitable definition for consumerism and cite at least two current issues that could possibly be influenced by that mode of action.

(Note: The five objectives written above are examples only and do not necessarily constitute the writers' recommendations for objectives for particular goal levels.)

The benefits of using performance objectives (P.O.'s) are many. A few of these benefits follow: (1) P.O.'s contribute to the logical sequencing of content in curriculum development. (2) P.O.'s contribute to effective communication concerning expected outcomes between developers, students, teachers, and parents. (3) P.O.'s help provide a mechanism whereby both instruction and curricula can be evaluated. (4) P.O.'s promote efficient learning when students realize what is expected of them. (5) P.O.'s facilitate pretesting when this component is appropriate. (6) P.O.'s help evaluators measure the acquisition of particular goals.

Pretesting (B_1) is undoubtedly of great value when an instructor is beginning a new unit or commencing to work with a group of unfamiliar students. When used, pretesting should involve an evaluation of the extent to which students have already mastered the performance objectives reflected in the curriculum. Pretesting must be consistent with the objectives and anticipated instruction if to be of any value whatsoever.

In situations where the instructor is thoroughly familiar with the students - or where the courses are very sequential in nature - pretesting for every unit or module is probably not necessary.

Instruction: Content and Methods (B) involves the selection of the content most appropriate for getting students to master the objectives in question. Also involved are the selection of suitable methods, the selection of instructional materials to be used, and the sequencing of activities used in instruction.

Content used for achieving particular goals may differ from school to school or nation to nation. Certainly, students living in an oak-hickory ecosystem should learn the concepts associated with "ecosystem" by interacting with the forest. It would be foolish to ignore the student's own regional biome and focus on another in a distant region, e.g., rain forest. Similarly, environmental issues vary from region to region and those of immediate concern to the student should be used - at least initially - when curricula are being prepared.

The availability of instructional materials will also differ from school to school and region to region. Some schools may have access to many visual aids while others do not. The same is true for library resources, access to field study areas, and laboratory facilities. These considerations must be kept sharply in focus when developing curricula.

Modes of instruction are critically important to the curriculum developer and instructor. The best available methods should be employed when designing instructional sequences. A field trip may prove eminently more profitable than a lecture about a resource. Debate may provide considerably more values clarification potential than simply reading about an issue. A laboratory may well teach far more about an ecological principle than a discussion about that principle. Methods can make the difference between a powerful learning experience and one that fails to result in the acquisition of desired knowledge, skills, or attitudes.

Posttesting (C) may, in fact, be a poor term to describe all of the attributes of this component because it infers that instructional evaluation will take place upon the completion of a unit or module. Certainly, many objectives can and will be evaluated enroute, as students progress through the learning sequence. Many affective objectives, for example, can be evaluated by the instructor's observation of receiver behavior during a variety of activities, e.g., the student's involvement in the values clarification process during a debate, a case study analysis, or a simulation activity.

Still, many objectives will be evaluated subsequent to instruction. Regardless of when evaluation takes place, the critical thing to keep in mind is to guarantee that students are evaluated on the objectives as stated, in a manner consistent with instruction. Herein lies a much too common problem in education, that of preparing objectives, providing instruction, and then evaluating receivers on some other set of objectives.

If the performance objectives have been carefully prepared and clearly stated, evaluation becomes a relatively simple matter. Of course, the evaluation mode or strategy will depend entirely on the way in which the objectives have been stated, i.e., the evaluation instrument will measure what the objectives specify as appropriate human behavior following instruction.

Oftentimes educators infer that the evaluation process is measuring only student success. This is only partly true in that posttesting is a remarkably good indicator of the suitability or success of instruction, particularly if the objectives and instruction are sound. Posttesting is also a powerful mechanism

> for establishing the need for revision in either the objectives or instruction or both. When revision is called for it should be undertaken promptly and with careful planning.

The above model provides a rational and orderly approach to instructional practice in EE. For a more extensive discussion of those processes, the reader is referred to Strategies for Developing an Environmental Education Curriculum[4] (Hungerford and Peyton, 1980).

Preparing the Practitioner

If the curricula are the vehicles by which EE goals are taken to the classroom, then the practitioner (the instructor) is the driving force behind those curricula. Recent research (Champeau, et al., 1980; Peyton and Hungerford, 1980; Volk, et al., in press) clearly substanciates the need for improved teacher education at both pre- and inservice levels. Numerous other international, national, and state level surveys have documented similar needs (Bottinelli, 1976; Childress, 1978; Hyde, 1977; Miles, 1971; NEA, 1970; Trent, 1975; Unesco, 1977).

With respect to teacher education needs, Selim (1977) writes that:

> ...the conclusion that arises clearly and pervasively from a consideration of needs in the training of teachers for environmental education is that a broad, multifaceted approach is necessary. A long and arduous journey separates conference rhetoric and goal-setting from practical implementation of effective teacher-training programmes.

"Arduous" may prove to be the understatement of the last quarter of this century. Indeed, changes in teacher education--except those imposed on the educational community by superordinate political/legislative systems--are hard to achieve. But, it is imperative that the environmental community believes that change is possible. And, of course, it is, however arduous the task.

A major step in effecting this change is the identification of those competencies needed by teachers which will enable them to become effective environmental instructors. Fortunately, these competencies have been described in a Unesco publication prepared by Wilke, et al. (1980) entitled Strategies for the Training of Teachers in Environmental Education.[5] In this publication the authors identify, in behavioral terms, competencies needed in two areas: (1) foundational competencies in professional education and (2) competencies in environmental content. These competencies parallel completely the goals for EE described earlier and are described below.

EE TEACHER COMPETENCIES

I. Foundational Competencies in Professional Education

The effective environmental education teacher should be able to...

(1) ...apply a knowledge of educational philosophy to the selection (and/or development) of curricular programs and strategies to achieve both general education and environmental education goals. (It is important that all educators be aware of the philosophical basis for education in their own society. Environmental education goals and methods should be evaluated in light of such philosophies as Experimentalism or Reconstructionism. Many accepted goals of general education supported by such philosophies are entirely consistent with environmental education goals. General education materials and methods may sometimes need to be merely "environmentalized" to achieve the goals of each.)

(2) ...utilize current theories of moral reasoning in selecting, developing and/or implementing environmental education curricula in order to achieve accepted goals of EE with effectively selected receiver groups. (Included in this category of "moral reasoning" are not only theories of moral development, but theories of valuing processes as well. Environmental education teachers should be competent to assess the developmental readiness of receivers when dealing with attitudes and processes in the affective domain. Teachers should be able to use strategies which allow receivers to recognize the role of values in environmental decision-making, clarify value positions, and understand the valuing process.)

(3) ...utilize current theories of knowledge/attitude/behavior relationships in selecting, developing and/or implementing a balanced curriculum which maximizes the probability of desired behavior changes in receivers. (Environmental educators often assume linear relationships among ecological knowledge, positive environmental attitudes, and environmentally ethical behavior. Current research indicates that such may not be the case. Many variables impinge on environmentally ethical behaviors, including various categories of knowledge--e.g., ecological knowledge vs. trade-off costs, experiences, and locus of control, internal or external. A balanced and syntactically sound curriculum is necessary to achieve environmental education goals.)

(4) ...utilize accepted learning theory (e.g., Piaget, Bruner, Gagne) in selecting, developing, and/or implementing curricular materials and teaching strategies to effectively achieve environmental education goals with selected receiver groups.
(The nature of many environmental education goals is problem-solving. Learning theory has much to offer in guiding the selection of materials and strategies to develop problem-solving abilities. Selection of appropriate environmental education materials and strategies for specific receiver age levels may be effective when theories of learning development are considered. A pragmatic approach to this body of knowledge would do much to increase the effectiveness of environmental education teachers.)

(5) ...teach for the transfer of learning to insure that learned knowledge, attitudes, and cognitive skills will be transferred to lifestyle decision-making by receivers.
(The ultimate goal of environmental education is to produce environmentally literate citizens who are willing and capable of taking positive environmental actions in their lives. Too often, educators fail to teach for the transfer of knowledge, attitudes and cognitive processes learned in the classroom, to use in problem-solving in students' lives.)

(6) ...select and implement effective instructional methodologies to achieve environmental education goals appropriate for desired cognitive and affective outcomes, receiver characteristics, and available facilities (e.g., time, money, personnel):

(A) outdoor education methods.
(B) affective education methods (e.g., values clarification, Bank's inquiry model, moral dilemma model).
(C) simulation games (including role playing).
(D) case study methods.
(E) community resource use (ecological, issue-related, human resources).
(F) methods of autonomous student and/or group investigation and evaluation of environmental issues.
(G) methods for effectively handling controversial environmental issues.

(7) ...use effective means of planning for instruction.

(8) ...effectively infuse environmental education curricula and methods into all appropriate disciplines.

(9) ...effectively evaluate environmental education instructional outcomes in cognitive, affective, and behavioral domains.

II. Competencies in Environmental Education Content

Level I: Ecological Foundations

The effective environmental education teacher should be able to...

(10) ...apply a knowledge of ecological principles to the analysis of environmental issues and identify key ecological principles involved.

(11) ...apply a knowledge of ecological principles to predict the ecological consequences of alternative solutions to environmental problems.

(12) ...be sufficiently literate in ecology to identify, select, and interpret appropriate sources of scientific information in a continuing effort to investigate, evaluate and find solutions for environmental problems.

(13) ...communicate the major concepts in ecology and their implications for environmental quality. A partial listing of ecological concepts is presented below to provide examples of how this competency level should be further operationalized. The criteria for further development and selection should include the usefulness of the ecological concept in understanding man's dependence on a stable, productive ecosystem for survival, and how man's activities impact on ecosystems.

A. Individuals, populations, communities, and ecosystems represent legitimate organizational levels in nature which must use homeostatic mechanisms to cope with the laws of the universe (e.g., laws of thermodynamics) and the forces of change in the environment, in order to survive.
B. Energy flows through and matter must recycle in ecosystems.
C. Succession is the process of ecosystems changing with time, generally from a less complex stage to a more complex and mature stage.

D. The population as an organizational level is the basic unit of the ecosystem. Each population occupies a specific functional niche which "fits" into the organization of the ecosystem (e.g., as part of the energy flow and biogeochemical cycles).

Level II: Conceptual Awareness

The effective environmental education teacher should be able to select, develop and/or implement curricular materials which will make receivers aware of...

(14) ...how man's cultural activities (e.g., religious, economic, political, social, etc.) influence the environment from an ecological perspective.

(15) ...how individual behaviors impact on the environment from an ecological perspective.

(16) ...a wide variety of local, regional, national and international environmental issues and the ecological and cultural implications of these issues.

(17) ...the viable alternative solutions available for remediating discrete environmental issues and the ecological and cultural implications of these alternative solutions.

(18) ...the need for environmental issues investigation and evaluation as a prerequisite to sound decision-making.

(19) ...the roles played by differing human values in environmental issues and the need for personal values clarification as an integral part of environmental decision-making.

(20) ...the need for responsible citizenship action (e.g., persuasion, consumerism, legal action, political action, ecomanagement) in the remediation of environmental issues.

Level III: Investigation and Evaluation

The effective environmental education teacher should be competent to investigate environmental issues and evaluate alternative solutions, and to develop, select and/or implement curricular materials and strategies which will develop similar competencies in receivers, including...

(21) ..the knowledge and skills needed to identify and investigate issues (using both primary and secondary sources of information and to synthesize the data gathered).

(22) ...the ability to analyze environmental issues and the associated value perspectives with respect to their ecological and cultural implications.

(23) ...the ability to identify alternative solutions for discrete issues and the value perspectives associated with these solutions.

(24) ...the ability to autonomously evaluate alternative solutions and associated value perspectives for discrete environmental issues with respect to their cultural and ecological implications.

(25) ...the ability to identify their own value positions related to discrete environmental issues and their associated solutions.

(26) ...the ability to evaluate, clarify, and change their own value positions in light of new information.

Level IV: Environmental Action Skills

The effective environmental education teacher should be competent to take positive environmental action for the purpose of achieving and/or maintaining a dynamic equilibrium between quality of life and quality of environment, and to prepare, select, and/or implement curricular materials and strategies which develop similar competencies in receivers to take individual or group action when appropriate (i.e., persuasion, consumerism, political action, legal action, ecomanagement, or combinations of these action categories).

Once the EE competencies have been described, there is a necessity for convincing teacher educators that they must train teachers for the demanding roles that lie before them. The easiest strategy would be to make such training mandatory in every state in the USA. Even though this has been successfully accomplished in Wisconsin, it is highly unlikely that many states will follow suit. It appears that the only alternative is to "hawk" EE goals and the need for their implementation at teacher educator conferences and to do so until the message is internalized. Said persuasion must, however, be accompanied by a professional commitment to help train teacher educators wherever acceptance is observed. These things should most probably be coordinated and supported by our existing national organizations. Although the expenditures of time and money would be significant, such a commitment may be crucial.

Allied Challenges

Thus far, we have explored three major challenges to the K-12 EE community: 1) accepting an overriding goal for K-12 EE; 2) selecting subordinate goals which correspond to the development of an environmentally active and responsible citizenry; and 3) addressing critical variables which are precursors to seeing these goals implemented.

Needless to say, there are other challenges facing the environmental education community--some of them more crucial than others. Included among these challenges are the following:

4) Gaining community and administrative support for the curricular changes proposed in this document. That support must certainly be garnered not only from that part of the public which contributes to public education but also from that increasingly large sector which supports private educational institutions.

5) Consolidating EE into the general education curriculum. Instructional decision-makers face a difficult choice in this regard, i.e., whether to attempt to incorporate separate EE courses into already existing curriculum programs or to infuse environmental content into existing courses. Both strategies are replete with agonizing problems. Both require careful planning and monitoring in order to maximize their potential for success.

6) Establishing workable liaisons between formal and nonformal environmental educators and programs. Said liaisons must be supportive of both educational arenas and must result in the accomplishment of the same overall goals. Both formal and nonformal EE have important roles to play in the development of environmental literacy. A prime example of this might be found in the area of environmental sensitivity, which appears to be a precursor to pro-environmental behavior. Research has identified several variables which appear to affect environmental sensitivity (Peterson and Hungerford, 1981; Tanner, 1980). Among them are frequent and long-term experience in the out-of-doors, outdoor experiences in youth organizations and/or family outings, and role models who stimulate interest in environmental systems and provide educational and professional guidance. It seems cogent to suggest that some of these variables might best be addressed by formal environmental educators while others might prove better suited to the nonformal realm. Regardless, a cooperative effort between educators in both arenas and an educational articulation between formal and nonformal programs appear imperative in providing a comprehensive environmental education for today's young people.

7) Gaining federal support. Environmental education must also make a concerted effort to gain support from federal agencies, particularly those that are in a position to publicly affirm that support and to create legislative and/or financial pathways through which change can occur. It appears that EE has little respect in many federal quarters. Irrespective

of whether this is the case, it is obvious that EE is obtaining little support at the federal level. And, at least in part, it seems quite likely that this hypothesized lack of respect and support stems from a lack of cohesiveness and direction within the EE community itself. Until the EE community remedies these situations, society, society's children, and the environment will be the losers.

Concluding Statement

A paper such as this, by its very nature, usually raises more questions than it answers. Unfortunately, some of the unanswered questions are used or can be used as excuses for not acting on the challenges facing EE. In this particular instance it appears as though meeting the challenges should transcend both the questions and the excuses.

The K-12 schools in this nation provide a unique opportunity for the development of environmental literacy. Virtually every individual - every future citizen of our society - is shaped and influenced by the formal educational system. It is, at long last, time to look at what we know about changing behavior and to use that knowledge to produce teachers who can teach for environmental literacy and students who can respond successfully to that instructon. In a situation where the survival of society and the biosphere are probably at stake, it is cause to make one wonder why we are not already on task.

Acknowledgements

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Endnotes

[3]Although a number of studies have sought to identify determinants of environmentally positive behavior, one ongoing study merits mention at this point. Sia, et al. (1983) have incorporated several variables, which previous studies had denoted as having behavioral predictive power, into a single investigation in order to ascertain the relative strength of each in predicting pro-environmental behavior. The predictor variables included in this study were 1) level of environmental sensitivity, 2) perceived

individual locus of control, 3) perceived group locus of control, 4) perceived knowledge of environmental action strategies, 5) perceived skill in using environmental action strategies, 6) psychological sex role classification, 7) belief in/attitude toward pollution, and 8) belief in/attitude toward technology. Using two samples of convenience (Illinois and Wisconsin Sierra Club members and participants in Elderhostels at Southern Illinois University-Carbondale), Sia measured each of the above variables and also obtained a measure on the criterion variable, level of environmental activism. Subjecting the data to stepwise regression analysis, Sia has found that the strongest predictors of pro-environmental behavior are perceived skill in the use of environmental action strategies (accounting for 38% of the total variance) and level of environmental sensitivity (accounting for 13% of the total variance). What is remarkable about these findings is that no previous studies have been able to account for such a large portion of the variance (51%) when subjecting the entire sample to a regression analysis.

[4]This document is available from Unesco, 7, place de Fontenoy, 75700 Paris, France.

[5]This document is available from Unesco, 7, place de Fontenoy, 75700 Paris, France.

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"Environmental Studies": Towards a Definition

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Abstract: *Based on a review of the literature, this paper traces the recent history of attempts to define the scope of environmental studies as an interdisciplinary field within higher education. Highlighted are definitions phrased by early academic programs, pieces of legislation, and reports from international conferences. Environmental studies is then contrasted with seven other distinct fields of study (which are overlapping and contributory): (1) Conservation/Natural Resource Management - human management of natural resources to maximize human utilization; (2) Ecology - the science of ecosystems; (3) Environmental Design - applications by architecture, landscape architecture, and urban & regional planning; (4) Environmental Engineering/Technology - the techniques of sanitary engineering in the design of public works; (5) Environmental Health - deleterious effects of technological advancement on human health; and (6) Environmental Science - the biophysical 'hardware' of environmental studies. A table presents the 354 subject headings used to label fields of environmental specialization by six indexing agencies. In conclusion the author offers the following as a working definition for the broad middle ground of academic concern called Environmental Studies:*

Environmental Studies is the interdisciplinary search for knowledge about, and understanding of, natural (physical and biotic) systems and of the dynamic interactions between these systems and humankind's social and cultural systems.

Search For a Definition

Within higher education in the United States, the generic name that has come to be used to identify academic endeavors relative to the environment is Environmental Studies. This is true in any or all of the three historic areas of higher education's mission: teaching, research and community service; and it holds true in most of the English- and non-English-speaking world as well. It is not germane to this study to document exactly how or why this is so, but the style of the name is not out-of-keeping with other interdisciplinary studies areas: American Studies, Black Studies, Women's Studies, etc. Newly coined names such as "Environtology" (Davis, 1978b) and "Ecography" (Hafner, 1970) did not survive on their own campuses (Iowa State University and Hampshire College, respectively), to say nothing of taking hold elsewhere.

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Within governmental circles in the United States and elsewhere, and throughout the broad, many-faceted environmental movement, the name applied as an umbrella to this area of study and activity is Environmental Education. This term covers all aspects of communication, teaching, and training at all educational levels -- primary, secondary, post-secondary -- and in all modes: formal and non-formal.[2]

Within post-secondary education, the name Environmental Education is generally reserved for a specialization under teacher training located in professional schools of education.

These overlapping and duplicative terms create confusion for the uninitiated and experienced alike, and consternation for the purists among us. But once one makes the adjustment to this difference in usage of nomenclature, one can get on with more serious matters. However, it is important to note the organizational source of the environmental literature before one in order to adjust to the appropriate set of nomenclature.

Researchers in this field have had good reason to wish for a standard classification system of degree major programs in higher education. Such a taxonomy already exists under the acronym HEGIS (for Higher Education General Information Survey), a federal classification system introduced in the early 1970's. But it is not without its faults and limitations. First, it lacks universality of usage, New York State being the major proponent of the system. This is so because the New York State Board of Regents serves as the accrediting agency for institutions of higher learning within that state, in the place of a regional accrediting organization, and the Board of Regents has adopted and utilizes the HEGIS code. It requires an initial registration and an annual re-registration of all degree major programs offered at all accredited institutions of higher learning throughout the state (Collins, 1982). Secondly, the system as devised is similar to the Dewey Decimal System for library indexing, a four-digit number being followed by a decimal point, and more numbers to the right of the decimal point if further subdivision is required. As might be expected, there is no classification code for Environmental Studies or Environmental Science. The computer print-out sheets of the New York State Board of Regents provide four different classifications where one might expect to find such programs:

0201 Architecture and Environmental Design:
Environmental Design, General
0420 Biological Sciences:
Ecology
0922 Engineering:
Environmental and Sanitary Engineering
4902 Interdisciplinary Studies:
Biological and Physical Sciences

Of the 22 institutions in New York State identified and verified as having Environmental Studies programs, two were listed on their computer

print-outs under the category of Environmental Design, 11 under Ecology, 3 under Biological and Physical Sciences (Interdisciplinary), and none under Environmental and Sanitary Engineering. Unable to be located were the programs of six institutions altogether, these programs evidently being hidden under some other equally inappropriate subject heading. The proper location for classifications entitled Environmental Studies and Environmental Science exists under the overall heading Interdisciplinary Studies, coded 4900. Under that heading there are only five sub-headings presently assigned;

4901 General Liberal Arts and Sciences;
4902 Biological and Physical Sciences;
4903 Humanities and Social Sciences;
4904 Engineering, and Other Disciplines; and
4905 Other, Specify.

There is clearly a need for at least two more new sub-headings, making provision for Environmental Studies and Environmental Science, and their various specializations via further subdivisions to the right of the decimal point.

Thirdly, the federal government has determined recently that the HEGIS system should be discontinued and replaced by an as yet unreleased new system with the acronym CIP (for Classification of Instructional Programs) being prepared by the National Center for Educational Statistics in Washington, D.C. One can only hope that it will make better provision for interdisciplinary Environmental Studies than did HEGIS (which had the capacity, but lacked the formal designation of a number code for Environmental Studies).

Individually and collectively, persons from all areas of the environmental movement have contributed meaningful definitions of the sphere of concern and activity around which they have rallied. We will benefit from looking at some of these. But first we need to look at the key word 'environment' itself. According to A. Geoffrey Norman, "'(e)nvironment,' literally 'that which surrounds,' includes all conditions and stimuli that affect human life, whether natural or man-made, whether man is aware of them or not (Norman, 1974)." F. Kenneth Hare asks, then answers, how do we define environment?

> From a man's-eye view we can perceive three possibilities: (i) The natural environment, which means the physical-biotic world outside society, and our interaction with it. This view supposed that it is feasible to separate our handiworks from that of nature....(ii) The social environment, which arises from the obvious fact that each of us has to survive in a matrix of our fellow men, and that each society must coexist with surrounding societies. In practise for most of us this means the problems of the Western city, with its nightmare inadequacies....(iii) The built environment, which recognizes that man-made structures

> provide the actual home of both working and sleeping mankind, and in the richer societies that it also accommodates his play, his higher culture (whatever that may mean), and his vulgarities.... (iv) Finally, there is the total environment, which pops up in the more exalted literature and which seems to mean (i) + (ii) + (iii). The trouble with such concepts is that the thing environed gets so mixed up with the environment that they become rather fuzzy (Hare, 1970).

Hare's admission as to fuzziness of these concepts is in itself revealing. Since 'everything is connected to everything else' (as environmentalists maintain), the object of our study is not only fuzzy, it is all-encompassing, leading to a warning by Schoenfeld and Disinger that, although we must be concerned with the environment of humankind, we must at the same time be concerned with the <u>total</u> environment.

> First, we are concerned with the environment of humankind. It is possible, of course, to study the physical nature or the biological characteristics of the environment on an infra-human basis, but the concept in environmental studies is the study of humans as they affect and are affected by their environments. The focus, in addition, is upon the growing numbers of humans concentrating in increasing densities and bringing greater pressures to bear upon the environment. Yet our emphasis on the environment of humankind rejects a shopworn "utilization" approach. Perhaps "the most distinguishing characteristic of environmental studies is their recognition that the welfare of the total environment may require a subordination of the parochial interests of humankind" (Nash, 1977).
>
> So, we are concerned with the total environment: its social, cultural, economic, and esthetic, as well as its physical and biological, aspects. To seek an optimum total environment requires both an understanding of human needs and the needs of a healthy living natural environment. Any discussion of the goals of society must quickly draw upon a knowledge of the nature of the world people live in, just as any discussion of a balance of nature today must take into account the necessary impingements of humankind (Schoenfeld & Disinger, 1978a).

Roger E. Gold concisely states his definition of environment as "the system of interrelationships among society, economics, politics, and nature in the use and management of resources" (Gold, 1978). With that definition, despite its all-inclusiveness, this researcher must express a reservation. If all the environment is a "resource" (presumably <u>for</u> humans) to be "managed" (presumably <u>by</u> humans), we are perpetuating a mind-set that is, and has been, dangerous. There are many natural areas that should not be 'developed', and there are many natural things that should not be 'human resources'. More will be said about this reservation later in this paper when we turn to the subject of Conservation/Natural Resources Management.

Turning from definitions of 'environment' to those of 'environmental studies', we look at three statements from programs with early founding dates. Sooner or later every institution of higher learning contemplating the initiation of an Environmental Studies program must come to grips with the requirement to state exactly what it is that they plan to do. These efforts are instructive. In 1970 George Macinko wrote:

> The Environmental Studies Program at Dartmouth is conceived of not as a separate academic discipline, but as a problem-oriented application of science, social science, and the humanities to the fundamental problem of how to develop and maintain a stable planetary ecosystem with man as a member (Macinko, 1970).

In 1967 Western Washington State University founded Huxley College of Environmental Studies as an upper-division cluster college, choosing the term with the widest possible definition for the name of the new entity,

> recognizing that man's environment extends from his immediate surroundings to the biosphere and includes not only physical and biological entities, but also the social structure within which he functions and his cultural heritage which molds his response (Miles, 1978).

In 1966, the University of Wisconsin-Madison had an all-campus faculty Committee on Environmental Studies, charged with encouraging

> interdisciplinary studies that have as their orientation the discovery and dissemination of those attributes of the environment which will contribute to man's survival in a civilized state and to his progessive biological and cultural evolution (Schoenfeld & Disinger, 1978a).

Turning from the campuses to the legislative halls, we find the definition of environmental education given in U.S. Public Law 91-516, The Environmental Education Act (1970):

> The educational process dealing with man's relationship with his natural and man-made surroundings, and including the relation of population, pollution, resources allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment (Schmieder, 1976).

Moving to the international arena, the following definition of environmental education came out of the Belgrade Workshop on Environmental Education held in October, 1975 under the auspices of Unesco/UNEP. It is based on the Belgrade Charter unanimously adopted by 120 representatives from 60 nations.

> Environmental education is a life-long, multidisciplinary approach to teaching, mass communication, community participation, or some other strategy or combination of strategies aimed at the development of a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevencion of new ones (Schoenfeld & Disinger, 1978b).

At a later meetir neld under the same auspices, this time the Tbilisi (U.S.S.R.) Conference on Environmental Education held in October, 1977, a declaration emerged which reads in part:

> Environmental education, properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values. By adopting a holistic approach, rooted in a broad interdisciplinary base, it recreates an overall perspective which acknowledges the fact that natural environment and man-made environment are profoundly interdependent. It helps reveal the enduring continuity which links the acts of today to the consequences for tomorrow. It demonstrates the interdependencies among national communities and the need for solidarity among all mankind (Federal Interagency Committee on Education, 1978).

Moved to comment on the course mandated by the Tbilisi Document, Alexander J. Barton wrote:

> (W)e are called upon to demonstrate the wholeness of environmental concerns and their essential oneness with all other human endeavors -- to permeate, and hopefully to rejuvenate, all of education (Barton, 1978).

In similar vein, providing not another definition but amplification on the role of environmental studies/education, are two more brief commentaries, with which this section concludes.

> It is a way of looking at life, fostering awareness of other life and of interrelationships, learning to recognize the effects (good and bad) we have on physical surroundings, and the responsibilities we must accept for the mere fact of our presence and of our activities in our environments (McInnis, 1972).

> The new environmental education is not a course, a unit, area of study, or a new discipline or interdisciplinary study. It is not even a new curriculum. It is essentially a principle, a way of asking questions and organizing information so as to make sense out of the world and out of the world that is now and will be built. A study of music, art, literature, or architecture, as well as science or urban planning or physical education must surely make more sense when they are related to and seen as being part of the human habitat (Larkin, 1977).

Contrast with Other Areas of Study

While we will return to the definition of Environmental Studies later, it will be instructive to our purposes first, at this point, to contrast Environmental Studies with seven other areas of study in order to better understand what Environmental Studies is and is not.

1. Conservation/Natural Resources Management - The Conservation Movement was launched during the presidency of Theodore Roosevelt, whose administration adopted as policy "the use of the natural resources for the greatest good of the greatest number for the longest time" (Pinchot, 1947). To stress this policy, Roosevelt convened a national conference on the subject, the first meeting ever to bring together both houses of Congress, the justices of the Supreme Court, Cabinet Secretaries and the state governors. The coordinator of the conference was Gifford Pinchot, chief of the U.S. Forest Service and a close advisor to Theodore Roosevelt. Reflecting on this topic in his memoirs, Pinchot wrote:

> The Conservation of natural resources is the key to the future. It is the key to the safety and prosperity of the American people, and all the people of the world, for all time to come. The very existence of our Nation, and of all the rest, depends on conserving the resources which are the foundations of its life. That is why Conservation is the greatest material question of all (Pinchot, 1947).

The teaching of conservation principles made its way into American colleges, principally the land-grant universities, but the instruction was usually specific to one resource (Schoenfeld & Disinger, 1978). Conservation education also found its way to the primary and secondary school levels. It can be defined as:

> the educational process of communicating an understanding of the characteristics, distribution, status, uses, problems, and management policies of our basic natural resources. The emphasis has been on "stewardship" and the "wise-use" concept in relation to basic natural resources (McInnis & Albrecht, 1975).

While 'Conservation' was the original accepted term for studies in resource management in post-secondary education, Natural Resources Management superseded it in general terminology, with numerous programs now bearing the name of their particular specialization (e.g., Wildlife, Range, Water, Forest, etc.). Natural Resources Management does not qualify as a synonym for Environmental Studies because it is based mainly on the natural sciences and, as might be expected, concentrates on the characteristics, distribution, state variables, etc. of natural resources, most often to the neglect of the built environment. Although attention is given to the human demands for these particular resources, and therefore draws on the social, economic and behavioral sciences in this regard, the area of concentration is too specific to equate this specialization with the broad interrelationship of understandings sought by Environmental Studies. Often such resource programs deal with a limited number of options - each devoted to a specific resource and/or a specific ecosystem (range, forest, freshwater, etc.). Nonetheless, such programs can make a significant contribution to Environmental Studies programs, their management practice perspectives being a much-needed input.

2. Ecology - Ecology became a distinct but linking specialization within Biology when in 1866 the German biologist Ernest H. Haeckel, a professor at the University of Jena, and one very much influenced by the works of Darwin, saw the benefit of studying communities of organisms in the context of their habitat, including all the conditions of their existence (McIntosh, 1976). As defined by an ecologist, Beatrice E. Willard,

> Ecology is the science that studies ecosystems -- those recognizable discrete, homogeneous units of the landscape composed of organisms, physical/chemical environment factors, and the numerous interactions that go on between and among organisms themselves and with their environment. This science studies systems and, therefore, focuses on dynamics and on processes. Also, since human beings are organisms, they function as part of these systems (Willard, 1976).

By the 1920's four distinct ecological sciences had emerged in the United States: oceanography, limnology, plant ecology and animal ecology (Schoenfeld & Disinger, 1978a). What has come to be called Human Ecology or Social Ecology was not pursued in any major way until the 1970's (McIntosh, 1976), when there seems to have been a determined effort to develop a general ecology incorporating the complex of human affairs, including urban ecosystems. Ecology (with the exception of Human Ecology) is not a synonym for Environmental Studies, it being a systems approach to various specializations of the biological sciences. As such it does not draw sufficiently upon the other disciplines to achieve a total approach to the complex of activities defined as Environmental Studies. Its contribution to the curriculum is significant, however, there being few, if any, courses that appear as universally throughout Environmental Studies programs as General Ecology. Human Ecology, being an effort to merge human sociology and ecology, and dealing with the interaction of human culture and the

environment, is virtually synonymous with Environmental Studies, drawing as it does on the social and natural sciences, as well as on the humanities, to present a broad view of the phenomena of human culture. According to one proponent's account, Human Ecology involves a three-pronged study:

> (F)irst, analysis of the complex interactions occurring within human populations and communities, as well as those occurring between human populations and communities and the physical biological components of their own total environment; second, study of the mechanisms of adaptation of human populations and communities to the changing environment; third, identification of the parameters and of the ensuing rules for the harmonious development of human ecosystems (Buzzati-Traverso, 1976).

One application of the name Human Ecology to which this research definitely takes exception is that of Home Economics, a source of real confusion if not an outright perversion. Surely there must be a better substitute for Home Economics than Human Ecology if the former name is no longer timely or expressive of the true nature of the domestic arts.

3. Environmental Design - The application of the concepts and the methodologies of the design professions (most notably architecture, landscape architecture and urban and regional planning) to the design (or re-design) of environmentally-sound furnishings and living systems, structures and spaces, and whole neighborhoods, communities, towns and cities has been subsumed within the rubric Environmental Design. These professions have sought out and benefitted from the insights of certain social sciences (such as environmental psychology, environmental sociology, etc.) along with advances in alternative technologies (e.g., solar energy) and land use techniques (e.g., clustering) to advance their arts and make their practitioners more environmentally aware, sensitive and creative. Interior decorating and design, while technically addressing itself to a human environment, namely interior space for living, working, shopping, public assembly, etc., is (in my opinion) outside the strict concerns of Environmental Studies. This is not to say that the design and use of these enclosed human spaces is not an important area of concern in itself, but (except for the siting and construction of the structure which incorporates these interior spaces, and except for the energy forms and consumption required to maintain them) they have little or no relationship to the natural or larger environment of which they are a part. Therefore this researcher discounts the particular contributions of Interior Decorating to Environmental Studies, but definitely not the contributions of architecture, landscape architecture, and urban and regional planning, whose contributions are considerable. Environmental Design is not synonymous, however, with Environmental Studies. Major programs (pre-professional and professional) in these fields are viewed as being outside the area of this study. However, an undergraduate major in Environmental Studies makes good preparation for graduate studies in any of these design professions. On campuses where these design professions have programs, certain courses can and do make a significant contribution to the curricula of Environmental Studies programs.

4. Environmental Education - As previously indicated, Environmental Education, in its broadest sense, is the designation used to refer to all forms and levels of facilitating learning and disseminating knowledge about the environment and humanity's impact upon it. In this usage, the following definition of education is instructive:

> "Education" covers an enormously wide field of activity ranging from formal education in preparation for a vocation or specific qualification to nonformal education which merges with communication, entertainment and public relations work or even with liaison between governmental and nongovernmental organizations, community action groups and societies (Federal Interagency Committee on Education, 1978).

The following definition of Environmental Education grows out of the above understanding.

> Environmental Education - the process leading toward the development of a citizenry that is aware of and concerned with the environment and its associated problems, and that has the knowledge, skill, motivation, and commitment to work towards solutions to current and projected problems (Hernbrode, 1975).

Assessing the difference between Environmental Studies and Environmental Education, Craig B. Davis says that the latter "is primarily 'delivery-oriented'. Content is, for the most part, taken as a 'given' and emphasis is placed on developing effective methods and vehicles for presenting this content to school students and the general public (Davis, 1978a)." As such, Environmental Education is the process of acquiring, and applying, the content of Environmental Studies (Schoenfeld & Disinger, 1978a). But also (as previously mentioned), Environmental Education has a much narrower usage, that being the designation of a specialization within professional teacher training that equips one to be certified by the state as an instructor, curriculum coordinator, specialist or consultant within public school education in the area of environmental content and the methodology for imparting that content most effectively and creatively. In the broadest use of the term Environmental Education, Environmental Studies is enclosed under its umbrella. In the narrower sense of the term, Environmental Education is a distinct professional specialization that falls outside the field of generalized Environmental Studies. In that usage, Environmental Education is not synonymous with Environmental Studies, although courses from the curriculum of the former can and do certainly contribute to the curriculum of the latter (and vice versa).

5. Environmental Engineering/Technology - Put most succinctly by Craig B. Davis, Environmental Engineering

> is a title that is usually used to describe programs emphasizing the use of engineer-concepts and methodologies in the design of structures, equipment, and systems that interface with or attempt to describe our environment. Environmental engineering is also used as a title for sanitary engineering programs (Davis, 1978a).

The capabilities of Civil and Chemical Engineering have been merged with the knowledge of Public Health to form the professional specialization known as Sanitary Engineering (or Environmental Engineering). Areas of expertise include solid waste management, wastewater treatment and discharge, potable water supply and treatment, air quality and pollution control, stormwater control, disposal of hazardous wastes, and radiation detection. Because these technical skills are gained and applied only through highly technical training and professional licensure, Environmental Engineering is a distinct professional specialization that falls outside the field of generalized Environmental Studies. Environmental Engineering is not synonymous with Environmental Studies, although overview and less technical courses from the former can and do contribute to the latter, while courses from the latter can offer breadth and perspective to the former.

6. Environmental Health - The field of Environmental Health is a sub-set of the Public Health profession, itself an amalgam of the concerns of Medicine, Nursing, Home Economics, Sanitary Engineering and Public Administration. Environmental Health's particular area of concern is the study of the effects of human technological achievements (e.g., noise, radiation, population problems, building materials, occupational settings, pollutants, chemical pesticides, etc.) on human health (including mental health), largely through the analysis of air, water and food intakes. Although multidisciplinary, this specialization is highly technical, its offerings being largely outside the mainstream of the liberal arts curriculum. Environmental Health is a distinct professional specialization that falls outside the field of generalized Environmental Studies. Therefore, Environmental Health is not synonymous with Environmental Studies, although on campuses where both programs do exist, courses from the former can and do contribute to the latter, and vice versa.

7. Environmental Science - Again turning to Davis, an ecologist, we have another succinct definition, this time of Environmental Science.

> Environmental Science largely is a disciplinary or multidisciplinary approach to the scientific and technical aspects of manipulating, modifying, or preserving our natural environment. Emphasis is generally placed on the physical sciences, on the ecologically-oriented biological sciences, on engineering and on statistical and computer modeling (Davis, 1978a).

Commenting on the distinction of Environmental Studies from Environmental Science(s), Schoenfeld and Disinger write:

> Environmental studies can encompass, but are not synonymous with, the environmental sciences. The latter are the biophysical "hardware," so to speak, of environmental studies, in contradistinction to the social science and humanities "software." More explicitly, the environmental sciences include

such diverse fields as "meteorology, climatology, plant and animal ecology, oceanography, agriculture, geochemistry, soil engineering, civil engineering, and many more."

The environmental sciences, of course, play a major role in any environmental studies program, but only one role. To address any environmental problem at its root is to deal with the fundamental cause -- man and his ideas. Indeed, "the conclusion cannot be avoided: science, undiluted with ethical and humanitarian influences can be mankind's greatest problem rather than its greatest blessing (Nash, 1974)." Environmental studies seek to bring perspective to both the sciences and the arts (Schoenfeld & Disinger, 1978b).

Continuing this same line of reasoning, Roderick Nash has argued:

"Environmental studies" must not be transformed into "environmental sciences" but frequently is in fact, if not always in name. The sciences, for one thing, have an obvious relation to the natural and physical environment, and scientists are more familiar with collaborative teamwork than faculty of other disciplines. It is the rare environmental unit that is not led, if not dominated, by scientists. But the problems environmental studies should ultimately address are those that involve human values, attitudes, and policy. Man is at the root of most environmental problems, and the study of man is precisely the subject of humanists and social scientists.

Melding these scholars with their scientific colleagues is difficult. The intellectual and emotional gulf between what C.P. Snow called the "two cultures" is enormous. Not only indifference is involved but positive suspicion. To build a true interdisciplinary approach it is necessary to promote frequent intellectual and social interaction. Focusing on an actual environmental problem...is useful since its solution will usually involve input from a wide variety of scientific and non-scientific disciplines. Respect for what other disciplines can contribute will follow from such interaction (Nash, 1974).

Frey, for example, upholds the importance of distinct programs in Environmental Science.

The prevalent argument suggests that environmental science is merely a subset of environmental studies. This premise is founded on the observation that "the problems environmental studies should ultimately address are those that involve human values, attitudes, and policy." The argument usually spins on to say that uncontrolled technology, which among other by-products creates environmental and health hazards, is not the problem per se, but rather is the symptom of man's perverted values. Some

> argue that environmental studies deal with these underlying values while environmental science treats only the symptoms of man's dysfunction with his physical environment. Conceptually, I agree with this position, but history documents the difficulty society has in changing its values, attitudes, and even its policies. In the meantime, air and water become even more deadly and the land is decimated by the multiple demands which are placed upon it by industry, recreation, residence and transportation (Frey, 1978).

Frey goes on to applaud and support the long-term objectives of environmental studies, recognizing the need for academe to address these social issues. However, he believes the fact remains that the immediate by-products of an uncontrolled technology and the life styles of many Americans create problems such as air and water pollution, solid waste accumulation, wasted energy and multiple pressures on the land. Frey believes that these are precisely the kinds of problems which can best be solved through the application of the principles found in the biological, physical and engineering sciences; i.e., programs in environmental science. He continues:

> Rather than to dwell on the differences between the concerns of environmental studies and environmental science, and perhaps unnecessarily develop internecine warfare, let me simply say we need both approaches. The campus I represent, the State University of New York College of Environmental Science and Forestry (ESF), emphasizes the use of applied and basic science to solve the problems of our physical environment. However, we also have a strong commitment to address, as well, the underlying social milieu (Frey, 1978).

Because the vast majority of self-labeled Environmental Science programs (as well as some that bear the name Environmental Studies) are set in the context of a liberal arts curriculum, and because they do, as Robert H. Frey recommends above, "have a strong commitment to address...the underlying social milieu," such programs are included in the inventory and curriculum review undertaken by my larger study of which this paper is but one part.

Legitimately, and otherwise, the adjective 'environmental' has been applied to just about 'anything and everything'. There is even an institution (the University of Central Florida) that uses the term Environmental Studies to refer to its campus-wide general education distribution requirements, although these are not in any way distinguished by recourse to environmental concerns as a unifying theme (as well they might). Many traditional disciplinary departments added the prefatory adjective to highlight the relevance of an existing (and otherwise unrevised) course to environmental concerns. For a brief overview of the specialized fields that have emerged as the result of environmental concerns bringing multidisciplinary theories and practices together for the purposes of environmental problem-solving, the reader is referred to the appendix,

wherein is provided a categorical listing of subject headings used by major ongoing reference services and others to index fields of environmental emphasis or specialization.

This researcher has not attempted to identify and inventory Environmental Studies programs by fields of emphasis or specialization. Most of these fields, in any case, are outside the purview of this particular paper. This exclusion in no way indicates a lack of appreciation for the contribution each of these specializations can and does bring to the overall advancement of environmental knowledge and betterment. This study has chosen to focus its attention on the broad, middle ground of Environmental Studies, admittedly to the exclusion of the vast array of specializations and technologies, for to do otherwise would expand this paper to encyclopedic and unmanageable proportions. Having acknowledged and differentiated the major fields of environmental study, and most of the major specializations within these fields, we move to a definition of the broad middle ground of academic environmental concern called Environmental Studies.

Working Definition

Modifying and adapting the efforts of others (Davis, 1978a), I arrived at the following definition for Environmental Studies:

> Environmental Studies is the interdisciplinary search for knowledge about, and understanding of, natural (physical and biotic) systems and of the dynamic interactions between these systems and humankind's social and cultural systems.

In contradistinction to the predominant thrust of Environmental Education, Craig B. Davis points out that

> environmental studies is more than a series of instructional programs for training undergraduate and graduate students. It is also a field of scholarly pursuit. Faculty members engaged in environmental studies are, for the most part, keenly interested in examining the body of knowledge, sifting it, resorting it, and examining it again with the hope and expectation that their efforts will shed some light on the interrelationship of Man, culture, society and the environment. It is this pursuit of knowledge that is the true raison d'etre for the field of environmental studies. It provides the substantive conceptual base on which instructional programs can be developed (Davis, 1978a).

In an effort to summarize much of the previous discussion relative to the nature of Environmental Studies, broadly defined, a figure has been prepared (page 45). In the left-hand column listed by conventional groupings are the various disciplines and professions contributing to the

HUMANITIES:
- Fine Arts - visual, performing
- Philosophy - ethics, aesthetics
- Literature
- History

SOCIAL SCIENCES:
- Political Science/Government
- Economics
- Psychology
- Sociology
- Anthropology
- Geography - demography & population studies

NATURAL SCIENCES & MATHEMATICS:
- Natural History
- Geology/Earth Science - hydrology
- Chemistry
- Physics - meteorology, climatology
- Biology - botany, zoology, microbiology ecology
- Mathematics - statistics, computer science

PROFESSIONS:
- Theology
- Medicine/Public Health, sanitation
- Law
- Engineering: civil, mechanical, sanitary, chemical, architectural, agricultural, soil, transportation, surveying
- Architecture & Design - interior decorating
- Landscape Architecture - horticulture
- Public Administration/Affairs
- Urban/Regional Planning - urban studies
- Journalism/Communications - advertizing
- Education: PreService
  InService
  conservation education, physical education, camping & outdoor education
- Business Administration/Finance - management
- Home Economics - nutrition
- Agriculture: animal husbandry, agronomy
- Conservation/Natural Resource Management: wildlife, fisheries, wildlands, range, forestry, water, soil conservation/science, parks/recreation, minerals, energy

ENVIRONMENTAL STUDIES

Specialties:

-)
-)Envir. Perception
-) & Quality of Life
-)
- Envir. Policy
- Env. & Resource Economic
- Envir. Psychology
-)
-)Human Ecology
- Envir. Geography
-)Envir. History/Geology
-)Water Pollution:
-) thermal
-) contaminants
-)Pollut. Control Measurem
-)Envir. Toxicology:
-) water
-) air
-)Air Pollution
-)Noise Pollution
-) control/abatement
-)Water Quality
-)Marine Studies
-)Limnology
-)Pests & Pest Control
- Env. Medicine/Health/Sani
- Envir. Law/Protection
-)Envir. Engineering
-) solid waste disposal
-) waste water treatment
-)Systems Analysis
-)
-)Envir. Design
- Envir. Policy Formation
- Envir. Administration
- Envir. Planning
- Env. Assessment/Analysis
- Envir. Interpretation
-)
-)
-)Envir. Education
-)
- Envir. Management
-)
-)
-)Env. Resource Management
-)
-)
-)

'interdisciplinary search' referred to in the above proffered definition. Environmental Studies does not result from the contribution of any single discipline/profession or combination of disciplines/professions short of all capable of making a contribution. In the right-hand column listed opposite the discipline(s) or profession(s) from which they most directly derive, are the major environmental specializations that have emerged to date in an effort to apply the insights of one or more disciplines/professions to environmental concerns. Environmental Studies does not result from the application of any single specialization or combination of specializations short of all capable of making a contribution to the environmental concern under investigation. To reinforce this point, the columns are superimposed on a diagram depicting the atomic bonding of a protein molecule. The complicated, interconnecting and mutually reinforcing arrangement of atoms that results in the structure of a particular protein would not produce that particular protein if the structure were deficient in even one of its component atoms. By analogy, I intend to convey the realization that Environmental Studies is not a new discipline or mere combination of disciplines, but is the deliberate effort to apply a systems approach of learning to the interrelationship of natural and human systems under investigation. Each and every potential discipline/profession is needed to contribute to the joint effort that will be realized only when all are figuratively 'present' (literally 'available') in a single place and time applying their individual insights in a way that synergistically yields a result larger than the sum of its parts.

Endnote

[2]"Non-formal": governmental agencies and private organizations devoted to environmental concerns, such as the Fish and Wildlife Service of the U.S. Department of the Interior and the National Audubon Society.

APPENDIX

SUBJECT HEADINGS USED TO INDEX FIELDS OF ENVIRONMENTAL SPECIALIZATION

Agriculture	IM
Agronomy	C
Animal Husbandry	I
Animal Sciences	C
Biocontrol	I
Economic Aspects	I
Farming	I
Fertilization	I
Preservation, Farmland	
Range Management	C
Range Ecosystem Mgm't	C
Range Science	C
Range & Wildlands Sc	C
Air Pollution	INU
Atmospheric Science	C
Atmospheric Studies	I
Emissions Control	I
Emissions Sources	I
Measurement	I
Odor Pollution	I
Quality Control	C
Quality Management	I
Remote Sensing	I
Architecture	I
Biological Sciences	I
Aquatic	
Biochemistry	I
Botany	I
Horticulture	I
Taxonomy, Plant	C
Entomology	C
Environmental	B
Fish & Fisheries/Sc	CI
Allied Aquaculture	C
Interdisciplinary	I
Microbiology	I
Phycology	C
Terrestrial	
Wildlife Science	I
Birds	I
Wildlife Science (cont.)	
Diseases	C
Endangered Species	I
Game	I
Management	CI
Natural Habitats	I
Waterfowl	
Zoology	CI
Animal Behavior	U
Natural History of Vertebrates	C
Chemistry	I
Chemical Contaminants	I
Environmental Chemical Technology	M
Demography	U
Population & Population Control	I
Birth Control	I
Genetics & Heredity	I
Poverty Programs	I
Design, Environmental	BI
Cultural Land Use Planning	C
Envt'l Planning & Design	B
Ecology	IM
Animal	C
Applied	C
Aquatic	C
Bio-Ecology	C
Ecology, Ethology & Evolution	C
Estuarine	
Human	C
Insect	C
Limnology	I
Microbial	C
Physiological	C
Plant	C

Ecology (cont.)	
Resources	C
Systems Ecology	C
Tropical Environments	I
Wildlife	C
Economics, Envirnm'tl	I
Agricult'l & Resource	C
Economic Planning	U
Env't & Resource Econ	B
Ent'tl & Business Econ	B
Resource	C
Education, Environmt'l	BIM
Civic Action & Community Programs	I
Consumer Education	I
Safety Standards & Testing	I
Product Quality Control	I
Interpretation, Envt'l	BC
Natural History	
Natural Resources	
Nature	C
Nature Study Centers	I
Outdoor Education	C
Survival Studies	
Teacher Training	I
Energy	IMN
Conservation	I
Fossil Fuels	I
Geothermal	I
Nuclear	I
Resources	C
Solar	I
Engineering	
Agricultural	I
Architectural	
Chemical	I
Civil	I
Environmt'l Control	C
Environmental	BIM
Civil Engineering	C
Engineering Science	BC
Health Engineering	BC
& Planning Engineer'g	B
Quality Engineering	B
Resource Engineering	B
Systems Engineering	BC
Technology	BN

'tl Engineer'g/Technology (cont.)	
Env Control Techn	B
Env Engn'g Techn	B
Env Health Techn	B
Env Pollut Contr Techn	B
Env Protect Techn	B
Env Science Techn	B
Environmental Mgm't	C
Mechanical	
Sanitary	I
& Environmental	C
& Environmt'l Health	B
Surveying, Land	C
Waste Water Management	IN
Cooling Water Treatment Plants	
Industrial Waste Water	I
Municipal Waste Water	I
Waste Water Systems	IN
Water Resources	C
Estuary Water Quality	
Stream Modeling	
Interdisciplinary Prgms	I
Environmental Studies/Science: General	
Communications	C
Information	I
Dissemination	I
Retrieval	I
Storage	I
Interdisciplinary Programs	I
International	
Laboratory Techniques	B
Man-Environm Relations	
Environm & People	B
Human Resources Mgm't	
Management, Envt'l	B
Control, Envt'l	B
Modification, Envt'l	B
Envt'l Change:	
Theory & Technology	
Resource Mgm't & Administr	
Scientific Communication & Interpretation	
Protection, Envt'l	C
Mitigation Techniques	
Quality, Envt'l	I
Control	
Visual Quality	

Environmental Assessment	U
Ecosystems Assessment & Management	C
Environmt'l Analysis	B
Impact Analysis	C
Options	B
Social Assessment & Policy	C
Socio-Economic Impacts	
Forestry	CI
Biology	C
Engineering	C
Fire Control & Prevent	I
Management	I
Paper Science	C
Products/Industries/ Business	C
Rangers	I
Recreation	C
Urban	C
Wood Sciences & Techn	C
Geography, Environmental	IM
Biogeography	C
Geology, Environmental	BI
Earth Resources	C
Earth Science/Studies	BCI
Geochemistry	I
Geophysics	I
Geoscience	C
Hydrology	I
Watershed Hydrology	C
Oceanography	CI
Biological	
Geological	
Physical	
Paleontology	I
Soil Science	CI
Conservation	I
Erosion	I
Plant &	C
Pollution	I
& Water Science	C
Weather	I
Agricult'l Meteorology	
Biometeorology	
Climatology	I
Forecasting	I
Meteorology	I
Modification	I
Monitoring	I

Health, Envt'l & Public Administration/Mgm't	BI BM
Environmt'l Health/Sc	BN
Health & Safety	I
Industrial Health	B
Industrial Hygiene/ Technology	
Industrial Safety	I
Nutrition	I
Occupational Safety & Health	C
Preventative Medicine	I
Radiation	N
Sanitation/Technology	
Toxicology	I
Historic/Archeologic Preservation	
Humanities:	
Environmental Art	B
Fine Arts	I
History	I
Literature	I
Philosophy	I
Ethics	
Public Values & Institutions	
Quality of Life Values	
Interdisciplinary Programs:	
Physical Sciences	I
Social Sciences	I
Landscape Architecture	IM
Horticulture, Envt'l	B
Law, Environmental	IM
Envt'l Legislation	
Marine Biology/Studies	IM
Chemistry	
Ecology	C
Envt'l Marine Science	B
Geology & Geophysics	
Medicine, Environmental	IM
Preventive Medicine & Environmental Health	C
Natural Resources	IM
Conservation of	CI
Analysis & Conservat of Ecosystems	C
Education	C
Envt'l Conserv & Mgmt & Management	B

Natural Resources (cont.)	
Nature Conservation & Outdoor Education	C
Wildland Interpretation	C
Management, Resource	CIM
Analysis	C
Conservation	C
Economics	C
Environmt'l Resources	B
Non-Renewable Res'ces Policy	C
Range	C
Sociology	C
Marine Resources	I
Natural Resource Inventories	
Planning	C
Renewable	C
Water Resources	I
Coastal Resources	I
Coastal Zone Mgm't	
Estuaries	I
Marshlands	I
Potable Water Supply	N
Rivers & River Basins	I
Seashores & Lake Shores	I
Swamps	I
Watershed Management	C
Wetlands	I
Noise Pollution	IN
Noise Control/Abatem't	IU
Noise Sources	I
Pests & Pest Control	IU
Parasitology	C
Pesticide Technology	C
Pesticides & Toxicology	N
Physics	I
Applied	C
Planning, Environmental & Management Process	B BC
Land Develop & Mgmt	I
Land Resource Mgm't	C
Land Use Analysis & Planning	
Land Use Conversion	

Planning, Environmental (cont.)	
Regional Planning	IM
City & Reg'l Plnng	C
& Community Plnng	C
Community Developm	C
Community Sciences	C
Pollution, General	I
Control	BI
Measurement	I
Toxicology Water & Air	M
Public Administration	
Envt'l Administration	BC
Envt'l Operations	B
Envt'l Policy, Public Policy Studies	CU
Public Decision Making	
Recreation	IM
Administration	C
Health, Physical Education & Recreation	C
Leisure Studies	C
Natural Resources	C
Nature, Recr & Interpr	C
Outdoor Recr Mgm't	C
Parks	I
Mgm't/Administration	I
Park & Game Warden Training Programs & Recreation	I
Park Studies	C
Resources Management	C
Therapeutic Recreation	C
Solid Wastes Disposal	INU
Systems Analysis	M
Systematics & Ecology	C
Environmental Systems	B
Toxicology, Envt'l	C
Toxic & Hazardous Wastes	
Transportation	IM
Air Safety	
Alternative Forms	
Engineering	
Highway Traffic & Safety	
Public Railroads & Rapid Transit Systems	
Water	
Urban Studies	IM
Envt'l & Urban Studies	B

Urban Studies (cont.)	
& Environmt'l Planning	
& Regional Studies	
& Regional Planning	
Urban Design	I
Urban Planning	I
Urban Problems	I
Urban Society & Envt'l Policy	

Water Quality	U
Control	B
Desalinization	
Pollution	IU
Contaminate	U
Thermal	IM

Key to Users of Subject Headings:

B = The College Blue Book, 17th edition, volume 3 (Macmillan Information, 1979).

C = Conservation Directory, 1980, National Wildlife Federation (National Wildlife Federation, 1980).

I = World Directory of Environmental Programs, prepared by International Institute for Environmental Affairs in cooperation with the Institute of International Education (Quigg, 1973).

M = Institute of Environmental Studies at Miami University, Ohio, on behalf of the International Environmental Referral Center of the U.S. Environmental Protection Agency (Baldwin, et al., 1979).

N = Directory of Post-Secondary Environmental Education, as part of the National Environmental/Energy Workforce Assessment commissioned by the U,S. Environmental Protection Agency (National Field Research Center, 1979).

U = United National Environment Program (UNEP)/International Referral System (Baldwin, et al., 1979).

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Nonformal Environmental Education: An Overview and Methodology for Evaluation

Edward J. McCrea[1] and Glenn D. Weaver[2]

Introduction

The field of nonformal environmental education is broad and eclectic. It includes the traditional disciplines of nature study, interpretation, and conservation education as well as education programs at such diverse sites as zoos, museums and nature centers. Because of the encompassing nature of the field, attempts to produce a concise, accurate definition are difficult. Some definitions have focused on what the field is not: It is not formal classroom activities in schools nor is it the structured research activities of higher education. However, even with this approach, distinctions are often blurred, as when grade school teachers take their classes to a park for education activities. Other attempts at definition have focused on sites used: Nonformal environmental education is education which occurs in parks, nature centers, museums, zoos, aquaria, arboreta, public gardens, wildlife refuges, forest areas, etc. Again, as in the previous definition, the line between park and classroom, nonformal and formal is less than distinct. Goals and purposes within the field are equally diverse. Some practitioners see the main objective of nonformal environmental education as stimulation and enlightenment to help create an environmentally aware public. Others choose to focus their educational activities on the solution of specific environmental problems.

Rather than belabor the semantic difficulties in defining the field, or argue the merits of a particular philosophical orientation, the authors of this paper have taken a different approach towards giving an overview of the field. This paper is divided into three main sections: A brief history of nonformal environmental education, a list of key attributes of the field taken from research in learning theory, and a final section on establishing standards for nonformal programs. Taken together, the first two sections give on overview of nonformal education from an historical and theoretical viewpoint. The section on standards is included to promote consideration of what makes a high quality, effective program.

It should be noted that even in a paper of this length, only a sketch can be drawn of the nonformal field. The sections on history and learning theory in particular are abbreviated and deserve a more detailed treatment

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by other authors. Both sections are also highly selective; e.g., because the field of interpretation is better documented, the history section focuses more on interpretation and tends to place less emphasis on parallel developments in museum, zoo and nature center programs. In a like manner, the section on learning theory draws heavily on work of obvious relevance to nonformal education. Attempts have not been made to include more theoretical constructs with important but less direct implications for nonformal environmental education.

History of Nonformal Environmental Education

It is possible, as Dr. Harold Weaver points out in his excellent article, "Origins of Interpretation" (Weaver, 1982), to find examples of nonformal education in the writings of the ancient Greeks and Romans. Certainly the questioning strategies of Socrates or the natural history tomes of Aristotle deserve mention in a detailed history. However, the "modern" era of nonformal environmental education probably can be traced to the middle and late 1800's when several U.S. museums and zoos became active in promoting nature study and the trailside museum concept. This era and the early 1900's also saw the establishment of many organizations devoted to nature study, including the American Nature Study Society in 1908.

The first three decades of the 1900's witnessed the development and first use of some nonformal education techniques that have become traditional for the field. During this period, guided interpretive walks, talks and tours were practiced in Yosemite and Yellowstone National Parks as well as in Palisades and Bear Mountain State Parks. Also in this period, nature trails were constructed in Banff National Park and Bear Mountain State Park. These developments are particularly important since they denote a departure from the fairly scientific approach to nature study towards a more recreational view. The trend in the 1920's and through the 1930's was to see nature study as an educational, yet pleasurable activity for families and individuals visiting parks, museums and other facilities. Many activities during this period tended to emphasize this recreational aspect of the process and were primarily education for the sake of self-enlightenment and edification rather than being focused on particular issues or towards correcting problems. The evolution, however, was away from mere identification and systematics towards developing understanding of ecological relationships and processes.

The Dust Bowl of the 30's strengthened an education movement that departed from the general, recreational view of natural history study and began to focus on conservation issues. During this era, conservation education was particularly concerned with such issues as soil erosion, sustained yield of forests, and wildlife conservation. This was the era of educating the public about the "wise use of natural resources." Many of these activities emphasized improved agricultural and forestry practices. State fish and game agencies and the 4-H played a major role in this aspect of the nonformal education movement, as did private organizations such as the American Forest Institute, founded in 1941.

While most aspects of the nonformal environmental education field were slowed by World War II, the 1950's saw the natural history interpretation path broaden to include cultural interpretation and maturing as the focus became more and more on relationships and concepts rather than on identification. Freeman Tilden's seminal work, Interpreting Our Heritage, published in 1957, was to become the philosophical and practical underpinning for this area of nonformal education for the next two decades. The 50's also saw conservation education advancing beyond fairly narrowly defined soil and wildlife conservation techniques towards a broader ecological approach to education. The Conservation Education Association was founded in 1953 and was instrumental in shaping the face and character of this area of nonformal education.

The 1960's, with the upswing in visitation to parks and other natural areas brought about by increases in general mobility and affluence and by specific government efforts such as Mission 66, saw a continuation and refinement of traditional interpretive and conservation education approaches. During this decade, important organizations such as the Association of Interpretive Naturalists (1961), the Natural Science for Youth Foundation (1961) and the Western Interpreters Association (1967) were founded. By the end of the 60's, however, a more activist approach to nonformal environmental education was beginning to develop. This movement had two main characteristics:

1. The view that environmental education should be a means to an end rather than an end in itself, as was the case with many early nature study and interpretive programs, and;

2. The concept that environmental education should go beyond stressing general concepts and promoting environmental awareness. It should attempt to educate people as to how they fit into the picture and motivate them to solve specific environmental problems.

Earth Day in 1970, the Stockholm Conference in 1972 and, perhaps most importantly, the Tbilisi Conference in 1977 all shared these concepts of activism and the use of education in environmental problem-solving. The Tbilisi Declaration (Unesco, 1978) was to become the "guiding light" for many environmental educators. With its emphasis on nonformal as well as formal education techniques, it was quickly adopted by many educators working in nature centers, parks, refuges, and other nonformal settings. The Tbilisi Declaration may prove to be as important in the context of the nonformal education field of the 70's and 80's as Tilden's work was in the 60's and 70's.

Action orientation, with the use of education as a tool in environmental problem-solving, was not universally adopted nor did major changes occur overnight. A look at a few of the major nonformal education materials produced in the late 1960's and 1970's reveals a fairly general approach. Whether because of philosophical orientations of the organizations involved or because of general inertia of government organizations, Project Learning

Tree, Western Regional Environmental Education Council, 1975-78; We Can Help, U.S. Fish and Wildlife Service, 1975; The NEED materials, National Park Service, ca. 1968; and Investigating Your Environment, U.S. Forest Service 1978 revision of materials produced in the late 60's and early 70's all focus on concepts, relationships and skill development rather than on sharply defined environmental issues.

However, by the late 1970's and early 1980's most Federal and many State resource agencies had official policy or programs in place promoting the use of education to help solve resource problems. Also the concept of interpretation as a management tool was becoming more common in the literature (Gensler, 1977; Hudspeth, 1982; Larson, 1982; Roth, 1978). Perhaps nature centers carried this concept farthest, quickly adopting strategies to educate and motivate their publics on everything from recycling to toxic waste disposal.

This activist, problem-oriented approach to education went hand-in-hand with the environmental decade of the 70's. However, as pointed out, it has not gained universal acceptance. Some organizations feel that an aggressive, issue-oriented approach is inappropriate given their constituency, and many practitioners in the field still value traditioal interpretive programs as legitimate ends in themselves--a "right" of the visiting public to be stimulated, informed, and inspired by the natural history of parks and sanctuaries. Other organizations such as zoos and museums feel that the environmental problems-solving concept goes beyond their primary objectives and mandates. However, even here, at least in the case of endangered species and other issues such as the effects of pollution on marine life, zoos, museums amd aquaria are delving into the action, problem-solving orientation.

The decade of the 1970's saw the creation of several organizations focused on specific environmental problem areas such as the Center for Environmental Education in 1972 and other environmental organizations with a more integrated approach to education such as the National Association for Environmental Education (now the North American Association for Environmental Education) (1971), the American Society for Environmental Education (1971), the Alliance for Environmental Education (1972), and the American Society for Environmental History (1976). Other groups and organizations such as the American Institute of Architects, United Auto Workers, and National Science Teachers Association also initiated programs in nonformal environmental education. This decade and, in particular, the early 1980's also saw the development of a variety of issue-oriented nonformal education materials as well as more general materials: Missouri Department of Conservation education packets, ongoing from 1978; the Class Project, National Wildlife Federation, 1982; Conserving Soil, U.S. Soil Conservation Service, 1982; The Global 2000 Countdown Kit, Zero Population Growth, Inc., 1982; Wildlife Conservation Teacher's Pacs, U.S. Fish and Wildlife Service/National Institute for Urban Wildlife, 1982 and 1984; Project WILD, Western Regional Environmental Education Council, 1983.

The traditional, awareness-level nonformal environmental education programs and problem-oriented approaches will undoubtedly continue to co-exist for some time to come. As the following section on learning theory suggests, both make a definite contribution and should be viewed as mutually supportive and compatible rather than being seen as competitive in purpose and scope.

Attributes of Nonformal Environmental Education

Underlying most environmental education programs is the deep-seated belief that education is a force for positive social change. As stated in the Tbilisi Declaration, one of the basic goals of environmental education is "to create new patterns of behavior in individuals, groups and society as a whole towards the environment" (Unesco, 1978:3). Perhaps one reason for the split between issue-oriented and more traditional approaches to nonformal environmental education in the 1980's is the desire to bring about improvements in environmental quality as quickly and effectively as possible. Many administrators and practitioners have seen little indication that environmental education programs aimed at heightening public awareness in general are effective in promoting change. In the absence of empirical data to the contrary, a growing number of people in the nonformal field are turning to issue-oriented programs in the hope that they will prove more directly effective in changing behavior and solving problems. Practitioners with more traditional views would argue that a narrow focus on issues is shortsighted and the field should concentrate on teaching basic concepts. However, few reliable data are available to document the effectiveness of either type of program. In these times of tight budgets there is increasing reluctance to fund nonformal environmental education programs without more evidence that they are beneficial.

Obviously, more research is needed to provide this evidence, but until such time as additional results are available, a look at the field of learning theories can provide some insights into the potential efficacy of nonformal environmental education. Such analysis will yield only inferential results, to be sure, but, if current efforts in nonformal education can be shown to be in accord with modern theories of how people learn, then predictions can be made about the potential effectiveness of these nonformal programs. The first step in the process is to isolate key points in learning theory. These key points can then be used to develop a list of quality attributes that should be present in nonformal environmental education. Practitioners and administrators can use such a list of attributes to evaluate their particular programs--either informally or formally (as developed in the last section of this paper). As indicated previously, the following discussion of learning theory is far from exhaustive and is drawn from those materials which seemed to have the most relevance for nonformal education. For a broader perspective the interested reader should consult Piaget (Ginsburg and Oper, 1969); Zais, 1976; Novak, 1977; and Ausubel and Novak, 1978.

Learning Theory. Educators, psychologists, and learning theorists have long debated the process by which people learn and what motivates them. Many definitions of learning have been accepted and rejected through the years. Many learning theorists view learning as a process that changes behavior (Hergenhahan,1976:4). There are many variations on this idea, for example:

1. Learning is shown by a change in behavior as a result of experience (Cronbach, 1954:46).

2. Learning is a relatively permanent change in behavior or in behavioral potentiality that results from experience and cannot be attributed to temporary body states induced by illness, fatigue, or drugs (Hergenhahan, 1976:9).

3. Learning is a process of discovering how one relates with people, things, and ideas (Pittenger, 1971:136).

Actual behavior change resulting from experience or the interaction with one's social and physical environment is the common thread in these definitions. The consequences of learning may not always be apparent to the observer, but many learning theorists would state that learning has not occurred if there is not an observable change in behavior.

Although there is no single theory that accounts for the learning process, several modes of behavior and patterns of learning are almost always considered in the attempt to understand the phenomenon of learning. In recent years many neuroscientists have focused their research on understanding how the brain functions and have revealed new insights into how learning occurs.

The brain is accepted as the central focal point for conscious thought and control. As such it is involved in the organization, analysis, and nonreflexive response to all stimuli. Although the study of how the brain functions is still in its infancy, enough is known to suggest how learning may be enhanced rather than hindered. The brain is extremely complex and attempts to study it experimentally via isolated, observable facets of behavior have been inadequate. The brain is not passive; it does not await stimuli to which to respond. It is aggressively active and continually seeks out what it needs to make sense of the surrounding reality. What the brain seeks and how it processes what it receives depends predominately on what is already stored in the brain. All learning is based on past learning. The brain seeks information that it doesn't already have--the least expected, the contrasting--and continually tests the programs it has structured to make sense of a situation. Kidd (1959) suggested that perhaps the most important task in learning is the development of a self that can deal with reality.

The idea that the brain builds a series of structured programs as an aid in dealing with both familiar and unexpected experiences is detailed in

Proster Theory. Proster Theory is based on actual brain functions, and "proster" is a neologism meaning program structure. Hart (1975) describes behavior in very simplistic terms as occurring in two steps: 1) "Choosing from an existing repertoire, a program that best seems to fit the observed situation;" and 2) "Putting the program into effect." In other words, an individual decides first and then acts.

Many neuroscientists have suggested that programs are arranged in a hierarchy of levels. All thought (creative, analytic, etc.) proceeds through levels upon levels of programs. "As the aggressive brain attacks the environment, the entire perceptual apparatus concentrates on what is recognizable, or almost recognizable, via binary codes, to existing prosters, and usually brushes aside the rest as meaningless to this brain" (Hart, 1975:109). In other words, individuals cannot perceive that which they have neither experience nor purpose to receive. You "see" what you need to see, what is useful for making sense of your world.

Behavior is, then, goal-directed. The action or response chosen to fit the individual's perception of the situation will be determined by past experiences and present needs (physical, emotional, social, etc.). No two people will perceive a situation the same way, nor will perception be exactly the same twice for one individual. According to Proster Theory, learning is the acquisition of useful programs (Hart, 1978a) and the process of learning is the extraction of meaningful patterns from confusion. What is called insight is most likely the recognition of the pattern that solves a problem. The brain does not have to be taught to distinguish patterns; pattern distinction is what it does best. The mind possesses an innate order-generating capacity, a built-in drive to learn.

The brain does not work "logically," step-by-step. It sometimes approximates and makes quantum leaps. And, it builds on success. A program that works, that serves its purpose, will be retained, enhanced and refined. The end product is a self that can deal with reality.

Children process enormous amounts of information from birth on. They sort patterns, interact with their surroundings, and by trial and error, trial and success, are able to make sense of their world and learn to function in it.

Their rewards are intrinsic; the processes they use are not taught by someone, they are discovered. Children play in an holistic manner; they do not operate in separate physical, cognitive or affective domains. In a sense, play is the "natural" way to learn.

> What children do is 'play' only by the conventional wisdom of adult perspective. One could say just as well that what they do is work. But both labels are confusing: what children do most of the time is interact with the environment on a level at which their skills match opportunities. Left to themselves, children seek out flow with the inevitability of a natural law. They act without interruption if they can use their bodies, their hands, or their brain to produce feedback which proves they can control the environment. They stop only when the challenges are exhausted, or when their skills are (Csikszentmihalyi, 1975:199).

Eble (1966:11) has suggested that "everything possible should be done to make the child's zeal for play serve the purpose of formal education." He described a perfect education as "one that proceeds by surprises and the promise of other surprises, one that offers the most opportunity for discovery." (Eble, 1966:18)

Educators, and others concerned with learning, attempt to structure or control an environment so that learning of one type or another occurs. Learning, of course, occurs outside of--and sometimes in spite of--these structured situations. Learning is personal and people learn as they experience the world. Many different methods and media will facilitate learning; in fact, variety in itself may enhance a learning environment.

The learning environment must be free from threat. Many learning theorists (Rogers, 1961; Pittenger, 1971) have observed the detrimental results of threatening situations on the learning process. More recently neuroscientists have described the physiological reactions in the brain that explain why learning cannot occur under threatening conditions. Learning is inhibited by threat because that threat produces downshifting to more primitive brain functions. The brain acts to defend against the threat and no real learning can occur.

Threat involves more than the fear of physical harm. Experiences that cause the person to feel inadequate generate the expectation of threat. Punishment, ridicule, chastisement may also be perceived as threatening to the self. By inference, an atmosphere of acceptance of individuals, their mistakes, inconsistencies, inadequacies as well as their more positive attributes will allow learning to occur.

Because the brain seeks out only the information it needs to make sense of a situation, learning can be facilitated by making the subject matter relevant to the purposes of the learner. We remember what we want to remember and forget what we want to forget--both reasonably well.

Part of making something relevant is showing relationships between the unknown and the known--in other words, new programs can be built by relating to existing programs. Material can be made meaningful to the learner both in terms of meeting the needs and purposes of the learner and building on that which is already known. Bigge (1964:314) stated that, "Meaningfulness consists of students' grasping relationships between facts, generalizations, rules and principles for which they see some use."

Motivation (and the related topics of reinforcement and rewards) has been widely, and disparately, discussed by educational psychologists to explain why individuals want to learn a particular subject. Hart (1975) stated that:

> Learning in humans can readily be blocked, impeded, discouraged, or fostered, facilitated, encouraged... But the one thing we don't have to do is motivate. If we weren't motivated by a billion years of evolution to be learners, a few of us would be fossils of an extinct species and the rest of us would never have been conceived.

Many theorists, however, would disagree about the role of motivation in learning and hold differing views as to whether intrinsic and extrinsic rewards are the more effective. Some researchers feel that the basis of motivation is reward and an organism will tend to repeat responses that are rewarded. Skinner (1953) in particular views motivation as external to the learner. However, many researchers disagree with the behaviorists. Hellix (1977:157) stated that, "Altogether...the conviction seems to be growing that reinforcement is not necessary for learning and that the role played by reinforcement in both learning and performance is much more complex than one could imagine on the basis of the law of effect." Extrinsic motivation is generally considered less desirable. The learner tends to forget what was "learned" as soon as the extrinsic purpose is met. It is not a matter of motivation; everyone is motivated to learn. It is a matter of relevance.

Closely related to relevance, and related as well to the needs and experiences of the learner, is the "reality principle." We learn best in real life, and the best learning environments are real--with real objects, real problems, real situations. Children learn much by watching others around them and then imitating what they have observed. Eble (1966:86) noted that the "knowing that is important is the knowing the student acquires after he is on the job, precisely because it is related to his doing." Watching and then doing is superior to reading or being told about the experience. The tasks in which students are involved and the materials and settings used should be real rather than contrived.

Pearce (1977:12) offers a further explanation of why reality is the best learning environment. "All thinking arises out of concreteness, which means out of the brain patterns resulting from actual body movements or interacting with actual things. But thinking then moves toward autonomy, that is, moves toward independence of those concrete patterns or physical principles. This progression toward pure thought is itself genetically programmed and unfolds in neat, sequential stages."

Real situations direct all of one's senses to the subject at hand; the brain receives input from hearing, seeing, smelling, touching and maybe even tasting. When all senses can't be directly involved the next best choice is to involve the imagination in creating a seemingly real, problematic situation which is vital and relevant to the individual.

Hart (1975:211) stated that "reality principle lets the right answer come from actual materials or circumstances rather than in words of judgment or evaluation by a teacher." This does not mean the teacher should not be involved. One classical method of teaching, the Socratic method, actively involves both learner and teacher in helping the student discover the answer. Through a series of focusing questions the student applies what he or she knows to a new circumstance and is thus led successfully to the solution.

The teacher can and should insure that the experience is successful. Learning feeds on success. It is not that one does not learn from mistakes because making errors can show how not to do something. But continual mistakes will thwart motivation, and may even elicit a defensive response to a threatening situation. The teacher can help by limiting a specific problem or task so that it is solvable. "The problem should be so compelling that students really want to study it, but not so overwhelming that they are prone to give up." (Bigge, 1964:344)

Cognitive theorists have long argued in favor of the "whole" (the largest meaningful unit) approach, stressing the patterns and relationships. Once the concept is established in the brain (a program), the connecting facts have a place to attach themselves; they become relevant to that brain. The concept is also in place to be applied in other situations (transferred, if you will). There is no conclusive proof of whether "part" or "whole" methods are more successful. Hart (1978a:645) states that, "To extract patterns from the confusion of the real world, children must have input... This input can be utterly random and unplanned--the quantity matters, not the order."

However, Hart's statement should not be taken to mean that random input and the establishment of certain basic concepts in the brain will automatically enable the learner to apply this knowledge to new situations. As early as 1913, Thorndike was proposing the idea that knowledge in one situation was likely to be transferable to a second situation only if the situations possessed elements in common. Today, the idea of the need to "teach for transfer" is well established with many theorists. As Trow (1970:284) explains:

> We can no longer assume that merely dunking all students in the same brew of the disciplines will enable them to think in general. Certainly the more competent they can become in dealing with the facts and relationships of a particular structure--a discipline, a vocation, or pattern of life--the more successful they can become as operators within that structure. But if abilities, attitudes, and skills in general, and ability to think in particular, are to be transferred outside the structure, the emphasis must be shifted to the other kinds of situations in which they are to be used. Methods of teaching are thus of the essence...we can hardly depend on the transfer of learning from traditional subjects, even when well taught, to enable young people adequately to meet the life situations that confront them.

Attributes of Nonformal Programs. It is possible to synthesize this plethora of information on learning theory and develop a list of broadly stated attributes that nonformal education programs should have in order to maximize learning potential. The list serves to point up many of the strengths of the nonformal environmental education field as a whole--putting on a more firm conceptual basis what many practitioners in the field have felt intuitively through the years. While the following list is far from all-encompassing, it can serve as a first step in more exhaustive work and is sufficient in itself for use in various evaluative processes.

1. *Learning is Based on Past Learning*

Nonformal educators need to recognize that introduction of new concepts must relate to previous knowledge or experience. The student must be "primed" to learn and at an appropriate level to receive the material. Freeman Tilden (1957:11) recognized this many years ago in his principles of interpretation: "Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitors will be sterile." Fortunately, nonformal education provides numerous opportunities to tailor learning opportunities to the appropriate level for the learner. By stressing the patterns and relationships in nature, for instance, it may be able to stretch a person's perceptions and bridge the gap between the known and new learning experiences.

2. *Learning Occurs Best When it is Multisensory*

This tenet has been adhered to for years by practitioners in nonformal education. "Touch and feel" exhibits, audio visual productions and "acclimatization" are standard techniques intuitively used by nonformal educators.

3. *Learning Should Build on the Reality Principle and Use Concrete Examples*

Here again, the sometimes maligned "touch and feel approach" frequently employed (albeit at varying degrees of sophistication) has been successfully used by nonformal practitioners for years. Examples abound of nonformal programs structured to provide interactions with natural or historical environments and artifacts.

4. *Learning Should be Nonthreatening and Reinforcing*

This is an area that some nonformal practitioners overlook. Since some educators feel comfortable in a swamp or beside a dinosaur skeleton, they think that students should also. In fact, many students need help in feeling comfortable in an unfamiliar environment and will not (cannot) learn about that environment until the anxiety level is reduced. Over-emphasis on asking participants for facts may also be threatening to some.

In a like manner, fear of failure must be reduced by structuring learning activities so that positive reinforcement rather than punishment or negative response is integral to the experience.

5. *Educational Activities Should be as Enjoyable as Possible and be Structured to Provide Challenges*

While this concept is closely related to the need to create nonthreatening learning opportunities, it goes beyond this idea. A child's (and adult's) love of challenge, surprise and play in general can be used to facilitate the learning process. Nonformal educators, particularly interpreters, often employ media and methods from the entertainment field, and the idea of interpretation as educational recreation appears well-founded.

6. *Education Activities Should be Structured to Facilitate Concept Building*

Students need to establish systems or sets of relationships in order to process and make sense of new materials. With these systems in place, they are better able to recognize (or transfer) existing knowledge to new situations. Nonformal education can be structured, e.g., by use of familiar concrete examples in nature to define patterns, and then these patterns can be generalized to more complicated concepts. Memorizing facts as a learning experience without establishing their relationships to a larger context may be why retention of purely factual material is often low.

7. *Learning Should be Demonstrated by a Change in Behavior*

Nonformal environmental educators frequently have little feedback to justify the assertion that learning results from their activities. Some educators try to link observable behavior of their students to effectiveness of programs. For instance, it is possible to use a decrease in the incidence of bottles and cans in roadside litter as an index to the effectiveness of a particular program on recycling. As discussed later, traditional cognitive testing is difficult to apply in the nonformal setting and more innovative techniques are needed for evaluation.

8. *Specific Attempts Should be Made to Teach for Transfer*

It can be argued that a general knowledge of ecological concepts and environmental issues will not result in that knowledge being applied to help solve specific problems. Such general knowledge is necessary, but many people would be unable to apply this knowledge to a particular situation. Nonformal environmental educators need to recognize that awareness level programs fill an important function, but that action and application will probably depend on teaching specific strategies.

As a conclusion to this section, it might be appropriate to comment on the implications for practitioners of the two main approaches to nonformal environmental education currently most commonly used. Learning theory would seem to support the argument that both the awareness-level programs designed to educate in broad concepts and relationships and the issue-oriented, problem-specific approaches are needed. The student must have a basic knowledge of ecology and environmental relationships and be conceptually ready to transfer this knowledge to other situations. However, in order to facilitate this transfer and motivate the learner into positive action, a more direct, structured and issue-oriented approach is often necessary. Neither approach alone is likely to be as effective as the synergistic application of both.

Evaluation--Standards for Nonformal Programs

Most evaluation in education is done through the cognitive testing process. However, this process is difficult to employ in the nonformal environmental education field. Because of the variety of settings, the often brief exposure of the learner to a given nonformal educational experience and the relatively less structured nature of this learning mode, documenting educational gains in the nonformal environment is even more difficult and costly than in the classroom setting. Some observational techniques have been used or suggested, where reductions in litter or increases of books on a particular subject being checked out of a library are taken as indices of an educational program's effectiveness. However, these measures are often specific to a given situation and have limited general utility.

One evaluation technique with the potential for general usefulness is the creation of educational standards. Standards, by creating a hypothetical average or optimum program against which a particular educational program can be compared, can by inference give an indication of the potential effectiveness of that program, i.e., if standards define the attributes of a good (effective) program, then a program which possesses those attributes should also be good.

This relatively simple concept turns out to be quite difficult to implement for two reasons:

1. Creation of standards which identify attributes of a good program is often a subjective and controversial process; and

2. Measuring adherence to those standards is also difficult.

Nevertheless, precedents for the effective creation and use of such standards do exist. Operational and physical standards have been in use in nonformal educational programs for many years. However, it is relatively easy to gain agreement on (and measure adherence to) such things as how often nature trails should be patrolled for hazards or how wide the trail should be. It is much harder to devise standards that give an indication of how educationally effective that nature trail might be.

Standards which go considerably beyond physical and operational standards have been developed by both the American Camping Association (ACA) and the National Recreation and Parks Association (NRPA). These standards were derived from factor analyses of the literature and on expert opinion as to what constituted quality attributes in the organized camping and recreation fields. The attributes identified were then used as the basis for developing actual standards. The standards themselves were specific, concrete statements that were intended to measure the presence or absence of a particular desirable attribute.

While the ACA and NRPA standards do not deal specifically with education, the methodology has great promise for use in evaluating the quality of educational programs in nonformal settings. During 1981 and 1982, the authors developed standards for the nonformal environmental education programs of the U.S. Fish and Wildlife Service (FWS). The project was under the direction of Dr. Conley Moffett, Chief, Office of Public Use Management. Limited field testing of these standards has demonstrated that the concept is a workable one, and that with refinements, precise, reliable instruments can be developed for use in evaluating nonformal programs.

The core of the FWS standards is the collection of key attributes derived from learning theories as discussed in the previous section of this paper. These attributes, combined with opinions from experts in the areas of nonformal education, were synthesized to produce standards to which FWS nonformal education programs should adhere. The final step was to develop several specific statements designed to determine if a particular standard was being met. The final document was a lengthy but uncomplicated checklist of simple "yes" or "no" statements. For instance, to measure adherence to the concept that learning is facilitated when material presented is relevant to the learner, the FWS standards contain a variety of questions similar to the following:

Have the following characteristics of the audience been identified:

-- Amount of time spent on site?

-- Type of visiting group (families, couples, etc.)?

-- Average age and education level?

-- Frequency of visits?

-- Whether most visitors are local people or tourists?

-- Predominant foreign language?

-- Reasons for visiting field station?

-- Physical or mental limitations?

-- Interpretive activities pursued?

To measure adherence to the concept that learning takes place best in a nonthreatening environment, statements of the following types were included:

-- Are teachers using outdoor classroom s' es warned of potential safety hazards, and are safety hazard identified in interpretive media or presentations?

-- Is the content of interpretive and :door classroom presentations and media regularly monitored to in re that these are free of sexual, religious, cultural, or ethn c biases?

-- Do FWS staff encourage visitors to ask questions during presentations?

-- Do FWS staff correct erroneous answers or responses from audience members without causing them embarrassment?

-- Are outdoor classroom activities structured to provide students with some degree of success?

As can be seen from these examples, an instrument can be constructed to evaluate whether a program is in conformance with modern learning theory. By asking specific, very definite questions and by using many questions to insure that the gamut of pertinent theories and perspective are covered, it is possible to define what the attributes of a good program are and whether these attributes are present. When a wide array of attributes are used and when the questions are written with sufficient specificity, the standards in the aggregate give a comprehensive analysis of the potential quality of the program being evaluated.

More sophisticated approaches can employ Likert scales rather than yes/no answers, assign weighted values to more important attributes, include questions on adherence to safety rules or agency policy, etc., and include a mechanism for devel ping a total score for each program. Such a score would allow comparisons among programs at different sites and also allow evaluations of the same program over time.

Most importantly, the careful development and use of such an attribute checklist would give practitioners feedback on the quality of the jobs they were doing and give administrators insight as to the cost effectiveness of different programs. While a program's high score on a well-developed checklist is no direct assurance that persons exposed to that program will increase their knowledge, it does present a good, indirect measure of a program's potential effectiveness. (A logical next step in this area of evaluation would be research to measure correlations between a program's checklist scores and cognitive gains by participants.)

Conclusion

While the foregoing discussion is general in nature, it is hoped that the reader will gain a sense of the diversity to be found in the nonformal environmental education field as well as become acquainted with some of the underlying conceptual bases of the field. In addition, the authors have tried to demonstrate how, despite the diversity of the field, underlying, unifying concepts can be used to evaluate nonformal environmental education programs.

The field, is, indeed, comprised of a variety of disciplines and a considerable number of philosophies. Despite this (or perhaps even because of this) the nonformal field is healthy, vigorous, and well-suited to take on the task of bringing innovative techniques and programs to environmental education efforts in the 1980's and beyond.

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Section II:
Selected Papers from the 1983 Annual Conference

An Incentive Approach to Riparian Lands Conservation: A Case Study

John H. Baldwin[1], Nancy E. Duhnkrack[2], and Paul M. Ciminello[3]

Abstract: *This paper summarizes the development, passage and implementation of Oregon's new riparian lands preservation legislation (Senate Bill 397). This legislation is unique (and may serve as a national model) because it utilizes an inventive approach (through tax credits) for the protection and preservation of ecologically valuable lands. The unique nature of this legislation is reflected in its widespread political support, its low-cost approach to achieving its goals, and its ease of applicability to other states. Finally, the problems encountered in implementing the program in its first year are summarized and recommendations made for more effective program development.*

Riparian (adj.): of, pertaining to, situated, or dwelling on the bank of a river or other body of water (The Random House Dictionary, 1968).

Introduction

Riparian habitats are extremely important for fish and wildlife, protecting water availability and quality, and for economic uses such as agriculture, grazing, forestry, and recreation. In an effort to protect riparian habitats, the State of Oregon in 1981 passed a "Riparian Tax Incentive Program" (Senate Bill 397). The first section of this paper will briefly review the value, sensitivity and management of riparian habitats. The main provisions of the Riparian Tax Incentive Program will then be overviewed, followed by a preliminary discussion of the problems encountered in the first year of program implementation. Finally, recommendations will be made for effective program development, followed by a discussion of the applicability of this program to other states.

This paper was developed for three purposes: 1) to inform citizens and professionals about this new and innovative approach to habitat conservation; 2) to provide preliminary feedback to the Oregon

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Department of Fish and Wildlife (ODFW) for program development; and 3) to provide information to other states considering similar programs.

At the onset, it is important to emphasize that the ODFW is currently not actively promoting the program. Senate Bill 397 specifically states that counties cannot participate in the program without a state-approved or "acknowledged" land use plan. With only 16 of 36 counties approved, the ODFW is waiting for more counties to become eligible (Faast, 1983b). Most of the remaining county land use plans are expected to be acted upon by the state within the next two years. Therefore, the material presented in this paper is in no way, shape, or form a criticism of ODFW. Rather, we have found that several important questions and problems have developed in preliminary efforts to promote the program. By highlighting these issues and suggesting possible solutions, it is hoped that the program can be more effectively implemented.

Characterization of Riparian Habitats

Because of the many combinations of water conditions and physical characteristics of the site (e.g., topography, soils, etc.), riparian lands can vary considerably in size, structure, and ecological diversity. The word "riparian" is used to describe both lentic (standing water) habitats such as lakes, ponds and bogs, and lotic (running water) habitats such as springs, streams, and rivers. In general, however, all have several common features (Thomas, et al., 1979):

1) they create a well-defined habitat zone within a drier surrounding area;

2) they are relatively small habitat areas;

3) they have a relatively high biomass production rate; and

4) they are a critical source of ecological diversity in arid regions of the world.

Riparian zones are generally identified by the presence of vegetation (e.g., sedges, rushes, shrubs, trees) that require large amounts of free or unbound water.

Value of Riparian Habitats

As previously indicated, riparian zones are extremely important to the local economy and ecology. Hydrologically, riparian habitats act as a sponge to hold and gradually release water after a high water event. This may serve many valuable functions, including:

- reduction in flooding

- increasing minimum stream flows,
- increasing acquifer recharge,
- preventing erosion and sedimentation,
- trapping dissolved nutrients,
- increasing forage availability and habitat diversity, and
- increasing anadromous fish populations.

In eastern Oregon, for instance, riparian habitat restoration has prevented small streams from becoming intermittent or dry during summer months (National Marine Fisheries Service, 1981; Winegar, 1977).

The value of riparian habitat to water tables and forage production was demonstrated by Claire and Storch (1977) in a study of the habitat within and outside of a ten-year livestock exclosure (an area fenced off to exclude livestock). They found that compared to the area outside the exclosure, the area inside had a water table 8 to 10 feet higher and that biomass productivity had increased from 200 pounds/acre (mostly Kentucky bluegrass) to over 2,000 pounds/acre (mostly native grasses). In addition, they found that 77% of the fish in the exclosure were game fish, compared to only 24% outside the exclosure. A study by the U.S. Bureau of Reclamation (1981) found a 3:1 benefit-cost ratio when comparing just the value of the enhanced fishery to the cost of building and maintaining a riparian livestock exclosure (a fence).

The importance of riparian habitats to other wildlife cannot be overstated. For instance, of the 363 terrestrial species known to occur in the Great Basin of Southeastern Oregon, 288 are directly or indirectly dependent on riparian habitats for food, water, protection, or movement (Thomas, et al., 1979).

A study by Unsicker, et al. (1981) of the Lake Tahoe Basin found that undisturbed riparian habitats removed 94% of suspended solids, 74% of total nitrogen, 86% of total phosphorous and 92% of the iron in runoff water.

Finally, it must be emphasized that riparian areas are extremely valuable for a number of other ecologic and economic functions such as removal of some pollutants from water, recreation (hiking, canoeing, etc.), scientific study, transportation corridors, and as a gene pool for maintaining ecological diversity (U.S. Fish and Wildlife Service, 1981).

Human Impacts and the Management of Riparian Lands

Because of their multiple uses, sensitive community structures and relatively small areas, riparian habitats are particularly vulnerable to

physical, chemical, or biological disruptions. It is estimated that 70%-90% of all natural riparian ecosystems in the United States have been destroyed (CEQ, 1978). In some areas of the United States, such as the Gila Valley of Arizona and the Sacramento Valley of California, as much as 96% to 98.5% respectively has been lost (Warner, 1979). In 1978, the Oregon Department of Environmental Quality estimated that over 2,600 miles of streams in the State were suffering from severe erosion problems.

The principal causes of the disruption are grazing and watering of livestock, mining, roadbuilding, clearcutting and recreational uses of the riparian habitats (Thomas, et al., 1979). The grazing and watering of livestock in riparian zones of arid rangelands are particularly damaging because of the removal of vegetative cover, trampling and disruption of soils, and the loss of surface and groundwater.

If these detrimental impacts are reduced or eliminated, riparian lands are amazingly resilient. Figure 1 pictorally demonstrates the regeneration of vegetation on two streams in Eastern Oregon that were fenced off from livestock grazing. Simple, cost-effective measures such as fencing and designing livestock access to the riparian lands can realize enormous returns. In addition, proper siting and management of roads, mines, campsites, logging activities, etc. through the application of basic land use principles, can, in a very cost-effective manner, reduce many of the detrimental human impacts on riparian lands. Dr. Richard Warner (1979) of the California Field Studies Center states "all we need to do in many cases is to lean less heavily on them (riparian areas) in order to reverse the destructive trends." For example, in areas of heavy recreational use (e.g., the Grand Canyon), regulations and enforcement, user permits and the proper development of campsites have dramatically improved riparian habitats (and reduced user hazards).

In summary, riparian habitats are extremely valuable to the local ecology and economy; they have been seriously impacted by human activities; they are very resilient, and the detrimental impacts can be readily reduced or eliminated by very cost-effective measures. Once citizens and professionals become aware of the problems, their causes and the ease of resolution, considerable public support for riparian habitat conservation programs can be generated.

The Oregon Riparian Tax Incentives Program

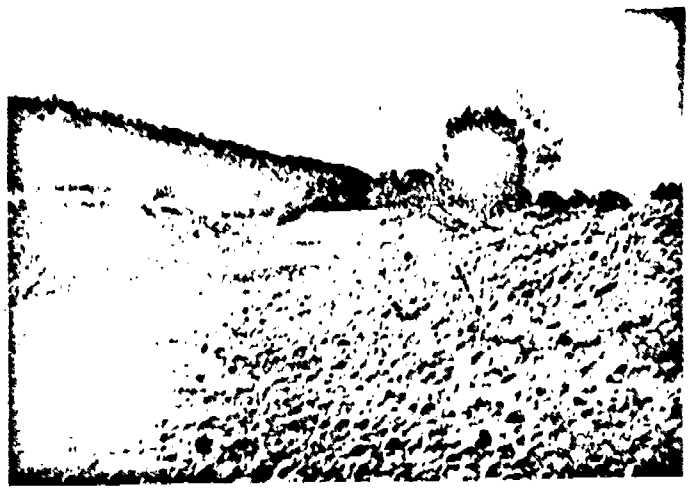
The dramatic success of early efforts of the ODFW, private landowners, other state and federal agencies and conservation organizations such as the Northwest Steelheaders Association to rehabilitate riparian habitat provided the impetus for the passage of Oregon's Senate Bill 397 (SB 397), the "Riparian Tax Incentive Program." Those concerned with riparian area protection asked the question: if these efforts have produced such dramatic results, why aren't more riparian areas being rehabilitated? In particular. why were existing state and local programs inadequate to

Figure 1. The Resiliency of Riparian Habitats. The photographs depict the regeneration of riparian vegetation in Fifteen Mile Creek and Ramsey Creek in Eastern Oregon (Wasco County) after fences were installed to exclude livestock. The top photographs indicate the dramatic effects of only one year of livestock exclusion. The bottom photographs indicate the habitat restoration over a period of four years (Courtesy of the Oregon Department of Fish and Wildlife).

Ramsey Creek
1974

Ramsey Creek
1975

Fifteenmile Creek
1974



Fifteenmile Creek
1978

protect privately owned riparian areas? The primary answer given was landowner resistance to regulatory programs that restricted private property rights without some form of compensation. Other, related answers were the cost to the landowner of implementing protective measures and the small return on their investment in protection.

Supporters of riparian area protection in Oregon designed SB 397 to address these identified concerns. The law established voluntary programs that provide financial incentives for private landowners to protect or rehabilitate riparian lands. The two incentive programs are: 1) a complete ad valorem property tax exemption for riparian areas that are protected or enhanced, and 2) a twenty-five percent personal or corporate income tax credit for costs incurred in qualified instream habitat improvement projects (these projects could include fish passage improvements, bank stabilization efforts, streamside fencing or other work that improves habitat). Both programs are administered by Oregon's Department of Fish and Wildlife.

Private lands that are zoned agriculture, forest, or range in a county land use plan that has been approved by the state Land Conservation and Development Commission are eligible for inclusion in the property tax exemption program (ORS 308.025, Section 5(2)(a)).

To quality for a tax exemption, the landowners must sign a management agreement for the exempted lands with the ODFW. The management agreement contains a legal description of the property, present and proposed use of the land, and steps that will be taken (generally by the landowner) to protect or rehabilitate the riparian area (ODFW. n.d.). The agreement remains in effect for subsequent tax years unless its terms are violated. If the landowner does violate the agreement, he or she can be assessed up to five years back taxes as a penalty (ORS 308.025, Sections 7 and 8).

An individual or corporation need not be a landowner to qualify for the twenty-five percent income tax credit for habitat improvement projects (ORS 308.025, Section 18(1)). To receive the tax credit, however, an individual must apply for and receive both pre-project and project completion certifications from ODFW. Applications for pre-project certifications must include a description of the proposed project, its anticipated benefits, and an estimate of project costs. When the project is completed in conformance with the preliminary description, ODFW will issue a final certification to the applicant (ORS 308.025, Sections 22(1), (5), and (6)). This serves as verification of the actual cost of the project for use in computing the income tax credit (ORS 308.025, Section 18(5)).

Both tax incentive programs established by SB 397 are restricted in scope and size to limit their impact on state revenues. First, the programs did not go into effect until January 1, 1983. As mentioned previously, only farm, forest, and range lands are eligible for the riparian area property tax exemption. Further, exempted lands can be no more that one hundred feet wide and no more than one hundred new miles of streambank can be

exempted each year in each of Oregon's 36 counties (ORS 308.025, Sections 3(2) and 12(1)). The annual ceiling on the income tax credit is $25,000 (on $100,000 worth of projects) (ORS 308.025, Section 23). A final restriction on these programs is a sunset date of December 31, 1989 (ORS 308.025, Sections 12(2)(a)).

Once the riparian area protection legislation was drafted, the lengthy effort to secure its passage began. Passage of SB 397 was a complex process which involved a considerable amount of compromise and negotiation. Many issues were raised by legislators. As a result, the bill was comprehensively amended three times. Final passage of the Bill by the House and Senate occurred on the last day of the 1981 legislative session by 46-8 and 19-6 votes, respectively.

One of the principal concerns expressed by legislators was the impact of the tax incentive programs on state revenues. As a result, amendments were made to the original version that imposed the limitations on the programs (previously discussed). ODFW offered to implement the programs without additional staff or funds. This further reduced the fiscal impact of the legislation. Without ODFW's offer and the limiting amendments, SB 397 would not have become law.

Because of the voluntary nature of the incentive programs established by SB 397, the legislation had no active opposition. Further, it had a broad base of support composed of conservationists, sport and commercial fishermen, farmers and ranchers, and representatives of the timber industry. The results of the efforts in eastern Oregon to rehabilitate riparian areas were used successfully to demonstrate the merits of the legislation, both in testimony by scientific experts and in a striking slide presentation which documents the vegetative recovery. Because of this support and the minimal fiscal impact, SB 397 was the only legislation which established a new property tax exemption and income tax credit to pass during the 1981 session of the Oregon State Legislature.

Implementation - Process

As previously mentioned, the Oregon Riparian Land Tax Incentive Program is administered by the Oregon Department of Fish and Wildlife (ODFW), headquartered in Portland. However, the District Biologists who direct the 23 ODFW Field Offices have primary responsibility for implementing the program. Landowners interested in participating in the program first contact the state or local field office of the ODFW. The field offices provide information to the landowner, then follow-up with a phone call to answer any questions or concerns. If the landowner expresses an interest in participating in the program, the District Biologist arranges an on-site inspection. During the inspection, the landowner is verbally informed of the improvements (e.g. fencing, planting, etc.) necessary for participation in the program. In an agreement is reached, a contract is written and signed between the landowner and the District Biologist (with copies sent to the Portland office of the ODFW and to the county tax assessor's office).

It must be emphasized that this program is entirely voluntary until the agreement is signed. The ODFW is approached by the landowner (not vice versa) and the landowner may withdraw from negotiations at any time prior to the signing of the contract without penalty. In addition, because the District Biologist is able to inspect and negotiate a contract for each parcel of land, the program can be very flexible. This flexibility was built into the program because of the tremendous diversity of land shapes, lot sizes, habitat conditions and ownership patterns present in the state. Perhaps most importantly, the program is directly administered by the "local" field offices of the ODFW, with the state offices involved only in record keeping. Thus, a landowner has direct contact and negotiations with a "local" in a manner that can build knowledge, understanding, and trust should any problems arise.

Despite these programatic pluses, there are questions about the viability of this incentive approach. It must be reiterated that the ODFW is waiting for approval of more county land use plans before fully implementing the program. The material from our analysis was obtained from the ODFW and from landowners considering participating in the program before the program was widely promoted. The analysis is intended as an information source to help the ODFW design its implementation plan and in no way is intended as a criticism of any agency or individual.

Implementation - Program Analysis

Our analysis of the program involved:

- an interview with Tony Faast, State Director of the Riparian Tax Incentive Program (Faast, 1983a),
- a review of all information available from the state office,
- selection of the counties with the most active programs,
- interviews of the District Biologist from those counties (ODFW District Biologists, 1983), and
- phone surveys of approximately two-thirds of the eligible landowners in Lincoln County who expressed an interest in the program, whether or not they agreed to participate (Lincoln County Landowners, 1983).

As previously mentioned, the major contraining factor for statewide implementation of the program is the failure of counties to submit land use plans to the State Land Conservation and Development Commission (LCDC) which is required by state law (Senate Bill 100, 1973). Before a county can join the program, it must have an "acknowledged" land use plan. To date, 16 of 36 counties in Oregon have complied (Faast, 1983b).

According to state program director Tony Faast (1983a), the ODFW cannot enter into a contractual agreement with a landowner unless the county's land use plan is acknowledged. This constraint also inhibits the ODFW's efforts to publicize the program. The ODFW is currently awaiting the approval of the county's plans before it implements a regional educational campaign. According to Faast (1983a), "you do not want to raise their (the landowners') expectations and not be able to deliver or get them excited about something they cannot participate in."

In several counties with approved land use plans, however, the program has been more widely publicized and the ODFW more active. One of them is Lincoln County, on the north-central coast of Oregon where heavy winter and spring rains and extensive clearcutting have made flooding and soil erosion a continuous problem.

In Lincoln County, the ODFW attempted to promote the riparian lands conservation program by offering a tax deduction on property taxes if the landowner contacted the District Biologist by December 31, 1982. This promotion was successful in publicizing the program, with 52 landowners contacting the ODFW prior to the deadline. Through this experience, one problem became immediately apparent. More than 20 of the 52 landowners had lands zoned as "rural residential" or were within an urban growth boundary and were declared ineligible for participation in the program. Some flexibility may be needed in these restrictions to allow landowners with substantial riparian lands that are zoned rural residential or are within an urban growth boundary to participate (See recommendations section).

Nearly all of the qualifying landowners in Lincoln County were contacted and 19 agreed to participate in the survey. The survey was designed to assess the landowners' knowledge and opinions on program administration, knowledge of the program, problems encountered, why they did or did not join the program, and suggested changes.

Table 1 summarizes the results of the survey. In general, landowners agreed that the program was needed, that government should become involved in riparian land conservation (with the notable exception of large landowners) and that the ODFW was the appropriate lead agency. However, the landowners repeatedly mentioned several concerns they had about the program. These problems are summarized in the following discussion.

To improve the riparian habitats of entire watersheds noticably, it is extremely important that large landowners participate in the program. Yet, large landowners (with 100+ acres) are not participating in the program. The large landowners surveyed indicated that the costs of the habitat improvements were too high. Most of these landowners grazed cattle and sheep on the land and used the waterways for watering their animals. To them, the costs of the habitat improvement (fencing, planting, etc.) were too high and the benefits negligible. One landowner of 95 acres stated, "for $25 to $35 per year, it would not be worth it to participate in the program."

Table 1. Summary of Survey Responses of 19 Lincoln County, Oregon Landowners - August 23-25, 1983.

Topic	Question		Land Holdings 10 acres (3)	10-100 acres (12)	100 acres (4)
I. General Government	1. Should government be involved in stream improvement	yes	2	12	2
		no	1		2
	2a. Should ODFW run the program	yes	2	9	1
		no		3	1
	2b. If NO, who should run program	1. SCS			1
		2. USDA		1	
		3. LCDC		1	
		4. DEQ		1	
II. What problems do you see in the program? (more than one answer permitted)	1. Too small a tax deduction for improvements		1	6	4
	2. Landowner already receiving tax deduction				2
	3. Lack of support from other professionals			2	
	4. Perceived government control of private land		2	5	3
	5. Inadequate follow-up information		1		
	6. State, rather than local control			1	2
	7. Lack of evidence of effectiveness			2	
	8. Topographically inappropriate			3	
III. Suggestions for improvement (more than one answer permitted)	1. Larger tax deduction and/or have ODFW pay for fencing			5	4
	2. More land exempted		1		2
	3. Greater use of other professionals				
	4. Government should stay out of stream improvement		1		
	5. More local control				3
	6. Evaluate program continually			1	
	7. Let Welfare recipients work on improvements			1	
	8. Less regulations		1		
	9. Become more flexible		1		

In Lincoln County only five landowners are participating in the tax incentive program (four of the five were in the group contacting the ODFW before the December 31, 1982 deadline). All the landowners participating owned parcels ranging from 5 to 50 acres in size. In general, their lands were forest or open (non-grazed) rangeland that require little improvement for participating in the program. In essence, these landowners were using the tax benefits as an incentive to keep their land in its present condition. One respondent stated, "The land was doing nothing anyway, so the tax break was beneficial. The streams for me don't require any great effort and no money was required." This pattern of participation appears to be consistent state-wide. In northeastern Oregon, the four landowners participating in the program have primarily agricultural lands. According to District Biologist Ken Witty, they require "minimal improvement." Similarly, in Douglas County, 100 miles southeast of Lincoln County, Assistant District Biologist Dave Liscia states that the only landowner that to date had joined "because he's retired and has no plans to do anything with the property at all." In summary, the small land owners that were not intensively using (or abusing) their land for economic gain were taking advantage of the tax incentives, while those large landowners that were intensively grazing their land and using the water were not participating because their costs far exceeded their perceived benefits.

Several lesser concerns were enumerated by the landowners. They expressed a concern that the ODFW involve other government agencies (e.g. Soil Conservation Service) to improve the level and nature of advice and support. Large landowners were suspicious that the CDFW was trying to gain control of their most valuable lands. They stated that they would prefer to remain in established state programs (e.g., Salmon Trout Enhancement Program) rather than the Riparian Tax Incentive Program. The Lincoln County Respondents also expressed the concern that serious flooding would frequently damage fences, plantings, etc., and replacement could be expensive; in essence, that the program was not appropriate for the topography of their county. Finally, the landowners were very suspicious of government intervention in private property rights. This was not aimed specifically at this program; however, several respondents expressed concern that future changes in the program could infringe on their rights. Several respondents stated that they were extremely hesitant to sign a contract involving their land with either a public or private agency. They were very suspicious of legal contracts and lawyers.

Many of these same concerns were also expressed by the ODFW District Biologists (1983). The District Biologists also strongly supported the program conceptually and unanimously felt that stream improvement should be a concern of government. They also saw a strong need for other governmental agencies to be actively involved in promoting the program and realized the position of large landowners who are unwilling to invest in expensive improvements for, in many cases, negligible benefits. Further, the District Biologists perceived the present zoning restrictions which exclude rural residential properties from participating as a hindrance (actual or potential) to the effectiveness of the program.

In summary, large landowners are not participating in the program. Small landowners with negligible improvement costs are. The net result is that some healthy riparian habitats are being properly maintained. However, the large majority of partly or totally destroyed riparian habitats are not, and likely will not participate under present conditions. The following section contains some recommendations and suggestions to the ODFW and State Legislature for altering and implementing the program.

Recommendations and Suggestions for Administrative Action by the ODFW

The major obstacle for program participation appears to be the high cost of fencing and habitat restoration. One suggestion was made that the ODFW (or other government agency) offer low-interest long-term loans to program participants. Another more popular (and costly) option was voiced by District Biologist Ed Schwartz: "If we, the state, want to get this thing off the ground, we are gong to have to start building fences for landowners on an experimental basis." In such a program, the ODFW could, on a limited basis, offer free fencing for landowners willing to contribute labor. After a period of time, they could then evaluate the relative costs and benefits of the program. Several respondents to the survey (who did not participate in the program) indicated that they would be willing to install the fences to receive some tax benefits.

Although this could become prohibitively expensive to the ODFW, the burden could be shared by other public and private agencies benefiting from the program. In addition, foundation grants, matching funds, or contributions of labor and money from various user and conservation groups is possible. Through creative financing, considerable progress in improving public knowledge, support, and participation is possible.

A second recommendation involves the integration and use of the program by other government agencies that constantly interact with landowners. Few landowners objected to the ODFW's lead in the program. However, many other agencies such as the U.S. Soil and Conservation Service, the Oregon State University Extension Service and the Agricultural Stabilization Committee were also mentioned as possible program participants. One respondent claimed that he had sought information on the program from the latter agency and they knew nothing about it. Every effort should be made to expand the depth and breadth of knowledge about the program among professional groups.

The state officials, landowners, and District Biologists also made several other suggestions for more effective program implementation. Several people mentioned that the ODFW should form a Program Advisory Committee comprised of representatives of the ODFW, other professional agencies, and citizens to share information, to advise of program development, to coordinate the effort, and to provide that motivation necessary for successful implementation.

A second popular suggestion involved the development of an independent legal service to help the landowners negotiate and sign the contract with the District Biologists. As previously mentioned, several of the landowners stated that they were very wary of lawyers and were hesitant to sign a contract that involved their property rights. If a third-party legal advisory progr ould be developed to engage in the negotiations and protect the legal rig of the landowners, this barrier may be overcome.

Recommendations that Require Legislative Action

The zoning restrictions of the state of Oregon should be amended to allow lands within an urban growth boundary and those zoned "rural residential" with sizable recoverable riparian lands to participate in the program. Several District Biologists voiced concerns about the number of inquiries ruled ineligible because of these restrictions. The result has been a foregone opportunity to protect and regenerate many valuable riparian habitats. If the program is to be administered as a local program, the District Biologist should be empowered to make some discretionary judgments.

A second legislative alternative involves increasing the direct benefits received by the landowners. The direct benefits may be increased in two, not necessarily exclusive, ways. The first would involve increasing the per-acre property tax relief. According to State Program Director Faast (1983a), "an increase in the tax credit possibly up to five times the present amount" may be needed to entice larger landowners. The second alternative involves the allowance of a larger tax deduction for land improvements. Presently, this is 25% of the costs, which for example, can run between $1,000 and $3,000 per mile just for fencing. In combination, a greater per-acre property tax relief allowance and a greater deduction for improvements could only help to encourage program participation.

Finally, to make the program work, the ODFW must place it high on its priority list and commit time and energy to its success. This is an incentive program with no penalties for not participating. Therefore, the need is even greater for aggressive program promotion. In addition, the fact that this program is new, innovative and voluntary makes it imperative for the ODFW to develop a solid on-going research effort for program assessment, evaluation and adjustment. The success of the entire program may hinge on the ability of the ODFW to amend its basic provisions through time and to be able to react to changing ecological and socioeconomic conditions.

Application of the Program to Other States

The Oregon Riparian Tax Incentive Program is currently the only state-wide program in existence designed specifically to encourage the improvement of private riparian lands. Because this program is so unique and innovative,

over one-half of the states (and almost all western states) and several federal agencies of the U.S. and Canadian governments have requested program information. It is important to highlight some of the unique aspects of this new program, which include:

- voluntary participation of landowners,
- incentive-based approach,
- flexibility for the agent and landowner,
- minimal administrative costs,
- use for habitat protection as well as enhancement,
- widespread political and public support, and
- locally controlled and implemented

From our survey and study, several issues and concerns have surfaced that are extremely important in successfully implementing a riparian tax incentive program. These include:

- qualifying lands-
  - defining riparian zones, and
  - restricting certain administrative units from eligibility (e.g., "rural residential" zones),
- developing a state-wide or regional program to cover entire watersheds and to properly administer and publicize the program,
- setting county, regional or state ceilings in annual expenditures,
- active integration with other public and private agencies,
- the level of incentive--through deductions, property tax incentives, loan programs or giveaways,
- providing local demonstration projects showing the benefits and cost effectiveness of the measures implemented, and
- providing independent legal services for contract negotiation and signing.

The Oregon Riparian Tax Incentive Program provides an excellent model for the development of incentive-based programs for the conservation of sensitive or ecologically significant lands. Although the type of habitat conserved, topography, demography and legal administrative framework may

vary widely from region to region, incentive-based programs may become extremely popular in the next few decades as an alternative to the regulation and enforcement approach to land management. It is hoped that this study can help in the comprehension, promotion, and implementation of similar programs.

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Forging an American Environmental Consciousness: The Historical Interplay of Technology, Politics, and Economics

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The strident pro-development ideology of James Watt and Ronald Reagan and the equally vociferous protectionist response of environmental organizations revived ideological images of the environmental movement not seen since the early 1970s. Essentially, these images portray environmental politics as a moral struggle between good and evil -- between "the people' and "the interests" -- a contest whose outcome will determine if the land will be raped and devastated by developers. As a simple emotional appeal, environmentalism has been a part of the mainstream of twentieth century liberal political ideology since the time of Theodore Roosevelt.

Environmentalism, seen as a central tenet of the liberal political faith, masks a complex and paradoxical American environmental consciousness whose American origins go back to the pilgrims and the Mayflower. This consciousness has evolved over several centuries of cultural interaction with the natural environment. Far from constituting a simple moral creed, American environmental values are historically ambivalent, often in conflict, and frequently at odds with cherished political and economic ideals.

For example, at the turn of the century, two of the forefathers of the environmental movement -- Gifford Pinchot and John Muir -- were locked in mortal combat over the basic direction the movement should take. Pinchot, leader of the conservation forces in the Theodore Roosevelt Administration, favored efficient, multiple use of the nation's natural resources. Muir, founder of the Sierra Club and champion of the emerging national parks system, favored the preservation of wilderness areas in their pristine state. Muir seemed to deny economic necessity and democratic values by advocating the "locking up" of resources with access such that only a few people could enjoy a kind of Thoreauian aesthetic experience. Yet Pinchot, who would use wilderness in a variety of ways to benefit the greatest number of people, was in league with the big timber companies such as Weyerhaeuser, which also favored efficient development.

In the end neither man was triumphant. The Hetch Hetchy dam which Muir opposed for years was built in Yosemite National Park. Pinchot's multiple-use proposal for development of the nation's waterways was defeated in Congress by forces opposed to regulation of localized economic interests.

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An opportunity for an integrated approach to the use and preservation of the natural environment went by the boards with the defeat of Pinchot's multiple use plan. Another unifying concept of the relationship between human society and the environment did not appear until the late 1960s with the emergence of the ecological paradigm. And, today, although the ecological world view is a compelling one, the influence of Watt and Reagan suggests the degree of philosophical conflict which remains.

The central thesis of this paper is that Americans have a fractured consciousness of the environment which is a product of our culture's historical experience. As a society we lack an integrated philosophical framework within which to analyze environmental issues comprehensively and consistently. In the absence of a philosophical context which takes into account all relevant political, economic, social, and ecological interests in a systematic way, Americans resort to simplistic divisions of "the good guys and the bad guys," the "we" and the "they," the "people" and the "interests." The tendency to oversimplify is as American as apple pie and, historically, has produced a number of durable myths and gross distortions of reality. This essay illustrates some of the contradictions between environmental ideology and reality and describes pivotal historical events which have shaped American environmental consciousness.

If one is puzzled that Congress, supposedly the deliberative body representative of the people, defeated Roosevelt and Pinchot's multiple use bill -- legislation defended as benefiting the people -- recall that for three centuries America was the land where ordinary people could become successful entrepreneurs, acquiring wealth and status through hard work and exploitation of abundant natural resources. Any form of governmental regulation was viewed as a potential curb on the opportunity for material success. In shaping American attitudes it can hardly be overemphasized that immigrants of the colonial period departed a pre-industrial Europe just emerging from the oppressive feudalism of the middle ages. A land-based cultural system, feudalism allowed virtually no freedom of opportunity for ordinary people. Later, in the American Revolution these same colonists overthrew English mercantilism, the system of colonial regulations which insured that the profits of industry and trade flowed primarily to the mother country. Finally, the rise of laissez faire served as a popular ideology of nineteenth century industrialization to deny a role for government in regulating economic activity.

The possibility of three centuries of unfettered American environmental exploitation without serious environmental repercussions -- other than lost soil fertility -- owed much to the existence of a vast, undeveloped western frontier with a rich abundance of natural resources. As well, the state of technology was such until the late nineteenth century that most environmental exploitation occurred with hand and animal power rather than sophisticated machines. In the main, outside the teeming slums of large cities, the impact, prior to World War I, of environmental degradation on a large scale was a phenomenon of the future.

Economic values and abundant resources were not alone in shaping an exploitive environmental ethic. The social and religious values of the society evolving across the Atlantic from mother Europe and the egalitarian political spirit of the American democratic experiment combined to add further justification to unregulated economic activity. To the superstitious medieval mind, wilderness represented a somewhat frightening haven for evil spirits, or, at least, could by imagined as harboring strange and unknown beings. Consequently, the Judeo-Christian admonition from Genesis to "multiply and subdue the Earth" was a most reassuring mandate to cut down the forests and plow the land for crops -- to build civilization from the primitive and barbaric wilderness.

It is an irony of history that Thomas Jefferson authored the Declaration of Independence in the same year that Adam Smith, in the seminal book The Wealth of Nations, proposed the laissez faire relationship between government and the economy. Both writers borrowed heavily from the eighteenth century Enlightenment emphasis upon natural law and reason. Jefferson declared that it was "self evident that all men are created equal" and that all men possess inalienable rights to "life, liberty, and the pursuit of happiness," the latter widely understood to mean the ownership and free use of property. Smith claimed the existence of natural laws of economics, such as free competition and supply and demand, which, rather than government, acted as an "invisible hand" to regulate economic activity.

By the time Jefferson had become President at the beginning of the nineteenth century, he had in effect adopted laissez faire as a political slogan of his administration, "The government that governs best, governs least." Jefferson as President also extolled the virtues of a mythical small yeoman farmer -- an appeal, incidentally, to about ninety per cent of the population -- as the backbone of American democracy taming the wild frontier for civilization. Indeed, by the time of Jefferson's Presidency the process was well underway of using democratic and social values which support an idea of civilization's progress as bulwarks rationalizing a burgeoning, entrepreneurial economic order. Jefferson's time is important because it essentially institutionalized democratic ideology as a paradoxical justification for utilitarianism. The democratic ideal of equal opportunity, for example, became most significant in an economic sense at the very time that slavery was being institutionalized in the sociopolitical context.

Although depicted as a subsistence tiller of the land who lived in ideal harmony with nature, the so-called yeoman farmer was in reality engaged in commercial agriculture on a scale resulting in widespread land exhaustion. Land exhaustion continually pushed the frontier westward in quest of fertile new lands to cultivate. By the time of President Andrew Jackson, the yeoman farmer had become celebrated as the common man, and Jackson's presidency was depicted as the triumph of the common man. The transition in terminology from yeoman farmer to common man signaled the appearance of a growing middle class composed of small businessmen and independent artisans, as well as farmers, in an American society becoming more urban and beginning to industrialize.

The political struggle between Jackson and Nicholas Biddle over the rechartering of the Second Bank of the United States first depicted the issues in terms of a moral battle between the common man and the wealthy "interests." In a sense the Bank struggle saw the birth of modern American liberalism, a movement which Pulitzer prize winning historian Arthur Schlesinger, Jr., has termed "The struggle on the part of the other elements of society to control the business class."

Jackson triumphed. The Second Bank of the United States was not rechartered and the stage was set for rapid, unregulated industrial expansion, replete with economic boom and bust for the remainder of the century. Re-establishment of Federal government regulation of banking and currency awaited the creation of the Federal Reserve system in the early twentieth century. The common man of Jackson's time became the "rugged individual" of post-Civil War industrial expansion and, finally, the "self-made man" of Horatio Alger's dime novels near the end of the century. Horatio Alger's self-made man succeeded by the virtues of hard work and keeping his nose clean. He did not engage in actions that would rock the boat, such as involvement in radical politics.

The ideological path from the yeoman farmer to the self-made man was one of increasing myth making, a combination of applying the pre-industrial symbols of an agrarian society (e.g., the "noble yeoman" farmer) to an industrial age and of failing to acknowledge the realities of industrial America. Rather than face squarely the growing poverty, urban squalor, environmental degradation, and technological depopulation of the countryside, millions read Horatio Alger and waited for the American Dream to happen to them.

The pervasiveness of pre-industrial values even reached to the inner sanctum of the historical profession. In 1893, Frederick Jackson Turner, destined to become one of the two or three most influential of all American historians, penned his famous "frontier thesis." Perhaps the single most midely debated paper ever written by an American historian, the Turner thesis argued that the existence of free land and the western frontier were the leading forces in shaping American democracy. With the frontier disappearing, Turner speculated, what would become of democracy? Although not a central concern of this essay, the Turner thesis also provoked a debate over environmental determinism in the shaping of culture.

Dominant social and religious theories also supported the entrepreneurial, laissez faire belief structure of eighteenth and nineteenth century America. Within a framework of the Calvinist theology of predestination, the so-called Protestant Ethic suggested that acquisition of material wealth implied the presence of God's grace, a sure sign that one was among the saved. Woe to those who did not experience material success!

The aloofness of the natural order from regulation by human institutions was expressed in English Sociologist Herbert Spencer's application of Darwinian theory to human society. Social Darwinism, as Spencer's derivation was called, enjoyed great popularity in the late nineteenth

century. Borrowing Darwin's principles of biological evolution, Spencer claimed that humans are engaged in a struggle for survival, a process of natural selection w ich results in the survival of the fittest. As was true with Adam Smit 's "invisible hand" which maintained stability in the natural economic orc:r, the natural laws of society rather than government, according to Spencer, maintained order in the social sphere. Government involvement, Smith and Spencer suggested, would violate the natural laws and lead to disaster.

Ultimately, gross maldistribution of wealth and human misery forced ideological concessions. Prior to the early twentieth century national progressve reform movement, however, the only accommodation viewed thinkable in ruling circles was private philanthropy. Andrew Carnegie coined a theory of philanthropy that was known as the "Gospel of Wealth," contending that the wea.r' had a stewardship obligation to aid society's downtrodden.

Henry David Thoreau notwithstanding, few people other than displaced artisans found the technological innovations of the industrial revolution to be alarming or threatening during the nineteenth century. Only George Perkins March, in his remarkable 1864 book Man and Nature, suggested that vital links exist between man and the land that economic activity, utilizing increasingly sophisticated technological means, disrupted in transforming the wilderness for civilization. Marsh's early ecological insights, however, ran counter to the prevailing view of technology as handmaiden of the civilizing forces of industrial progress.

In some instances Americans expressed a faith in technology which seems absurd by present standards. Settlers were lured to the semiarid Great Plains by the argument that "rainfall follows the plow." The story went that transforming these treeless grasslands into crop and forest lands would alter weather patterns and result in increaed rainfall. Similarly, railroads and others promoting settlement hailed the Great Plains as the "Garden of the World."

Unquestionably, the appearance of critical technological innovations made possible a continuation of settlement patterns in the vast and arid Great Plains and Rocky Mountains which had been developed in the more humid East. Walter Prescott Webb's epic 1931 work, The Great Plains, describes the role of the si. gun, windmill and barbed wire in the pacification of the West. Yet, Webb laments, had these technologies not existed, land use practices more appropriate to an arid environment might have evolved and later economic disasters and dust storms avoided.

Gifford Pinchot and his colleagues in the executive branch during the Theodore Roosevent years advocated a merging of science and technology for the efficient exploitation of natural resources. From the perspective of the TR conservationists, natural resources should be used for their highest purposes, including the recreational and aesthetic, based on scientific observation and analysis. During Roosevelt's time this meant reservng

certain areas for national forests or parks, as Presidents Harrison and Cleveland had done before him. For Pinchot and other scientific conservationists at the turn of the century, wise applications of science and technology served to advance civilization and human progress.

As suggested earlier, by the beginning of the twentieth century bedrock American political, social, and religious beliefs justified an economic system which valued entrepreneurship, laissez faire, and ruthless competition. The instability and unpredictability of economic activity led captains of industry in the late nineteenth century to attempt pools, trusts, and holding companies as private sector means to curb ruthless competition by controlling raw materials, transportation, and markets. For the most part these attempts failed, succeeding only in having their perpetrators labeled as plutocratic robber barons and monopolists in the public mind. In being so labeled, these captains of industry joined, in the American psyche, the company of such historical notables as feudal lords, George III, and Nicholas Biddle, who had earlier attempted to regulate economic enterprise.

During the early twentieth century, many industrialists turned to the federal government to obtain through federal regulation the stability which had eluded them in their private efforts. As a consequence, most of the reform legislation enacted into law during the progressive period came at the instigation or through the support of key figures in big business.

This interpretation contradicts liberal political ideology which contends that so-called reforms are triumphs of the "people" over the "interests," that the "interests" are enemies of such legislation. Yet, consider for a moment the economic and political logic of the situation. Larger corporations had more to lose from the boom and bust cycle and continued ruthless competition and could afford to seek more modest profits on a sustained basis for the long term. Small entrepreneurs had the most to gain from competition and often were able more readily to adapt technological innovations. Moreover, then as now, larger businesses have the greatest stake in curbing fly-by-night operators, out for quick profits, who can give an entire industry a black eye.

One lesson in comprehending environmental politics is that what is important is how natural resources are used, not who owns them. Large companies often have excellent records in managing natural resources; smaller entrepreneurs are often most guilty of wasteful and environmentally degrading practices because of a need to maximize profits. The public may fear the alleged power and influence of the big corporation more than its actual behavior.

The environmental political battles of the Pinchot-Muir era largely established the twentieth century framework for environmental politics. People such as Robert Marshall and David Brower have sharpened our sense of the issues involved with preserving wilderness. Likewise, Aldo Leopold and Rachel Carson made key contributions to the discipline of ecology and its

relationship to environmental questions. The spaceship earth metaphor of a few years ago wedded technology and ecology in an especially compelling image of the interdependent relationship of humans and their environment on a biosphere scale.

Yet, our society as a whole must write a new historical chapter on the values of our civilization to assure our long-term survival. The fact that, ideologically, the Watt-Reagan and liberal environmental forces occupy the center stage reflects both the extent to which Americans are prisoners of our history and how little popular understanding has advanced on environmental issues. Works such as Schumacher's Small Is Beautiful and Lovin's Soft Energy Path have sketched the societal and technological implications of cultural ecology, but the United States has a long way to go in making the ecological paradigm an everyday item for thoughtful political debate about the environment.

The perils of hazardous wastes notwithstanding, a place to begin is with the words, uttered a quarter century ago, of Wisconsin political scientist Henry C. Hart: "The modern issue is seldom conservation versus exploitation; it is often prudent exploitation for one purpose against prudent exploitation for another." This characterization, of course, does not apply to all environmental issues and problems, but it does imply that widely shared cultural values hamper the search for environmental solutions. An understanding of American history can contribute to the evolution of attitudes and perceptions compatible with ecological realities

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Who's In Control? Development of a Perceived Environmental Control Measure

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Abstract: *Locus of Control (L of C) constitutes a personality dimension that may be used in conjunction with other variables to explain and/or predict human social behavior. The purpose of this study was to construct a L of C instrument which could be used to measure the expected reinforcement perceived by an individual if specific types of environmental action are taken in a given situation. Methods used in instrument design and results of testing on three sample populations (i.e., college students, K-5 teachers, and Sierra Club members) are presented.*

Introduction

A major goal of Environmental Education (EE) is to produce an environmentally literate citizenry willing and capable of identifying, investigating and taking responsible action towards the remediation of environmental problems (Hawkins and Vinton, 1973; Hungerford and Peyton, 1976; Stapp and Cox, 1975; Belgrade Charter, 1976; Tbilisi Conference, 1978, and others). To achieve this goal it is necessary to promote within individuals those factors which institute responsible environmental action-taking behavior.

A multitude of investigations indicate that the variables affecting an individual's environmental actions are extremely complex, little understood, and deserving of further research (Heberlein, 1973; Ramsey and Rickson, 1977; Burrus-Bammel, 1978; Bowes, et al., in Schoenfeld, 1980; Peyton and Miller, 1980). In this study, Locus of Control (L of C) is presented as one variable which may play a significant role in affecting the environmental action-taking behavior of an individual. The general goal of this study was to develop a reliable and valid research instrument which could be utilized to further determine the role of L of C in promoting responsible environmental action-taking behavior.

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Background

A specific attitudinal variable which may impinge on the environmental action-taking behavior of an individual is his/her perception of control over a situation or event (i.e., environmental issue). This perceived belief about personal control or non-control of an event is directly related to the theoretical construct called Locus of Control. This construct was first introduced as a component of J. B. Rotter's Social Learning Theory (SLT) (Rotter, 1954; Rotter, Chance, Phares, 1972). The theory was developed in an effort to explain the social behavior of psychotherapy patients. Since its introduction, considerable empirical evidence has been established supporting the utility of the L of C theory for explaining human behavior.

Rotter's SLT states that a person's actions or behaviors are a function of three equally interacting components: expectancy for reinforcement, value of reinforcement, and the psychological situation. A "reinforcement" can be described as "anything that has an effect on the occurrence, direction, or kind of behavior" (Phares, 1976, p. 15). The "value of a reinforcement" may be defined as "the degree of preference for any reinforcement to occur if the possibilities of their occurring were all equal" (Rotter, 1954, p. 107). The "expectancy for reinforcement" is the "probability held by the individual that a particular reinforcement will occur as a function of a specific behavior on his part in a specific situation or situations" (Rotter, 1954, p. 107). The psychological situation is the accumulation of cues that might directly affect the expectancies and reinforcement values of a given person (Phares 1976, p. 17). It is the expectancy for reinforcement which reflects an individual's L of C.

Expectancies fall into two categories: specific and generalized. Generalized expectancies are those which originate or are drawn from a variety of life's experiences. Specific expectancies refer to those which originate from a particular experience or homogeneous class of experiences. In a novel or unfamiliar situation, generalized expectancies will be important in determining expectancy for that situation. Specific expectancies will be the primary determinants in more familiar situations (Phares, 1976).

Rotter (1966) has further identified two belief systems an individual may develop as a result of generalized and/or specific expectancies for reinforcement.

> When a reinforcement is percieved by the subject as following some action of his own but not entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. We have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent

characteristics, we have termed this a belief in internal control (Rotter, 1966, p. 1). (emphasis added)

The L of C construct is described as a distribution of individuals on a continuum reflecting the degree to which they accept personal responsibility for what happens to them (Rotter, 1966). Individuals are neither totally internal nor external (Lefcourt, 1976). The terms are not meant to imply that perception of control is a trait or typology. The terms internal and external control depict an individual's more common tendencies to expect certain events to be contingent or non-contingent upon their action.

The most widely tested L of C instrument that has been developed is Rotter's Internal-External Scale (I-E Scale). Since its development, a number of other instruments have been developed and tested in attempts to improve on the I-E scale. Early L of C instruments (e.g., Rotter's I-E scale) measured the degree to which people believe they exercise control over their lives (internal orientation) or the degree to which they feel their destinies are beyond their own control and are determined by fate, chance, or powerful others (external orientation). Several investigators have found reason to suggest that I-E functions as a multidimensional rather than the above unidimensional construct (Crandall, et al., 1965; Hersch and Scheibe, 1967; Gruin, et al., 1969; Levenson, 1972a; and others). Both chance and powerful others belief orientations are included as external control in the unidimensional I-E theory. Levenson suggested that individuals who believe the world is unordered (chance-oriented) could behave and think differently from individuals who believe the world is ordered but powerful others are in control. In the latter case, a potential for control exists (Levenson, 1974).

Levenson (1973a) conducted a number of studies which serve to ascertain the validity of separating L of C measurement into Internal (I), Powerful Others (P) and Chance (C) dimensions. This study utilized Levenson's tripartite/multidimensional approach under the assumption that it could be particularly applicable to exploring environmental action-taking behavior.

Peyton and Miller (1980) reviewed the literature and identified several key L of C generalizations that may have significant implications for furthering environmental literacy:

1. Internal individuals more frequently participate in productive action-taking than external individuals.

2. Internal individuals differ from external individuals in their ability to recall relevant material, and in how actively they seek additional information.

3. Internal individuals are superior to externals in their utilization of information.

4. Internal individuals are more resistant to subtle manipulation and are less influenced by high-prestige individuals than externals.

5. Internal individuals exhibit a greater capacity to delay gratification in order to attain greater, long-term gains.

6. Internals respond differently to those tasks which they perceive to be skill-related, than to tasks they perceive to be chance-related.

7. An individual's perceived L of C is susceptible to change.

Since achieving the goals of EE depends on developing individuals willing to initiate positive, rational behavior to resolve environmental problems, many of the characteristics associated with internality would seem desirable. It is not suggested here that externality does not have an important role in some situations, however (Phares, 1976; Lefcourt, 1976).

Although the inferred relationship between L of C and environmental action seem quite apparent, investigations supporting its existence are minimal. The few supporting studies (Levinson, 1972b; Arbuthnot, 1977; Tucker, 1978; Smith, 1979; Miller, 1981) have been largely based on instruments developed to sample L of C beliefs about life in general. Major proponents of the L of C construct (Rotter, 1975; Lefcourt, 1976; Phares, 1976) state that these generalized measures may function at a low level when trying to predict actions in a specific situation or homogeneous class of situations. A situation-specific measure should allow relatively high levels of prediction in the situations it was designed for although it would be limited in breadth of application. The need for an instrument specific to environmental situations has been identified by several authors as necessary to permit more effective investigations into the role of internality as a prerequisite to environmental action-taking (Tucker, 1978; Smith, 1979; Peyton and Miller, 1980).

Instrument Design

The instrument designed in this study was entitled the Perceived Environmental Control Measure (PECM). It consisted of three major sections: (1) a summary of an environmental issue; (2) L of C statements that pertain to the issue and require a response from the reader; and (3) questions on the extent of environmental actions actually taken by the respondent. Further rationale for content development and inclusion of the various sections is presented below.

Section I - The Environmental Issue

In Section I of the PECM, respondents were asked to read a one-page summary of an environmental issue and to consider themselves directly involved in the issue. After reading the issue, the subject was directed to respond to the PECM stacements in Section II. Solid waste and acid rain were the topics of two separate issues utilized in this study (Champeau, 1982).

Commensurate with Rotter's Social Learning Theory (SLT), the environmental issue summary confronts the reader with a "specific situation" and a "reinforcement" (i.e., environmental quality outcome of the issue) that should be of some concern or value to the individual. In addition, the issue is designed to make it possible for an individual to apply any or all of five categories of environmental action.

Section II - The PECM Statements

Section II of the PECM was designed to measure the expectancy for reinforcement. The respondents were asked to express an internal or external response with respect to their own use of certain environmental actions in the stated situation. Categories of environmental action proposed by Peyton and Hungerford (1980) were modified and used as a basis for the environmental behavior component of the instrument. The modified action categories are:

1) Persuasion: An effort to verbally motivate human beings to take positive environmental action as a function of modified values, e.g., argumentation, debate, speech making, letter writing.

2) Economic Action: Constitutes an action similar to one of the following: a) an economic threat by an individual or group aimed at some form of behavior modification in business or industry, e.g., boycotting; b) some conservative mode of behavior with respect to consumption of goods and services, e.g., purchase of recycled materials; c) some monetary contribution to an individual, group, or institution that actively favors or works for a position supported by the contributor, e.g., donations to environmental causes; membership fees paid to environmental activist organizations.

3) Political Action: An effort aimed at persuading an electorate, a legislator (or legislature), or executive governmental agency to conform to the values held by the person or persons taking that action, e.g., lobbying, voting, supporting candidates.

4) Legal Action: Any legal/judiciary action taken by an individual and/or organization which is aimed at some aspect of environmental law enforcement or, a legal restraint preceding some environmental behavior perceived as undesirable, e.g., law suits, injunctions.

5) Ecomanagement: Any physical action taken by an individual or a group aimed directly at maintaining or improving the existing ecosystems, e.g., reforestation, landscaping, installing bird boxes.

To assure that the respondent was aware of the actions that could be taken in the situation, a definition of each action category was provided in Section II of the PECM. A series of L of C statements that pertained to the use of that action in the given situation followed each definition (see Figure 1). These statements were divided equally among three L of C belief orientations: Internal (I), Powerful Others (P), and Chance (C). Specific objectives applied to development of the PECM items are as follows:

1. Items in the I-scale were constructed to elicit responses which measure the degree to which an individual perceives his/her use of an environmental action will have an effect on, or control, the outcome of a stated situation.

2. Items in the P-scale were constructed to elicit responses which measure the degree to which an individual perceives powerful others, more than his/her own use of an environmental action, will control or have an effect on the outcome of a stated situation.

3. Items in the C-scale were constructed to elicit responses which measure the degree to which an individual perceives chance or fate, more than his/her use of an environmental action, will control or have an effect on the outcome of a state situation.

Examples of I, P and C statements as they relate to one of the five environmental action categories (i.e., Political Action) are presented in Figure 1.

Section II - Scale Construction and Scoring

A six-point Likert-type scale was employed to quantify responses to the PECM statements. All P and C items were written in the external direction and items in the I scale were written in the internal direction (see Figure 1). All three scales were scored to reflect a common direction with regard to the externality and internality continuum. A relatively high score on the I items reflected a low belief in that orientation. A relatively high score on the P or C items reflected a high belief in those orientations.

Three types of summated scores were acquired with the PECM statements. First, individual I, P, and C scores summed across all environmental action categories allowed an individual three scores with a range of 15-90 for each. Second, combined I, P and C scores for each environmental action category allowed an individual five scores with a range of 9-54 for each. Finally, combined I, P, C scores summed across all environmental action

Examples of I, P, C Statements as They Relate to Political Action

INSTRUCTIONS

In this section you will find the definitions (in italics) of five approaches that might be used to solve the problem that has been described.

Following each of the five definitions is a series of questions regarding your use of each approach. Read each statement and carefully circle the number at the left of each statement which best indicates how strongly you agree or disagree with the statement. Please respond to every statement.

POLITICAL ACTION: *An effort aimed at persuading an electorate, a legislator (or legislature), or executive governmental agency to conform to the values held by the person or persons taking that action, e.g., lobbying, voting, campaigning for candidates, etc.*

1 2 3 4 5 6	1.	I believe that what is going to happen in this situation will happen regardless of any political action I take.	(C)
1 2 3 4 5 6	2.	By participating in some type of political action, I can play an effective role in determining the outcome of this situation.	(I)
1 2 3 4 5 6	3.	The political action I could take in this situation would be of little value in determining the outcome, because the outcome will mostly be influenced by a few people who already have their own ideas about the situation.	(P)
1 2 3 4 5 6	4.	I can implement some type of political action which would directly or indirectly influence the outcome of this situation.	(I)
1 2 3 4 5 6	5.	If this situation turns out the way I believe it should, it would be the result of luck more than the result of any political action I could participate in.	(C)
1 2 3 4 5 6	6.	The political action I could take in relation to this situation would be of little or no value because it would not have an effect on the people who really decide on how this situation will turn out.	(P)

Figure 1

categories (total PECM score) provided an individual one score ranging from 45-270.

Section III - Citizen Action Questions

A third section attached to the PECM consisted of questions designed to assess an individual's reported use of political, persuasive, economic, ecomanagement and legal actions. This section was included to test for evidence of instrument validity. Theoretically, those who scored internal on the PECM should have also scored relatively high on the citizen action questions.

The respondent was asked to state the number of times he/she had taken actions within a certain time period. Each action cited was worth one point up to a maximum of six points. One summated score (range=0-121) was used to quantify the action-taking reported by each respondent.

Instrument Development

Development of the final PECM instrument involved two pilot studies for the purpose of selecting internally consistent items. A total item pool of 150 statements developed for the first pilot study were divided into five separate instruments based on the five categories of environmental action. Each instrument was administered to a different sample of undergraduate students (each N>50) drawn from three different universities and containing a diversity of majors.

Items retained for pilot study II correlated well with the other 29 items (high item total correlation) and with the other items of the same I, P, or C orientation (high item subscale correlation) as recommended by Nunnally (1978), Tuckman (1978) and Oppenheim (1966). Fifteen items (5I, 5P, 5C) were selected from each of the five instruments. Selected items had a Pearson's r of greater than .50 with their respective total and subscale scores.

A total of 90 items were selected from pilot study I and collapsed into one instrument for pilot study II. The second pilot study differed from the first in that a subject responded to all five categories of environmental action. Pilot study II also included a series of questions designed to assess an individual's previous use of the five categories. These questions were included to test for evidence of construct validity.

Instruments were administered to two classes of undergraduate students at Michigan State University (MSU)--an environmental issues survey course (N=91), and an introductory course in fisheries and wildlife management (N=29).

Forty-five items (15I + 15P + 15C) were selected for the final PECM, each

had a Pearson's r of greater than .55 with their respective total and subscale scores.

Cronbach's alpha reliability coefficients were determined as a measure of internal consistency for the various scoring systems being considered (Nunnally, 1978). All of the reported reliabilities for pilot study II were above .84, indicating evidence of high internal consistency or reliability.

To test for evidence of construct validity it was hypothesized that subjects who scored relatively internal (low) on the PECM would score high on citizen action questions. For each of the various PECM scoring systems being considered, a significant negative correlation ($P \leq .05$) was achieved with citizen action question scores (Table 1). Individuals with relatively internal scores (low I, P, C scores) perceived themselves to be taking more actions (high citizen action-taking scores) than their comparatively external counterparts. This was accepted as evidence of construct validity for each of the PECM scoring systems.

Field Testing Analysis and Results

The PECM developed from the two pilot studies consisted of 45 IPC items, 21 citizen action questions, and demographic questions (e.g., sex, age, occupation, etc.). The major intent of field testing was to assess evidence of instrument reliability and validity. Given evidence of these two criteria, other relationships that might exist between L of C and Environmental Action were explored

Field testing of the PECM involved collecting data from four major groups of participants. Group I consisted of undergraduates enrolled in an introductory environmental issues course (N=85). Students were given time during the first class period of the term to fill out and return the instrument. Eighty-one usable instruments were returned.

Group II consisted of undergraduate students enrolled in an introductory biology course for non-science majors. This group was divided into two subgroups. A total of 40 students (subgroup II-A) were given the PECM with the solid waste issue summary and a total of 41 students (subgroup II-B) were the only subjects in the study given a PECM with an acid rain issue summary. The respective instruments were handed out during lab periods on an every-other-seat basis to provide some randomness in distribution. Students were given time in class to fill out the instruments. A total of 38 usable instruments were returned from subgroup II-A and a total of 40 usable instruments were returned from subgroup II-B.

Group III consisted of members from the Michigan State University/Central Michigan Sierra Club. A total of 23 PECMs were distributed at a monthly meeting. Memebers were asked to fill out the instrument at home and return it by mail. Ten usable instruments were obtained.

Table 1 Pilot Study II, Pearson Product-Moment Correlation Coefficients for the Various PECM Scales.

Variables Correlated with Citizen Action Scores	Correlation Coefficient r	Significance Level p	Sample Size N
Total Internal (I) Scores/Citizen Action Scores	-.4342	.001*	116
Total Chance (C) Scores/Citizen Action Scores	-.4076	.001*	117
Total Powerful Others (P) Scores/ Citizen Action Scores	-.3418	.001*	117
Total Political Action Scores	-.3816	.001*	120
Total Persuasive Action Scores	-.4571	.001*	118
Total Eco-management Scores	-.2131	.010*	119
Total Economic Action Scores	-.3139	.001*	117
Total Legal Action Scores	-.3454	.001*	117
Total PECM Scores/Citizen Action Scores	-.3917	.001*	120

*Significant Relationship ($p \leq .05$).

Group IV consisted of a sample of 159 K-5 teachers selected from 20 school districts in the western Michigan area. This group was divided into two subgroups. Fifty-nine of the teachers (subgroup IV-A) have worked with an intermediate school district environmental education coordinator and are known to have implemented environmental education programs in their classrooms. The other 100 teachers (sbugroup IV-B) represented the faculties of ten schools selected randomly from a list of area schools that did not utilize the environmental education coordinator. Instruments were distributed and returned by mail. Twenty-one usable instruments were returned from subgroup IV-A. Twenty-six usable instruments were returned from subgroup IV-B. No follow-up of non-respondents was attempted.

Reliability

Cronbach's alpha reliability coefficients were calculated for total PECM scores and for each of the PECM subscales. In addition, these coefficients were calculated for data from each of the sample groups. Consistently high alpha coefficients (alpha$\geq$.85) were achieved for total PECM scores and for each of the subscales, indicating a high internal consistency.

Content Validity

Evidence of content validity for the PECM is based upon planned development of item content and upon systematic selection of homogeneous items. All 45 items tended to maintain a rather high ($r \geq .60$) correlation with the total scale and with respective subscales. These results were true for data collected from all sample groups and seem to indicate that items are functioning in a manner prescribed by the objectives posed for item content development. Thus, it is assumed the systematic procedures used to develop and select PECM items substantiates evidence of the instrument's content validity.

Construct Validity

Construct validity is here defined as the extent to which an instrument can be shown to perform in a manner prescribed by a particular construct. Construct validity cannot be claimed simply on the results of one study. An accumulation of supporting results is necessary to provide evidence of construct validity. A number of findings in this study contribute to the support of construct validity for the PECM.

Generally, mean and median PECM scores for each sample group were in the lower half of the possible range of scores. This was true for total PECM scores (Table 2), I, P, C subscale scores and for enviornmental action category subscale scores (Champeau, 1982). Levenson (1972a) found also that very few of her subjects felt their lives were controlled by chance or powerful others to the degree they controlled their own lives. A number of

Table 2 Range of Scores, Means, Medians and Standard Deviations of Total PECM Scores for Each Sample Group

Group		N	*Range High Score	*Range Low Score	M	Md	SD
I	Env. Issues Class	73	270 (n=1)	45 (n=1)	117.301	115.00	37.402
II	Bio. Class						
	Group II A (Solid Waste)	38	157 (n=1)	45 (n=1)	111.684	116.00	28.347
	Group II B (Acid Rain)	37	202 (n=1)	47 (n=1)	119.703	113.00	37.010
III	Sierra Club	10	159 (n=1)	54 (n=1)	99.700	93.500	30.616
IV	Teachers						
	Group IV A (Env. Ed.)	21	264 (n=2)	45 (n=1)	140.095	134.00	55.675
	Group IV B	26	192 (n=1)	54 (n=1)	119.769	118.500	41.095

*Possible Range of Scores 45-270

Midpoint 157.5

researchers confirm her findings (i.e., Harrow and Ferrante, 1969; Hersch and Scheibe, 1967; Lefcourt, 1967; Rotter, 1966). This tendency for people to evaluate internal attributes in a more favorable light than external attributes seems to be a socially desirable response style that is inherent in L of C measurement (Phares, 1976; Lefcourt, 1976).

Past research using relatively generalized L of C instruments has given some indication of a relationship between internality and taking environmental action. It was hypothesized that total PECM scores and the various subscale scores would correlate significantly with the amount of citizen actions a person reports to have taken. Since the total PECM and various subscales are scored in the external direction (i.e., higher the score the more external), any significant correlations would be expected to be negative. Indeed, the hypothesized relationship between total PECM scores and reported actions were supported by findings.

Pearson r correlations between total PECM scores and citizen action scores were consistently negative for the five groups who were administered the solid waste version (solid waste groups) of the PECM and four were significant ($p \leq .05$). When the five solid waste groups were collapsed, analysis again produced a significant negative correlation between the two variables (Table 3). The one exception among solid waste groups was subgroup IV B (the random sample of teachers). Although the correlaion between PECM scores and citizen action scores was not significant ($r=-.2318$, $p=.127$), it was in the hypothesized direction and therefore provides a consistent trend for overall findings.

Correlations between total PECM scores and citizen action scores were also not significant for biology subgroup II-B which received the acid rain version of the PECM. However, the correlation coefficient was in the hypothesized direction ($r=-.2086$, $p=.098$). Since the acid rain version of the PECM was not administered to other groups, no additional data are available to determine whether results are a function of group characteristics or instrumentation. The characteristics of the acid rain issue may be such that even internal individuals feel less associated with the causes and solutions. Certainly, the question of issue specificity of the PECM is raised by these findings.

The total PECM is made up of a number of underlying subscales which should show some degree of construct validity to be included in the instrument. The pattern of correlations for I, P, and C subscales was similar to that of the total PECM scores. That is, the same four solid waste groups exhibited significant negative correlations between the I, P, and C subscales and citizen action-taking scores. As I, P, or C scale scores move toward the external direction (high scores), reported citizen actions significantly decrease.

Findings for the random group of teachers (IV-B) were not significant. All correlation coefficients, however, were in the hypothesized direction (I:$r=-.2925$; $p=.069$; C:$r=-.2808$; $p=.078$; P:$r=-.1361$, $p=.245$). Overall,

Table 3 Pearson Product-Moment Correlations for Total PECM Scores with Citizen Action Scores for each of the Sample Groups and for Sample Groups Responding to the Solid Waste Issue Combined.

Group		Total PECM Scores/Citizen Action Scores Correlation Coefficient r	Significance Level p	Sample Size N
I	Env. Issues Class	-.3391	.001*	81
II	Bio. Class			
	Group II A (Solid Waste)	-.5958	.001*	38
	Group II B (Acid Rain)	-.2086	.098	40
III	Sierra Club	-.6320	.025*	10
IV	Teachers			
	Group IV A (Env. Ed.)	-.4843	.013*	21
	Group IV B (Random Sample)	-.2318	.127	26
All Goups Combined (Except II B)		-.3451	.001*	168

*Significant relationship ($P \leq .05$).

correlations for all solid waste groups were in the hypothesized direction, adding some consistency to findings.

With respect to the acid rain group, only the C subscale scores produced a significant negative correlation with citizen action scores ($r=-.3223$, $p=.023$, $sig<.05$). This might be an indication that the C scale shows some predictive potential over the P and I scales with reference to the acid rain issue. Similarly, using a more generalized instrument, Levenson (1972a) found that only the C scale discriminated between males involved in anti-pollution activities and those not involved (i.e., those involved did not feel chance controlled their lives to the extent that those uninvolved did). Although not significant, the correlation coefficients for I and P scales were in the hypothesized direction. Non-significant findings again raise questions about the PECM effectiveness with different types of issues (e.g., local vs. national).

When the solid waste version of the PECM was analyzed according to environmental action category subscales, evidence supporting construct validity was still present. Across the five solid waste groups each of the subscales (i.e., persuasive, political, economic, ecomanagement, legal) produced a majority (at least 3 out of 5) of significant correlations. Subscales not achieving significance differ from group to group. However, even non-significant coefficients all fall in the hypothesized direction and many approached the .05 significance level. Since each of the five subscales show some evidence of construct validity, retention of each subscale within the PECM seems justified. Data analysis from the acid rain group (group II-B) produced significant negative correlation coefficients for all but the legal and ecomanagement subscales.

Theroetically, the I, P, and C subscales all measure the same underlying construct (i.e., a belief in internal or external control). For all groups, I, P, and C subscales scores achieved positive and significant correlation coefficients. As subjects increasingly agreed with personal control (I), their belief in powerful others and chance control decreased and vice versa (Table 4), supporting the theory of similar constructs.

The PECM was divided into I, P, and C statements based on the theory that the three subscales tap different dimensions of the same construct. It was assumed that if significant differences among the three subscales were discovered within groups, it would indicate that the subscales are possibly measuring different L of C belief dimensions. An SPSS MANOVA Profile Analysis (repeated measures) program was employed to determine differences between I, P, C scores within sample groups by sex.

Findings indicated no significant interaction between sex and measures for any of the groups sampled. For group I, females scored lower or more internal on the I, P, and C scales than males ($F=12.2379$, $p=.00084$) (Table 5). Since I, P, C scores add up to make the total PECM score it was inferred that for the environmental issues group females also scored lower than males on total PECM scores. Similarly, Miller (1980) used Levenson's

Table 4 Pearson Product-Moment Correlation for Total I, P, and C Scores within each Sample Group.

Group		Variables Correlated P/C r	P/I r	C/I r
I	Env. Issues Class	.8502* n=74	.8068* n=76	.8187* n=77
II	Bio. Class			
	Group II A (Solid Waste)	.7661* n=38	.7108* n=38	.8747* n=38
	Group II B (Acid Rain)	.8559* n=38	.7461* n=38	.7886* n=37
III	Sierra Club	.8994* n=10	.9131* n=10	.9079* n=10
IV	Teachers			
	Group IV A (Env. Ed.)	.9521* n=21	.8609* n=21	.8102* n=23
	Group IV B (Random Sample)	.9400* n=27	.7532* n=27	.8125* n=27

*Significant relationship ($p \leq .05$).

I, P, C scale with a sample of Youth Conservation Corps participants, and found females scored significantly lower (more internal) on P and C scales. Although not significant, the I scale showed a similar trend. Levenson (1972a) also found females differed significantly from males on the P scale with males believing more in control by powerful others than females. Phares (1976) speculated males may have more of an external orientation than females because the cultural pressures for success are greater for the male, and thus, the male protects himself from failure by recourse to external attributions.

No differences by sex were obtained from analysis of other groups responding to the solid waste issue. However, it should be noted that the relatively large sample of group I included an approximately equal representation of males and females. Other sample groups were considerably smaller and male to female ratios were quite unequal, which could have had an effect on findings.

Analysis for differences among I, P, and C subscale scores within sample groups (excluding sex) yields some indication that the P subscale statements introduce a L of C dimension that may be perceived differently from the I and/or C orientations. With the exception of group IV-B (random sample of teachers), no significant difference was found between I and C subscale scores within solid waste groups. However, for three of the solid waste groups (i.e., groups I, II-A, IV-B), P scores were significantly higher ($p \leq .05$) than C and/or I scores. Table 5 indicates the significant difference between C and P scores in group 1 and Table 6 indicates results from all other groups. These findings seem to support Levenson's original reasoning for dividing the external scale into P and C dimensions.

A similar analysis (i.e., MANOVA Profile Analysis) was conducted for the five environmental action category subscales. A difference between sexes was again determined only for group I, with females scoring significantly lower on all five scales than males. Also, for this group legal action scores were significantly lower than other subscale scores (Table 7). The trend was for all groups to score legal action relatively low.

The significant finding for the environmental issue group and the consistent trend for other groups to score legal action low indicates that subjects in this study may believe they have more personal control through the use of legal action. These findings would seem to conflict with the results of research conducted by Peyton and Hungerford (1980b), who found that when a sample of teachers were asked to provide examples of five environmental action categories they provided the fewest for legal action. In addition, when asked to evaluate their own ability to prepare and teach environmental education units based on the environmental actions, they felt least competent in the area of legal action. This suggests the interesting possibility that what individuals perceive they know about an action is not related to their perceived ability to exert influence by using that action. This possibility should be further investigated. It also indicates that at least some differential effect between certain environmental action

Table 5 Repeated Measures Analysis of Variance for I, P, C Scores by Sex for the Environmental Issues Class (Group I).

Sex	N	TOTAL PECM SCORE M	SD
Male	40	129.700	37.799
Female	28	99.857	29.431

ANOVA Summary

Variables	df	Multivariate F	Univariate F	P
Intersection between sex and measures	2, 65	(approx. F) .3089		.73534
Difference by sex	1, 66		12.2378	.00084*
Difference between measures	2, 66	(approx. F) 13.9000		.00001*
+ P vs C	1, 67		21.44	.00002*
+ C vs I	1, 67		.6063	.43892
P vs I	Assumption: If P>C and C=I, then it is assumed P>I			

*Significant relationship ($p \leq .05$).

+Means were rank ordered from high to low prior to analysis.

Table 6 Repeated Measures Analysis of Variance for I, P, C Scores for Groups II-IV.

ANOVA Summary

Variables	df	Multivariate F	Univariate F	P
Group IIA Difference between measures	2, 36	(approx. F) 13.876		.00003*
+P vs C	1, 37		21.145	.00005*
C vs I	1, 37		2.441	.12673
P vs I	Assumption:	If P>C and C=I, then it is assumed P=I.		
Group IIB Difference between measures	2, 34	(approx. F) 6.1569		.00522*
+P vs I	1, 35		.53277	.47030
I vs C	1, 35		4.20623	.04782*
P vs C	Assumption:	If P=I and I>C, then it is assumed P>C.		
Group III Difference between measures	2, 8	(approx. F) 3.12621		.09927
+P vs I	1, 9		2.781	.12973
I vs C	1, 9		1.444	.26031
P vs C	Assumption:	If P=I and I=C then it is assumed P=C.		
Group IVA Difference between measures	2, 19	(approx. F) 1.14575		.33900
+P vs C	1, 20		1.65919	.21242
C vs I	1, 20		.20581	.65495
P vs I	Assumption:	If P=C and C=I, then it is assumed P=I.		

Table 6 Continued

Variables	df	Multivariate F	Univariate F	p
Group IVB Difference between measures	1, 23	(approx. F) 8.7299		.00151*
+P vs C	1, 24		11.911	.0028*
C vs I	1, 24		5.848	.02355*
P vs I	Assumption: If P>C and C>I, then it is assumed P>I.			

*Significant relationship ($p \leq .05$).

+Means were rank ordered from high to low for each group prior to analysis.

Table 7 Repeated Measures Analysis of Variance for Total Action Category Scores by Sex for the Environmental Issues Class (Group I).

Sex	N	Total PECM M	SD
Male	40	129.700	37.799
Female	28	99.857	29.431

ANOVA Summary

Variables	df	Multivariate F	Univariate F	p
Interaction between sex and measures	4, 63	(approx. F) .8856		.47784
Difference by sex	1, 66		12.2378	.00084*
Difference between measures	4, 64	(approx. F) 5.8397		.00045*
+Econ. vs Ecomgmt.	1, 67		.5456	.46269
Ecomgmt. vs Pol.	1, 67		.7780	.38090
Pol. vs Persuasive	1, 67		.2283	.63431
Persuasive vs Legal	1, 67		9.29636	.00329*

*Significant relationship ($p \leq .05$).

+Means were rank ordered from high to low prior to analysis.

categories does exist which may add to the increased diagnostic potential of the PECM.

The major difference between the acid rain issue summary and the solid waste issue summary was that the prior issue could be identified as a problem of national origin and the latter as a problem of local origin. It was speculated that these issues might have some differential effect on various PECM scores. The two versions were randomly distributed to equal numbers of students in an introductory biology class (groups II-A and B).

A one-way analysis of variance showed no significant difference existed between the two groups with respect to citizen action scores. This finding confirmed some degree of homogeneity between the two groups. A MANOVA Profile Analysis (repeated measures) indicated significant interaction between groups and I, P, C measures (Table 8). This interaction was attributed to a significant differential effect of I subscale scores. Mean I scores for the acid rain group were substantially higher (more external) then mean I scores for the solid waste group. It should also be noted that the total PECM scores (Table 1) and all environmental action category subscale scores were higher (although not statistically significant) for the acid rain group.

Consistent differences between scores for the two groups indicate a feeling of less personal control over the broad-based acid rain issue as compared to the more local-based solid waste issue. This inference would support the assertion that L of C beliefs are situational.

Analysis indicated that the only significant difference between teacher groups was with respect to civil actions reported. The random sample of teachers reported more action-taking than the environmental education teachers. Another trend (non-significant) was that the random sample scored lower total PECM scores and subscale scores.

It is not immediately obvious why the random sample should have reported taking more action or exhibited a consistent trend to score more internal. These data were based on voluntary returns of the instrument by mail. There is evidence to suggest that internals would be more likely to return the questionnaire than would external individuals. Thus, internality may have been selected for in each of the samples, making them more similar than the original populations actually may have been.

Two of the college groups (groups I and II-A) did not differ significantly with respect to total PECM scores. They were combined into a college student group (N=119) and compared to a combined teachers group (N=51) who also did not differ significantly on total PECM scores. It was hypothesized that a differential effect on total PECM scores and/or citizen action scores would exist due to age and/or experience differences.

Teachers scored significantly higher (at $p \leq .05$) than college students on total PECM scores (Table 9). Teachers also scored significantly higher

Table 8 Repeated Measures Analysis of Variance with Respect to I, P, C Scores between the Two Biology Subgroups (Subgroups II A and II B)

Group	Approx. N	Internal M	Internal SD	P-Others M	P-Others SD	Chance M	Chance SD
Bio. Class II-A (Solid Waste)	38	34.500	8.831	41.395	11.360	35.789	10.467
Bio. Class II-B (Acid Rain)	40	38.500	12.725	42.128	13.324	38.795	15.407

ANOVA Summary

Variables	df	Multivariate F	Univariate F	P
Interaction between groups and measures	2, 72	(approx. F) 4.63922	-	.01273*
Differential Effect				
P vs C	1, 73	-	1.05812	.30704
C vs I	1, 73	-	6.27002	.01451*

*Significant relationship ($p \leq .05$).

Table 9 Analysis of Variance (Planned Contrasts) Based on Total PECM Scores between Sample Groups Administered the Solid Waste Issue Summary.

Group		N	M	SD
I	Env. Issues Class	73	117.301	37.401
II	Intro. Bio. Class (A - Solid Waste)	38	111.684	28.347
III	Sierra Club Members	10	99.700	30.616
IV	Teachers			
	(A - EE Teachers)	21	140.095	55.674
	(B - Random Sample)	26	119.769	41.095

ANOVA

Groups	ss	df	F	P
Within Cells	243104.105			
III vs I, II-A, IV-A & B	4697.894	1	3.1499	.07780
I, II-A vs IV-A & B	6493.872	1	4.3541	.03848*
I vs II A	285.931	1	.19172	.66202
IV A vs IV B	3748.482	1	2.5733	.11482

*Significant relationship ($p \leq .05$).

(F=11.200, p=.001, sig. level p≤.05) on citizen action scores (Table 10) indicating they perceived taking more action than college students but scored relatively more external. More action taking by teachers may be due to age and experience which allowed them more opportunity to get involved. To explain the more external orientation of the teacher group, it is suggested that teachers might have gained a more conservative perspective on solutions to the stated issue through experience. Less experienced students may have a more idealistic perspective of person control of the issue. Phares (1976) reports a similar trend for college students to score relatively internal.

The Sierra Club membership reported taking significantly more actions than a combined group of all other subjects administered the solid waste version of the PECM (Table 10). Differences between total PECM scores were not significant (p=.077, Table 9). A review of total and subscale PECM scores for the various groups shows that the Sierra Club group scored consistently and substantially more internal than all groups, which seems to lend some support to the predictive potential of the PECM. Present findings with this small sample of Sierra Club members indicate the need for further research on activist groups to establish normative data with the PECM.

Conclusions and Recommendations

The PECM has shown initial evidence of reliability, content validity and construct validity, and it has added further substance to the proposed relationship between L of C and environmental action-taking behavior.

The PECM provides some evidence that the majority of subjects perceived themselves as having some personal control over the stated issues. However, to some extent chance and, to a larger extent, powerful others have been identified as agents also having some control over the outcome of the issues. These findings endorse the assertation that the Internal/External (I-E) construct functions as a multidimensional construct. Results also provide evidence that subjects perceive themselves to have more personal control over the issue with the legal action process.

Finally, sex, age and/or occupational background may have some relationship to perceived control of environmental issues.

Ultimately, the reported findings have many implications for environmental education researchers and/or educators. Results of this study endorse the suggested relationship between L of C and environmental action-taking behavior and lend credence to a further consideration and/or investigation of the inferred relationships between internality and environmental action taking as proposed by Peyton and Miller (1980). The PECM has been shown to have potential for such investigations.

Although the preceding discussion places the PECM in a favorable light, there are many limitations involved with its development and use. Further refinement of the PECM will be necessary. Small sample sizes and general

Table 10 Analysis of Variance (Planned Contrast) based on Citizen Action Scores between Sample Groups Administered the Solid Waste Issue Summary.

Group		N	M	SD
I	Env. Issues Class	81	13.827	11.174
II	Intro. Bio. (A - Solid Waste)	38	14.394	11.068
III	Sierra Club	10	44.900	15.242
IV	Teachers			
	(A - EE Teachers)	23	15.086	11.036
	(B - Random Sample)	28	24.642	16.598

ANOVA

Groups	ss	df	F	P
Within Cells	26731.813			
III vs I, II A, IV-A & B	7256.344	175	47.503	.0001*
I, II A vs IV-A & B	1710.9003	1	11.200	.00100*
I vs II-A	279.228	1	1.827	.17811
IV-A vs IV B	1282.663	1	8.396	.00424*

*Significant relationship ($p \leq .05$).

lack of random sampling limit the usefulness of findings.

There is no indication the situation-specific PECM will provide substantially more or less information than a shorter, more generalized instrument. Minimal testing results from the acid rain issue seemed to suggest L of C is specific to the situation in question. It is recommended the PECM be tested against a more generalized instrument and that both instruments be tested with a variety of issues to determine if the PECM has potential diagnostic advantage over generalized L of C instruments and whether it is applicable to a variety of issues.

Predictive validity of an instrument is defined as the degree to which the predictions made by a test are confirmed by the later behavior of the subject (Borg and Gall, 1979). It would be pertinent to subject the PECM to further studies that test its predictive validity. The question might be posed: Do people who score relatively internal (i.e., on the PECM) about taking action on a specific issue actually take action when the opportunity is provided? If the answer is positive, the PECM could be applied to evaluating the effectiveness of EE curricula in establishing or reinforcing internality towards environmental action taking.

Predictive validity also related to another limitation of this study. Subjects were presented with a hypothetical environmental issue. Responses of individuals actually confronting a similar real-life situation may be substantially different from those responding to a hypothetical situation. An investigation into these possible response differences should be conducted.

That the human personality is a complex multidimensional entity hardly needs substantiation. The PECM is concerned with assessing only one personality dimension (i.e., L of C) that may interact with a number of other variables to promote or inhibit the environmental action-taking behavior of an individual. It is important to continue to define the relative roles of L of C and other variables impinging on behavior, if EE is to achieve the goal of environmental literacy.

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Children and Environmental Educators: Differing Views of the Urban Environment

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Abstract: *This study sought to understand children's perceptions of the urban environment and compare their perceptions with those of enviromental educators. Participants, 207 middle-school students and 92 environmental educators, rated 56 photographs of the urban environment in terms of both familiarity and preference for such scenes.*

Based on students' preference ratings, a nonmetric, factor-analytic method yielded eight patterns that characterize important categories within the urban environment. Three patterns related to housing and five dealt with other aspects of the urban environment. These patterns, rather than the individual scenes, served as the basis for further analyses of participants' familiarity and preference ratings.

Although students were less familiar with all of the patterns than were the environmental educators, both groups tended to know the same kinds of urban places. Regarding preference, the two groups agreed only on what they did not like about the urban environment. Both disliked the rundown deteriorated places. What the two groups did like bore litle resemblance to one another. Students preferred the more urban patterns while environmental educators favored the more "natural" patterns.

Based on the study's findings, I recommend that environmental education curricula and programs employ the user's environmental perceptions and the user's immediate environment as the starting point for exploring the environment.

To date, environmental educators have placed little emphasis on determining children's cognition[2] of their environment. They have assumed that their own cognitions of environment are similar to children's, or that they can surmise children's perceptions of the world. The validity of such assumptions is, however, questionable. A study by Jacobs and Jacobs (1980) revealed that adults with special training on the urban child were unable to approximate children's perceptions. Strong evidence also indicates that experts view the world quite differently than do non-experts (Anderson, 1978; R. Kaplan, 1973), and that children and adults view the world differently (Hart, 1978; Lynch, 1978). Because of children's special perspective (small size, fewer preconceived ideas), and because environmental educators are both adults and experts, cognitions of the environment are likely to be dramatically different between these two groups.

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In light of modern cognitive theory, it is essential that environmental educators learn what environment means to children. Environmental cognition theorists believe that people do not interact with their environment in an arbitrary manner. Individuals' cognitions of the environment determine their actions towards it (Moore and Golledge, 1976). Children's environmental actions are therefore a function of how they perceive their environment, what it means to them, and what it enables them to do.

The purpose of this study is to identify and examine children's perceptions of their environment. In addition, children's perceptions of the urban environment will be contrasted with environmental educators' perceptions of the same environments. Such information should be useful in the development of environmental education materials and programs. It should also be valuable in urban and outdoor recreation planning.

Background

Several important conclusions can be drawn from the literature. First, it seems that children and adults have different experiences of place (Hart, 1978). Not only are their environmental perceptions different, but adults do not seem to understand how children use the environment (Lynch, 1978). These differences in perception are greater with those adults who have had special training, i.e., environmental education trainees (Hungerford and Rubba, 1981). In addition, adults' childhood experiences seem to have been quite different from contemporary children's (Lynch, 1978). Although child and adult perceptions vary, there is evidence to suggest that children tend to share a common experience of place (Hart, 1978). Another significant finding concerns children's feelings about their environment. Children tend to find their urban environment lacking in opportunities for meaningful involvement. There is a feeling among children that there is little for them to do or be responsible for. They feel that there are no places they control (Lynch, 1978). Playgrounds, which are ostensibly developed for children, fail to involve them. The children instead prefer unplanned places (Berg and Medrich, 1980). Lastly, the immediate environment is a very important place in children's lives (Lynch, 1978). Issues such as lack of mobility and traffic are a common concern with children. Often these impediments prevent children from taking advantage of what the community has to offer (Berg and Medrich, 1980).

While the above research extends one's understanding of children's environmental perceptions, significant gaps in knowing their world still exist. As yet, what children find salient about their environment is not well described. What does the child's image of his/her environment look like? Why does it take the form it does? How do their views of the environment help them to function within it? In other words, what does it do for them? How do children's images of the environment differ from adults'? More specifically, how do their images differ from those of environmental educators--the adults who are primarily responsible for the

development of environmental education curricula and programs? Knowing the answers to these questions would give us a fuller understanding of children's environmental cognition. An intriguing line of research offers an avenue for gaining this knowldge.

A Unique Approach

One might expect that the differences between adults' and children's perceptions result from their varying preferences. Preference could, therefore, serve as a vehicle for understanding people's environmental perceptions. This is especially valuable because people can easily make preference judgements. Preferences about environment are neither random nor idiosyncratic. "We have also 'discovered' that, although preference is undeniably subjective, the subjectivity is often shared to a remarkable degree" (R. Kaplan, 1975). Preference ratings can be used to distinguish among different groups of people. Important differences in how experts and other people perceive the environment were demonstrated by Anderson (1978) and R. Kaplan (1973).

A factor which may affect an individual's preference is famliarity. Its affect on preference can be quite intricate. In R. Kaplan's (1977) roadside study, familiarity seemed to decrease preference. But this did not hold for the more spacious scenes. In the drain study (R. Kaplan, 1977), preference seemed to vary with the kind of experience the individual had with the scene. If the individual lived along a preferred part of the drain, similar scenes were preferred. If the individual's experience was with less preferred areas, then scenes from such places were not preferred. In their urban study, Herzog, et al. (1976) also obtained mixed results. The two dimensions with the highest familiarity and preference ratings were negatively correlated. The three remaining dimensions were positively correlated. As these results indicate, the relationship between familiarity and preference is complex and difficult to interpret.

Studies by Anderson (1978), Hammit (1978), R. Kaplan (1977), Gallagher (1977), and Ulrich (1973) used a Content Identifying Method to determine what people perceive as salient about their environment (S. Kaplan, 1979). In this method, participants are asked to indicate their preferences for 30-50 photographs of the environment under study. Two statistical procedures (a nonmetric factor analysis and a hierarchical cluster analysis) are then used to identify content domains and provide the researcher with a manageable number of groups. The groups are empirically derived from the participants' ratings. The investigator's skill and imagination are then required to interpret the meaning of the groupings and determine why particular photographs did or did not group (R. Kaplan, 1972).

Photoquestionnaire Development

Using the above model, I developed a photoquestionnaire for this study. During fall 1979, I took about 750 photographs of residential areas in Detroit, New York, and Ann Arbor. The scenes were taken at eye level with a 35mm camera equipped with a standard 50mm lens. Working from proof sheets, I made the first cut. The criteria used for reducing the number of photographs were picture subject, quality, and content.

Picture subject - Scenes which best represented housing, commercial districts, open space/recreation, and transportation were selected. These areas were selected because they directly impact children's lives. They also represent some of the more critical issues facing urban centers.

Picture quality - Only correctly exposed photographs, with good contrast, and in sharp focus were selected. These qualities are especially important in later reproduction of the photographs.

Picture content - Photographs with a minimum of street surface, few or no people, no water and a minimum of distracting detail from the subject were selected. Since streets are ubiquitous, it was important to de-emphasize them unless that was the specific subject of the photograph. People were allowed only in photographs where their presence was expected, e.g., a bus stop, or where they attracted little attention. This was done because people are a very strong stimulus which could bias the photograph ratings in uncertain ways. Scenes containing water were also not used for the same reasons.

Using these criteria, 200 photographs were selected for enlargement into 3x5 prints. The same criteria were then used with the prints. In addition, very similar scenes were eliminated. In this manner, 56 photographs were selected for the study. This number was considered appropriate for the students' attention span and was about the limit that could be easily rated in 50 minutes, the length of a normal class period.

The 56 scenes were distributed among seven pages so that similar subject photographs were not together. The photographs were printed in half tones, a process which gives an accurate reproduction of the image. Under each photograph two Likert-type scales, one marked "A" and the other marked "B", were printed. This enabled a participant to respond to two questions about each photograph by circling one number on each scale.

Two questions were developed to assess the preference and familiarity constructs discussed earlier. The constructs and their questions were:

Construct	Question
Preference	How much would you like part of your neighborhood to look like the kind of place shown in the photograph?
Familiarity	How familiar are you with the kind of place shown in the picture?

The instrument was tested in Ann Arbor, Michigan, with two groups of children. The pretesting was used to work out the procedure for administering the instrument and to identify potential trouble spots.

Obtaining Data: Student Sample

Seven classes, totalling 207 students (116 girls and 91 boys) from four schools, rated the photographs for familiarity and preference. The sample was 84 percent Black, 15 percent White, and 1 percent other. Students ranged in age from 12 to 14 years, as reported by their teachers. Age, Sex, and race/ethnic groups were used only to describe the sample. They were not used as independent variables. This was done because the focus of the study was on similarities among children's environmental perceptions.

After a general introduction to the study, the scales used on the photoquestionnaire were explained to the students. A sample question was then given as an example. Students were then told which scale (either "A" or "B") they were to use to answer the first question. "A" was always the familiarity question and "B" was always the preference question. The first question was then displayed and read aloud to the class. It was discussed to make sure the students understood it. Students then began to rate the photographs. The question remained on display so that students could easily refer back to it. After students completed the first question, the same procedure was followed for the second question.

The instruments were checked for completeness as they were collected. The whole process took approximately 40 minutes to complete. In all cases it was completed within the 50 minute class period.

Obtaining Data: Environmental Educator Sample

Environmental educators also rated the photographs for familiarity and preference. They used the same photographs and answered the same familiarity/preference questions as the students.

One hundred forty instruments were mailed to environmental educators in May, 1980. Names for the mailing were obtained from national and state environmental education organization membership lists. Environmental educators were selected to participate in the study if they met at least one of the following criteria:

1) The individual was involved in the development of environmental education materials and/or programs for children.

2) The individual taught in or was responsible for an environmental education program for children.

3) The individual conducted an environmental education program in an urban area.

4) The individual was involved in an environmental education teacher-training program.

The original sample of environmental educators was composed of 42 females and 98 males. They were from 32 states and the District of Columbia. Ninety-four returns (66%) were received by June. They came from 27 states and the District of Columbia as evidenced by the postmarks. All but two of the instruments were usable.[3] Because the returns were anonymous and did not ask for sex or race/ethnic information, it was not possible to determine an accurate breakdown of these variables. However, based on the present make-up of the environmental education community, it is fairly safe to assume that the sample is predominantly White. An accompanying questionnaire (not reported in this paper) indicated that 91% of the sample was fairly evenly distributed between the ages of 20 and 59. Seven percent indicated their ages were between 60 and 69 while two percent were over seventy.

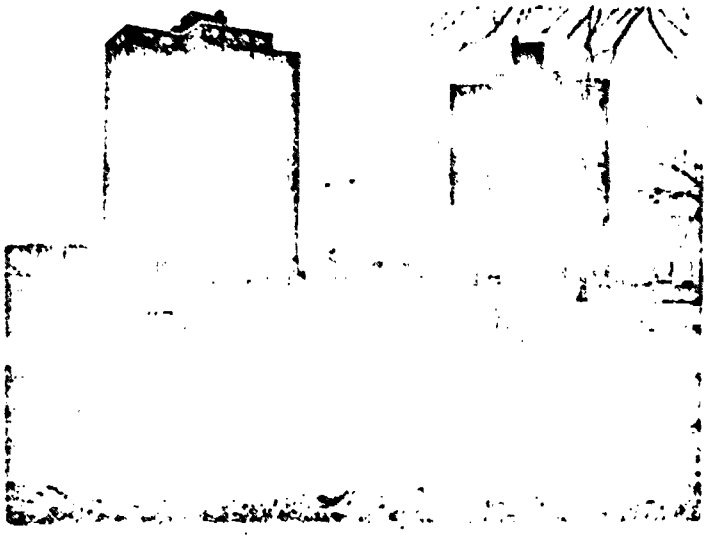
Discerning Patterns

In this study the Guttman-Lingoes Smallest Space Analysis (SSA-III) (Lingoes, 1972) was used to identify patterns of the urban environment. This procedure has been successfully used in several studies based on photographs (Frey, 1981; Anderson, 1978; Hammit, 1978; R. Kaplan, 1977). It is a nonmetric, factor analytic method which focuses on the relative magnitudes of the correlations instead of their precise numeric value. The analysis was based on the students' preference ratings because of the larger sample size for this group. If both groups had been used, the smaller environmental educator sample would not have been weighted properly.

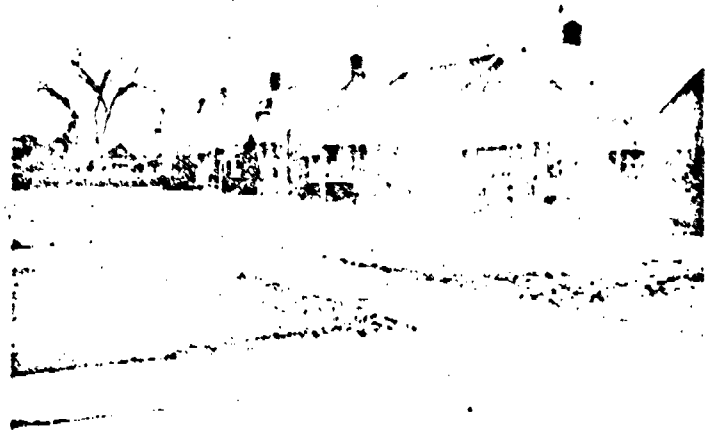
The SSA-III procedure yielded eight usable patterns which accounted for thirty-seven of the fifty-six photographs used in the study. The criteria used to construct the patterns were:

1) the scenes must have a loading of .42 or greater,
2) the scene must not load on another pattern at .42 or greater,
3) a pattern must consist of at least two scenes,
4) the pattern must be explainable (R. Kaplan, 1974).

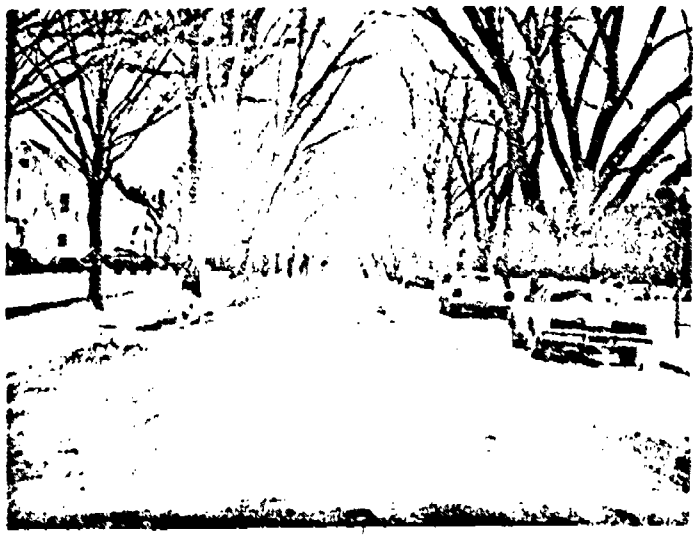
I named each pattern according to the dominant theme it represented. Three patterns were housing-related (Multiple-family Housing, Single-family Housing, Tree-lined Streets), and five dealt with other aspects of the urban environment (Urban Parks, Urban Mobility, Retail City, Industrial/Factory Sites, Run-down Urban). Selected pattern scenes are depicted in Figure 1. These patterns serve as the basis for the analysis which follows. The findings are based on t-test comparisons between



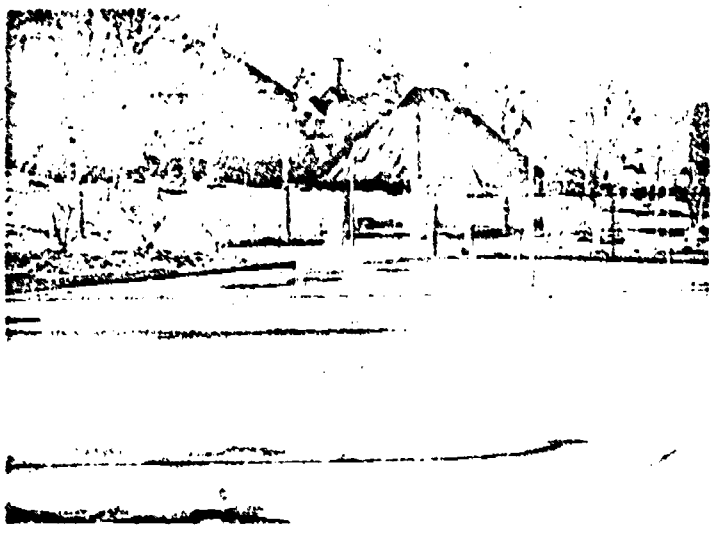
Multiple-family Housing



Single-family Housing

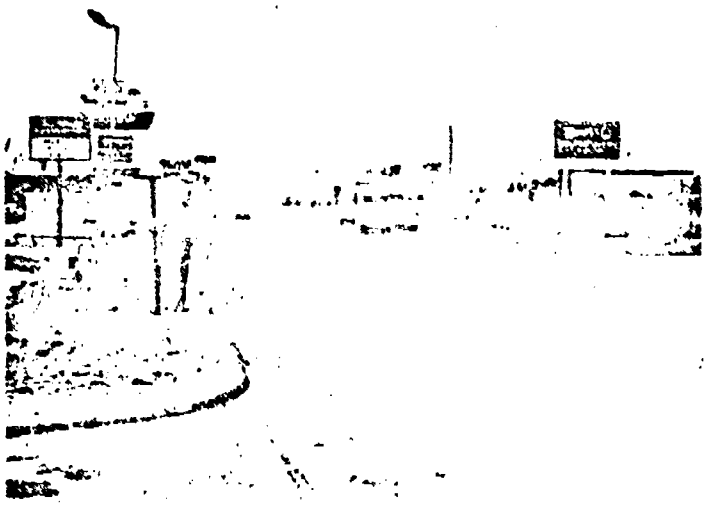


Tree-lined Streets



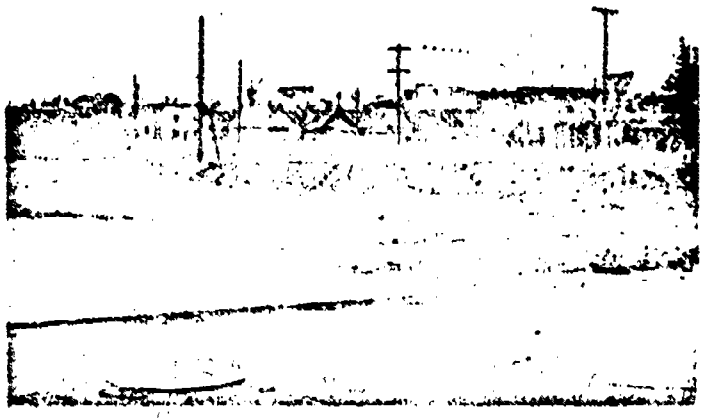
Urban Parks

Figure 1
Selected Pattern Scenes



Urban Mobility

Retail City



Industrial/Factory Sites

Run-down Urban

Figure 1 - Continued

students' and environmental educators' mean familiarity and mean preference ratings for each pattern.

Results

Familiarity and preference will be discussed, followed by an analysis of their relationships to each other.

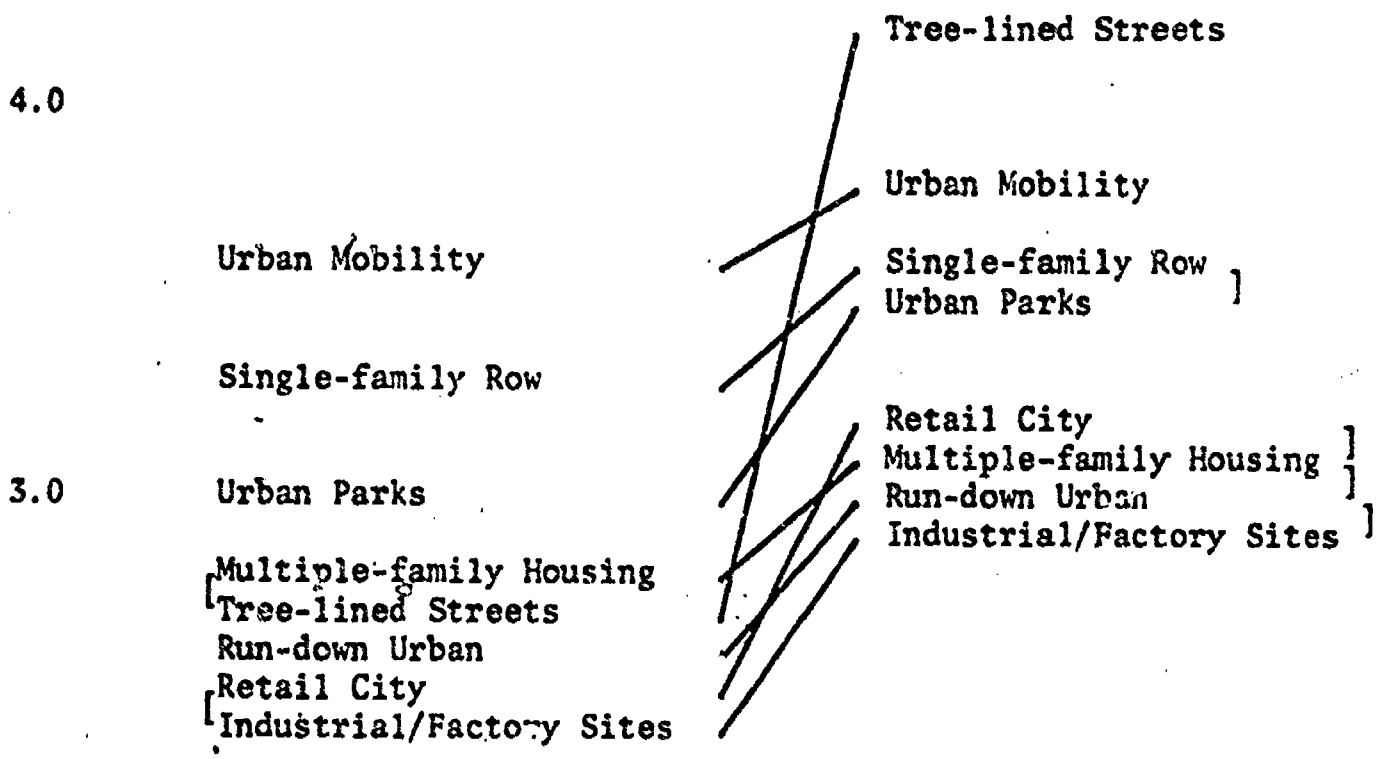
Familiarity: Students' and environmental educators' familiarity ratings differed strikingly from each other. The students rated all patterns as significantly less familiar than did the environmental educators (Figure 2 and Table 1).

Table 1
Comparison of Students' and Environmental Educators' Familiarity Ratings for Patterns

Patterns	Mean Ratings		P <.05=* <.01=**
	Students'	Env.Ed's.	
Urban Mobility	3.6	3.9	*
Single-family Row	3.3	3.6	**
Urban Parks	3.0	3.6	**
Multiple-family	2.8	3.2	**
Tree-lined Streets	2.7	4:2	**
Run-down Urban	2.7	3.1	**
Retail City	2.5	3.2	**
Industrial/ Factory Sites	2.4	3.0	**

Students' consistently lower familiarity with the patterns, when compared to the environmental educators, is a surprise. Their lower rating was not expected because over sixty percent of the photographs were from Detroit. This should have given students the home advantage. In addition, only fourteen percent of the environmental educators lived in large cities and only two lived in Detroit. Several factors seem to have outweighed any advantage students might have had.

The first is environmental educators' longer life experience. Their ages ranged from 20 through 70, whereas most of the students were 12 through 14. Second, over half of the environmental educators had had some experience living in large cities. Students' experience was limited primarily to Detroit, and in many cases probably only to their immediate neighborhood.



[,] = Difference between ratings is not significant.

Figure 2
Students' and Environmental Educators' Rank Order for Pattern Familiarity

Lack of mobility, and parental concerns with safety probably prevent these students from knowing more of their city.

The order of familiarity for the patterns also varied for the two groups. Students and environmental educators differed most in their ranking of Tree-lined Streets and Retail City. The Tree-lined Streets pattern is typical of small towns and older, residential neighborhoods in large cities of the East and Midwest. In cities, however, such areas are often associated with moderate-to-high income levels. The Retail City pattern depicts two New York City scenes. Such places are not common in Detroit. This would account for students' much lower rating of these two patterns when compared to the environmental educators. If Tree-lined Streets and Retail City are removed, the order of familiarity for the remaining patterns is similar. This indicates that students and environmental educators tend to be familiar with the same kind of urban places. Students, however, have less experience than the environmental educators with such places.

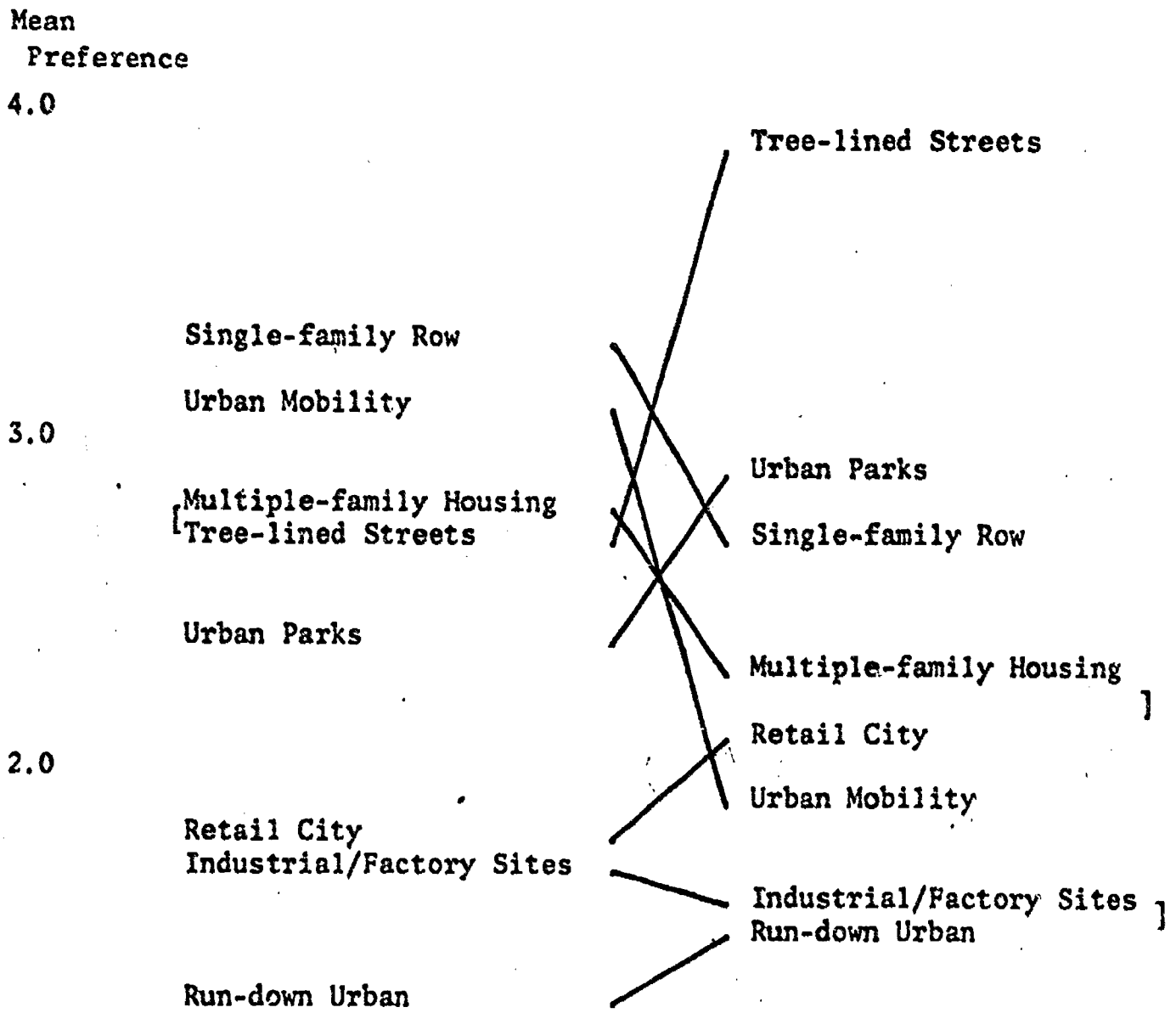
Preference: Major differences existed between students' and environmental educators' preference for the urban residential patterns. The two groups differed significantly on seven of the eight patterns (Figure 3 and Table 2).

Table 2

Comparison of Students' and Environmental Educators' Preference Ratings for Patterns

Patterns	Mean Ratings		P <.05=* <.01=**
	Students'	Env.Eds'.	
Single-family Row	3.3	2.7	**
Urban Mobility	3.1	1.9	**
Multiple-family	2.8	2.3	**
Tree-lined Streets	2.7	3.8	**
Urban Parks	2.4	2.9	**
Retail City	1.8	2.1	*
Industrial/Factory Sites	1.7	1.6	N.S.
Run-down Urban	1.3	1.6	**

Three patterns, Single-family Row Housing, Urban Mobility, and Multiple-family Housing were more preferred by the students than the environmental educators. The environmental educators rated four patterns higher than the students (Tree-lined Streets, Urban Parks, Retail City, and



[,] = Difference between ratings is not significant.

Figure 3
Students' and Environmental Educators' Rank
Order for Pattern Preferences

Run-down Urban). Only the Industrial/Factory Sites pattern was rated similarly by both groups.

Students' and environmental educators' order of preference for the patterns were also distinct. The two groups seem to agree only on what they did not like. Both students and environmental educators rated Industrial/Factory Sites and Run-down Urban as their least preferred patterns. What the two groups liked about the urban environment bore little resemblance to each other. Students' most preferred patterns were much more "urban." These patterns were characterized by high housing density, unobstructed open spaces, few trees, and opportunities for travel and activity. Environmental educators' most preferred patterns more "natural." These patterns were characterized by low housing density, lots of trees, and small open spaces. These differences are best exemplified by the Tree-lined Streets and Urban Mobility patterns. These two patterns were rated in dramatically different ways by both groups.

It is noteworthy how students and environmental educators differed in their preference ratings of the Urban Parks pattern. Environmental educators liked the Urban Parks pattern significantly more than did the students. For environmental educators, Urban Parks was their second most preferred pattern. Students rated four other patterns higher in preference. This is significant since parks are often designed for children. It seems, however, that the students find other parts of the urban environment, i.e., those designed for adults, much more appealing. What planners think children want does not seem to be what they prefer, at least in middle-school. As the Michelsons (1980) point out:

> ...any particular kind of space typically provided for children, like a playground, is likely to be appropriate for children of only a limited age range, being too advanced for younger children, while too elementary for teenagers.

Familiarity/Preference Relationship: Students had a positive familiarity/preference correlation for each of the patterns. Only one pattern (Tree-lined Streets), however, had a correlation over .40. Environmental educators' familiarity/preference correlations were also positive except for Urban Mobility. This pattern had a slightly negative correlation (-.05) which was not statistically significant. Environmental educators had three patterns (Tree-lined Streets, Urban Parks, and Single-family Row Housing) with correlations over .40. (the highest of any of these correlations for environmental educators or students was .48.)

The small number of patterns (only eight) make the use of a familiarity/preference correlation statistic between patterns unreliable. But Figures 4 and 5 help explain the relationship between the two variables. The environmental educators' pattern plot (Figure 4) reveals that a regression-like line can be drawn. This line connects seven of the patterns from low to high familiarity/preference. Only the Urban Mobility pattern does not fit this line. For students, the relationship is more

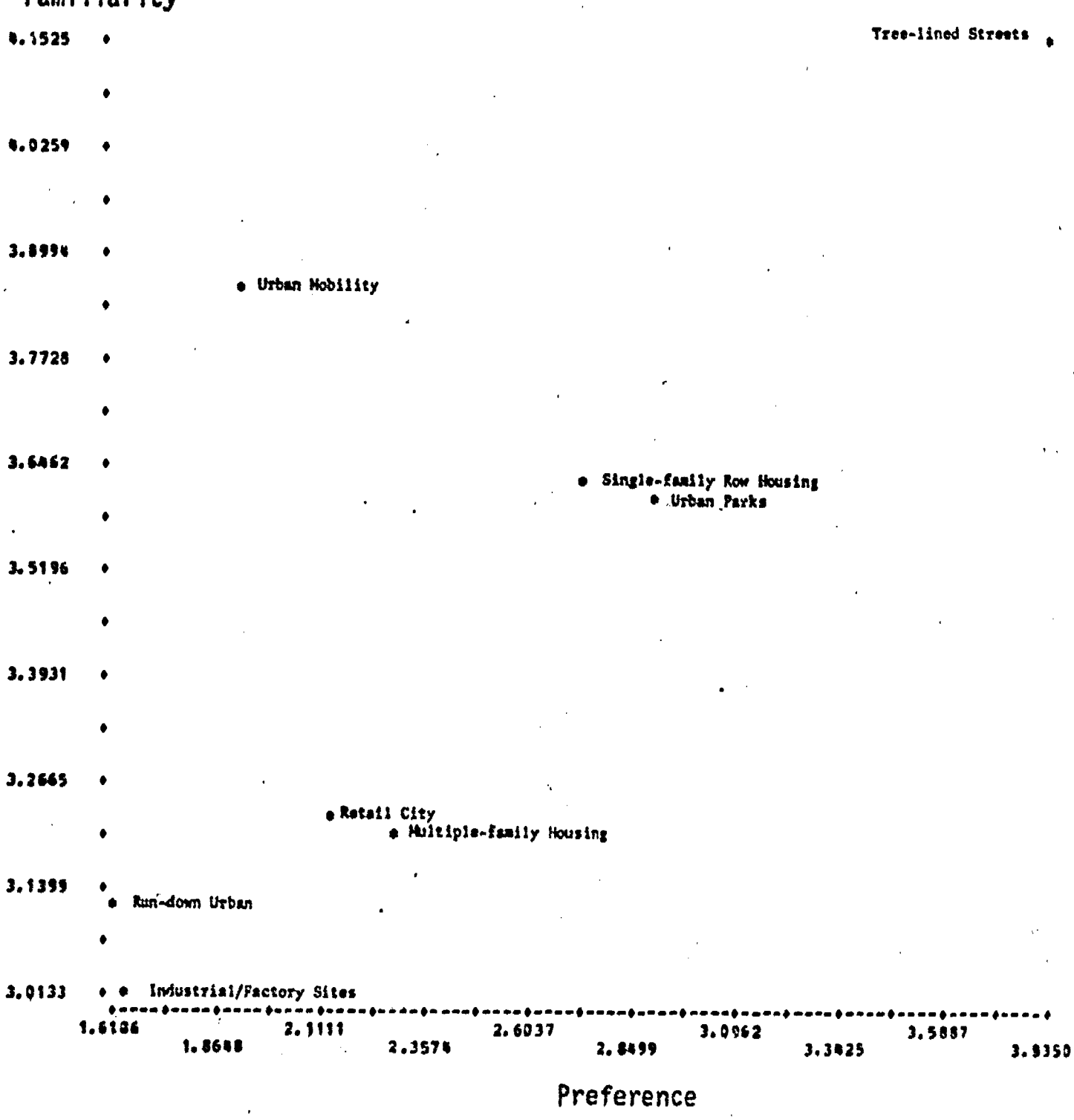


Figure 4
Relationship between Mean Familiarity and Mean Preference Ratings for Patterns: Environmental Educator Sample

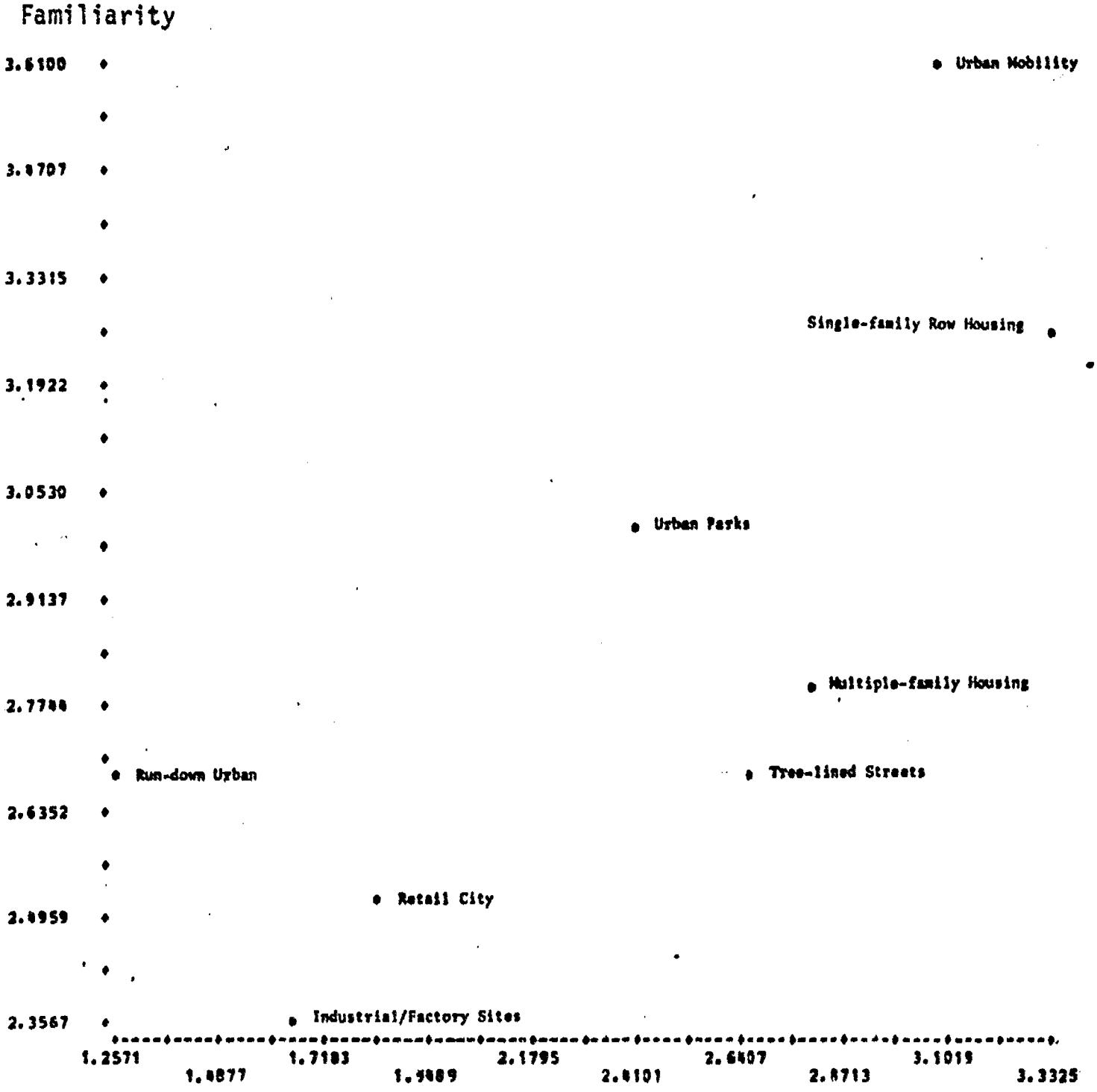


Figure 5
Relationship between Mean Familiarity and Mean Preference Ratings for Patterns: Student Sample

complex (Figure 5). Their patterns fall along two major axes from low to high familiarity/preference. One regression-like line connects Industrial/Factory Sites, Retail City, Urban Parks, and Urban Mobility. A second line, shifted towards higher preference, connects the three housing-related patterns (Tree-lined Streets, Multiple-family Housing, and Single-family Row Housing). These two lines are approximately parallel to each other and account for all the patterns except Run-down Urban.

These results suggest that, for both students and enviromental educators, the familiarity/preference relationship is positive and linear. The more familiar a pattern is, the more preferred it is likely to be. This relationship is especially strong for environmental educators. For students the relationship is less clear. They seem to divide the urban environment into two parts. One part is the home environment, the second is "everything else." This breakdown is understandable when one considers the importance of the home environment to children. Up through age 12, most of children's play activity is carried on in their immediate residential environment (Verwer, 1980). It is a place where they have more control over their behavior and they know how to function within it (Churchman, 1980). It is, in a sense, their world. The students in this study are probably just beginning to extend their activities beyond the home environment. It seems reasonable, therefore, that the students rated the housing patterns as more preferred than the other patterns of the urban environment with similar levels of familiarity. This is not to suggest that the home environment is any less important to environmental educators. But rather, as one grows older, other parts of the enviroment increase in significance.

Two patterns, Urban Mobility for environmental educators and Run-down Urban for students, require further exploration. In both cases the patterns were rated low in preference relative to their familiarity rating by the respective samples. These ratings deviate from the familiarity/preference relationship described above. For environmental educators the difference is large, for students it is less so. Why did environmental educators and students respond differently in these two cases?

It may be that the two groups perceived restricted opportunities for involvement in each of the patterns. For environmental educators, Urban Mobility may offer few challenges. If anything, they probably find it frustrating. The prospects of driving, shopping at the mall, and eating at fast food restaurants has more than likely lost any appeal it may have had for them. There is nothing to "figure out" in such places. They are too predictable, routine, and monotonous. Since the promise of new information with greater familiarity is missing, preference remains low despite increased exposure. It is important to note that for students this is not the case with the Urban Mobility pattern. For them it offers almost unlimited new information.

In contrast, Run-down Urban offers students few opportunities for involvement. Several factors seem to contribute to low involvement in this

pattern. One is that several of the scenes depict blocked-off areas. Two scenes (one a junk car lot, the other a vacant lot) are fenced-in. This makes further movement into the scene difficult. Two other scenes depict alleys. They suggest limited lateral movement into adjoining lots. The result is a linear pathway which offers few opportunities for activity. Involvement in some of these scenes may also be limited because they are forbidden places. One scene, depicting railroad tracks, may be viewed as dangerous simply because it is unfamiliar.

In both cases the level of involvement perceived in a pattern seems to mediate the impact of familiarity on preference. If the opportunities for involvement are low or limited, increased familiarity with the scene does not seem to increase preference. But if sufficient opportunities for involvement are present, greater familiarity suggests greater preference.

The results of this study clearly indicate the importance of the home environment in children's lives. These are the places children know and care about. As such, the home environment is a place where environmental education could effectively connect with the child's world. This is also true of environments high in involvement, such as represented by the Urban Mobility pattern.

Discussion

On one level the data in this study suggest that children prefer more urbanized, developed areas while environmental educators prefer more "natural" places. While this is true, one must search more deeply for the meaning of these results. The important issue is not so much what the groups like or dislike, but rather why certain places are preferred over others.

Information processing theory suggests that children prefer places such as Urban Mobility because such places provide for their needs. Middle-school children are testing and extending their cognition of environment. The things which are important to them are those which relate to functioning in their everyday world. In this regard, the absence of vegetation in Urban Mobility is much less important to children than it seems to be for environmental educators. At what stage vegetation begins to play a greater role in children's preference is an interesting research question.

Since environmental educators and children exhibit such divergent perceptions of the environment, it makes sense that environmental educators take the time to determine children's environmental perceptions. Otherwise, environmental educators will only be imposing their own limited values about environment. In doing so, they will fail to address children's environmental concerns.

The data suggest that the more familiar children are with an environment, the more it will be preferred. This is a strong argument for continuing

to expose children to the "natural" environment. This may seem contradictory to my earlier statement emphasizing the use of the immediate environment in children's environmental education programs. It is not, however, a question of one or the other; both are necessary. Both must be linked, if an understandig of the total environment is to be achieved. Because of the importance of the immediate environment in children's lives, it is an excellent point from which to begin exploring the world in which they live.

Children's level of familiarity with the environment may be used as a cue to the environments they prefer. It should, however, be used with caution. As the data indicate, not all environments rated high in familiarity were rated high in preference. One must remember the important role that involvement plays in children's preference. High familiarity may also result from the lack of better choices. It would be a mistake to assume that such places are necessarily preferred environments.

The results of this study have implications for other environmental professionals such as architects, urban planners, and recreation managers. Law-makers and city officials should also take heed. Since adult perceptions of the environment are different from children's, their attempts to plan for children's needs are likely to be deficient. (Note students' lower preference for the Urban Parks pattern.) Only by involving children in the planning process can they hope to come closer to meeting children's environmental needs. The use of visual data-gathering techniques, such as the one used in this study, can be an effective way of involving children in the planning process.

Environmental educators can make a valuable contribution in this regard. First, they can argue for the importance of involving children in environmental planning. Second, they can conduct research to determine children's environmental needs. Third, they can make such information available to other environmental professionals. Fourth, they can educate and lobby for the changes necessary to make the urban environment a better place in which to live.

Endnotes

[2]Moore and Golledge (1976) state: ..."environmental cognition refers to the awareness, images, information, impressions, and beliefs that individuals and groups have about the elemental, structural, functional, and symbolic aspects of real and imagined physical, social, cultural, economic, and political environments."

[3]One instrument was returned because of improper address, the second was returned uncompleted.

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A Study of the Relationship between Information and Attitude for Users and Non-Users of Computerized Water Resource Management Simulation

Terence J. Mills[1]

Abstract: *The Water Resources Management Simulator (WRMS), a multi-user interactive computer simulator, is designed to improve understanding of the major factors involved in intelligent management of water resources. The WRMS offers a visual model of hydrologic information and provides up to 30 participants at one time the opportunity to develop and evaluate water management strategies. The purpose of this study was to identify differences in knowledge and attitude between a total of 866 13- to 18-year old and adult WRMS users and non-users.*

The WRMS proved to be an effective (1) water information dissemination tool, particularly at the senior high school and adult levels, and (2) a method of increasing concern for water issues particularly with 16- to 18-year old high school students. Correlation between knowledge and attitude scores was generally positive for all students and negative for all adults. The ability of WRMS treatment to significantly increase adult knowledge, the initial high adult attitude scores and negative correlation between adult knowledge and attitude suggest that the WRMS may moderate extremely high levels of adult concern for water issues.

The application of the Water Resource Management Simulator as a public education tool has great potential. The simulator's ability to increase knowledge and low levels of concern for water issues before actual confrontation with major water problems makes it a valuable asset in the public education arena.

A U.S. Water Resources Council Study of U.S. water supplies identified water resources as the nation's most serious long-range problem (Sheets, 1981). Numerous articles in the popular press and TV specials reflect high public interest as well as indicate the magnitude of water resource problems. Public interest in environmental issues has been shown to represent a major and enduring social concern; however, public knowledge of issues is distressingly low (Council on Environmental Quality, 1980). A study of the water knowledge possessed by 160 university-bound high school graduates also revealed a distressingly low knowledge level (Mills, 1983). High school graduates possessed limited water knowledge particularly in the areas of (a) current issues; (b) water.resource management; and (c) the historical influence of water on human affairs. Students scored higher in

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areas concerning the (a) water cycle; (b) physical and chemical properties of water; and (c) the physical effects of water on the earth. It can be argued that these recent high school graduates scored higher in content areas commonly taught in the public schools while scoring lower in areas seldom taught. Water resource management was identified as one such content area.

A number of professional organizations are addressing the problem of how, when, what and whom to teach about water. One of the objectives of the Water Resources Education Project (Amend and Arnold, 1983) is the application of computer technology to the complex problem of water resource education.

Computerized instruction is commonly found in one of three forms: (a) drill and practice; (b) tutorial; or (c) simulation (Electronic Learning, 1982). Of the three forms, only simulation has the potential for creating interaction with functioning models of real phenomena. McLean (1973) defines simulation as an "operating model of the real world made up of selected sets of interrelationships that reduce complex problems to manageable size for instructional purposes." The use of computer simulation for complex environmental problems has great potential. It is uniquely suited to environmental education because it can (a) speed up or slow down time; (b) employ expensive or unavailable materials and procedures; (c) act to select random phenomena objectively; (d) provide active participation and input by the learner; (e) provide immediate feedback; (f) reduce complex problems to manageable size; (g) create problem situations where processes and concepts from many disciplines are interrelated in the search for solutions; and (h) allow exploration of alternatives without having to live with harmful consequences (Noonan, 1981; Disinger, 1982).

A current drawback of computer simulation is that participation is limited to one or a few persons at any one time. A critical ingredient of environmental education is missing. Group interaction in clarifying problems, considering alternatives and trade-offs, decision-making and cooperative action so necessary in environmental problem solving is slighted. A multi-user interactive computer simulation (MICS) solves this problem by providing input from a number of participants at one time, summarizing interactions and sharing results simultaneously with all participants. In addition to simultaneous group interaction, a MICS models situations where relevant environmental concepts and issues are considered objectively in the absence of excessive emotional bias common to local site-specific water issues. Emotional involvement is present but not to the extent that it interferes with consideration of rational alternatives!

The Water Resources Management Simulator (WRMS), a multi-user interactive computer, is designed to improve understanding of the major factors involved in intelligent management of water resources. The WRMS offers a visual model of hydrologic information and provides up to 30 participants the opportunity to develop and evaluate water management strategies. The

WRMS models four problem areas common to river basins: (a) source and quantity; (b) use of water; (c) quality; and (d) political management of the water resource. The WRMS operator can choose to model any one of nine different river basins.

A large simulator panel (Figure 1) placed in view of the audience is programmed to display snow pack and instream flow based on actual USGS data for the basin being modeled.

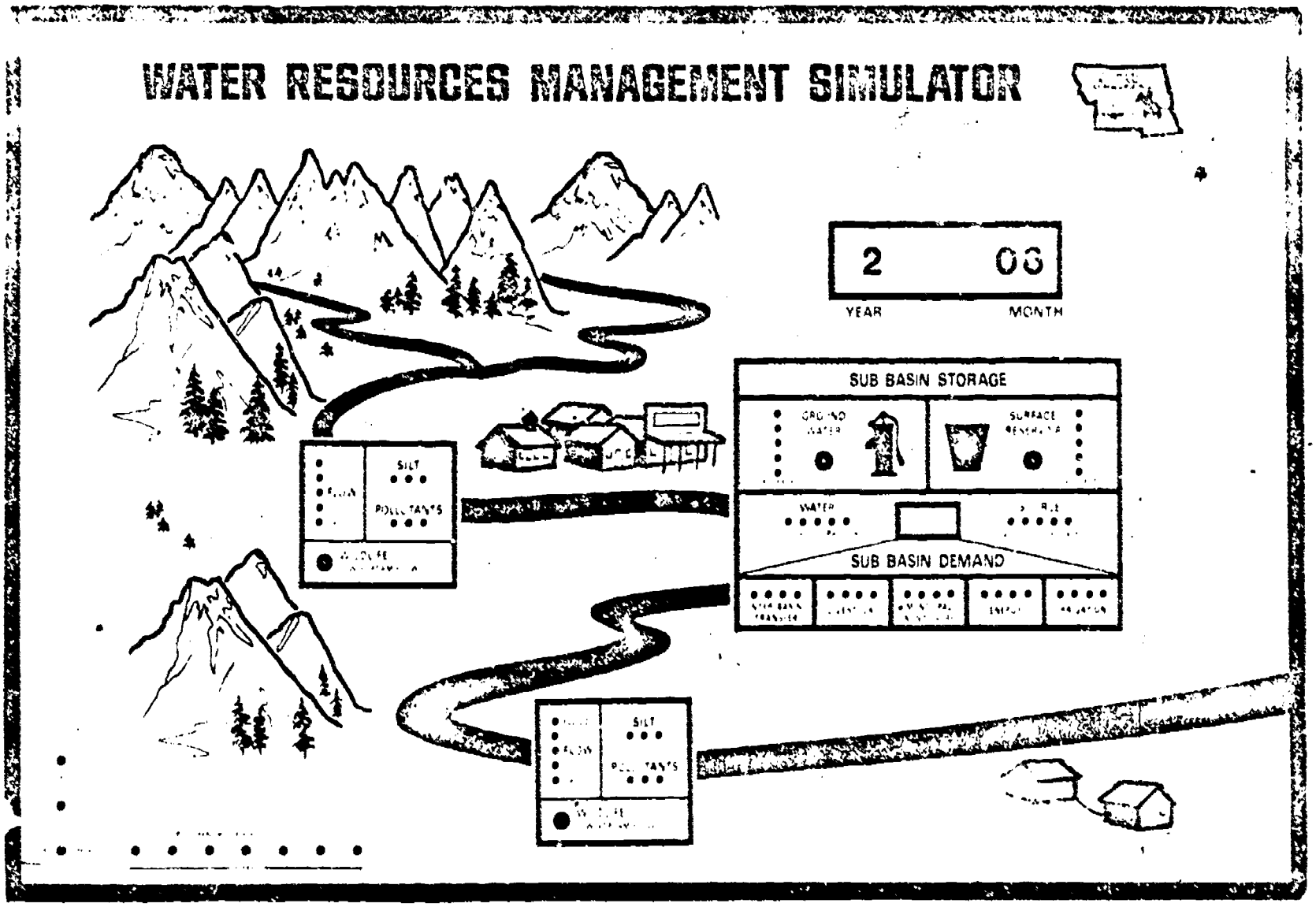

Figure 1: Water Resources Management Simulator

Instream flow and water quality (silt and dissolved solids) are monitored by visual up- and downstream LED (Light Emitting Diode) displays. Flashing lights indicate serious low water or flood conditions. The Sub Basin Storage and Demand displays show current ground and surface water reserves, and the relative demand by users. Horizontal LED's indicate the proportion of ground or surface water used and the proportion of water consumed or returned to the stream. A clock in the upper right hand corner displays accelerated time in months and years.

The simulator is operated by participants using several small control consoles (Figure 2).

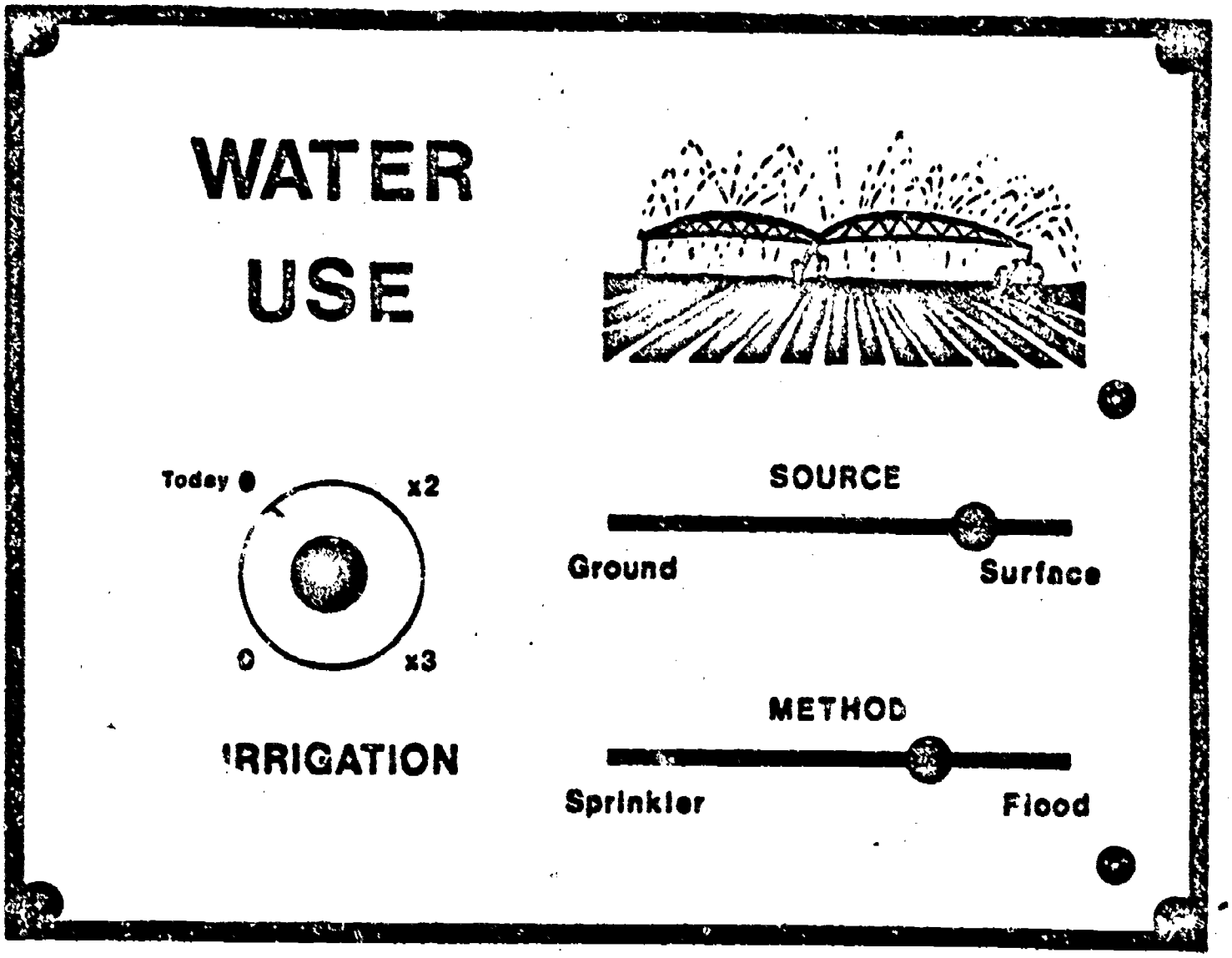

Figure 2: Control Console for Irrigation

Water management decisions regarding impoundment, demand, surface or ground source, technology applied to water use, and treatment of used water are made with controls on the consoles. Consoles allow participant input to the large display panel in four water use categories: (a) irrigation; (b) livestock; (c) municipal and industrial; and (d) energy. A fifth console provides for the creation and management of a reservoir. The hydrologic situation and user input are summarized and displayed on the main panel, providing the audience with the consequences of various user management practices. As the simulation operates, important data such as monthly instream flow, ground and surface water reserves and total demand are presented as a video color graphics display. In addition, these data are stored in memory and can be retrieved by manual or video display graph plotting.

The participants in a simulation may interact with the river basin model at any time, changing variables to optimize their situation. Supply/demand, pollution, applied technology, or other issues may be discussed, new

management strategies planned and another simulation initiated to test these newly developed strategies. A major attribute of the WRMS is its ability to place groups of people in policy-making situations involving real variables and alternatives, and to present within reasonable time the probable consequences of their various water management strategies.

Using an MICS format similar to that of the WRMS but related to energy resources, Dunlap (1979) studied the effect of simulation on inservice teacher energy-related attitudes. He found elementary teachers' attitudes changed the greatest and secondary teachers the least. Dunlap suggested that a lack of initial awareness of the issues may have resulted in a greater attitudinal shift in the elementary teacher population. Cartwright and Heikkinen (1981), also using the energy-environment simulator, studied its effect on the energy concepts and attitudes of college students at various levels of cognitive development. The energy-environment simulator was found to be more effective than a slide presentation covering the same concepts, and students at lower stages of cognitive development learned almost as much as the more cognitively mature students. However, the treatment did not significantly alter subjects' attitudes toward energy or energy-related issues. Using computer-simulated experiments in college chemistry courses, Cavin and Lagowski (1978) found students in the computer simulation groups generally achieved as well or better than students in regular laboratory groups. They also suggested there was evidence to support use of computer-simulated experiments with low- as well as high-aptitude students.

The development of educational computer simulation is in its infancy and although the number of available simulations is rapidly increasing, the analysis of computer simulation experiences and related research base is not extensive (Moursond, 1981). The intent of this study was to create base line data concerning the potential of interactive computer simulation for public information dissemination and attitude development in water resource management.

Objective

The major purpose of this study was to identify the effects of a multi-user computerized water resource management simulation (WRMS) on the water resource knowledge and attitude of 13- to 18-year-old and adult subjects. Using the WRMS treatment, Water Resource Management Assessment Test, and Water Concern Scale, the following null hypotheses were tested:

There is no significant difference between WRMS users' and non-users':

- mean knowledge scores for 13- to 15-year old, and 16- to 18-year-old subjects and adults;
- mean attitude scores for 13- to 15-year old, and 16- to 18-year-old subjects and adults;
- response on individual attitude test items by group.

In addition, the study examined the differences between 13- to 18-year-old and adult subject's scores for knowledge and attitude, and the correlation between knowledge and attitude scores for 13- to 18-year-old subjects and adults.

Method

The WRMS knowledge test was developed directly from the stated objectives for the simulator following critique of the objectives by over 60 science educators and water specialists. Test items were reviewed by two environmental science specialists and the content validity found to be satisfactory. The Cronbach Alpha reliability coefficient for the 25 water resource management knowledge questions was .87. Eighteen multiple choice and 7 true/false questions were included. Each question was given a one-point value. Thus, a perfect score is 25.

Attitude toward water resources was determined by administering the Water Concerns Scale. Watkins (1974), using factor analysis of interview data, isolated five questions which measured attitude regarding concern for water resources. The five items make up the Water Concern Scale (Appendix B). Subjects responded to each item by indicating their choice of strongly agree, agree, undecided, disagree, and strongly disagree. The Likert-type staements were weighted on a scale of 1 to 5, with 5 indicating a greater concern for water resources. Responses totaling 25 indicated the highest possible level of concern.

The population studied included 866 subjects ranging in age from 13 years to adult. Thirteen to eighteen-year-old subjects were given WRMS treatment as part of their junior or senior high school classes. Approximately 50% of the students at a particular grade in each school system were assigned to the WRMS treatment group and 50% to the control group. Approximately 200 adults participated with one-half receiving treatment prior to testing. Adult groups represented were teachers, League of Women Voters, Corps of Engineers, Sierra Club, and political science graduate students.

Each of the 1 1/2-hour WRMS training sessions was presented by a trained coordinator. Each coordinator followed a specific outline. All sessions used the same slide presentation introducing (a) simulation; (b) simulation variables controlled by users; and (c) data displayed on the main simulator panel. In addition to the session outline, the slide presentation assisted in keeping presentations uniform.

Findings

Table 1 compares mean knowledge scores of WRMS users and non-users by group. The junior high (age 13-14-15) and senior high (age 16-17-18) subjects not receiving WRMS treatment show lower mean scores than adults, as might be expected. Senior high and adult groups receiving WRMS instruction scored significantly higher than the control group. For 16- to 18-year-old and adult subjects, null hypothesis 1 was rejected!

Table 1

t-Test Comparison of User with Non-user WRMS Knowledge Scores for Junior High, Senior High, and Adult Groups

Source		N	$\bar{x}$	SD	Degrees of Freedom	t	P	Range Correct Respon.
Grade 7,8,9	Non-User	238	9.60	3.26	483	0.192	0.100	2-18
	User	255	9.70	3.14	281			3-18
Grade 10,11,12	Non-User	103	9.86	3.32	248	4.69	0.0001*	1-18
	User	147	12.39	5.19	246			2-22
Adult	Non-user	102	14.14	3.12	194.0	5.52	0.0001*	4-23
	User	94	16.46	2.71	193.4			10-24

*Significant Dif.

Table 2 compares mean attitude scores of WRMS users and non-users by group. No significant differences existed between 7-9th grade and adult users and non-users of the WRMS, although a slight mean increase is evident. High school students using the WRMS exhibited a significantly higher attitude toward water issues. For high school students (16- to 18-year-old subjects) null hypothesis 2 was rejected!

To determine if a significant difference in knowledge and attitude exists between student and adult users and non-users, t-test comparisons were made. Tables 3 and 4 summarize this information.

Table 2

Attitude t-Test Comparison of WRMS User and Non-user Mean Scores for Junior High, Senior High and Adult Groups

Source		N	$\bar{x}$	SD	t	P
Grade 7,8,9	Non-User	141	15.4	2.89	.46	0.64
	User	255	15.6	2.88		
Grade 10,11,12	Non-User	102	15.3	2.64	2.16	0.03*
	User	147	16.19	3.05		
Adult	Non-user	115	17.91	2.27	.40	0.68
	User	102	18.05	2.96		

*Significant at the .05 level of confidence

Table 3

t-Test Comparison of Adult and Student WRMS User and Non-users Knowledge Scores

Source		N	$\bar{x}$	SD	t	P
Users	Student	403	10.67	4.21	16.52	0.0001*
	Adult	94	16.46	2.71		
Non-Users	Student	247	9.69	3.3	11.5	0.0001*
	Adult	102	14.14	3.1		

*Significant at the .05 level of confidence

Table 4

t-Test Comparison of Adult and Student
WRMS User and Non-user Attitude Scores

	Source	N	$\bar{x}$	SD	d.f.	t	P
User	Student	402	15.8	2.9	502	6.8	.0001*
	Adult	102	18.05	2.9	156		
Non-User	Student	247	15.34	3.02	360	8.9	.0001*
	Adult	115	17.9	2.2	288		

*Significant at the .05 level of confidence

As might be expected, adults (WRMS non-users) initially knew more and had higher concern for water issues than did students. This relationship also existed between adults and students receiving WRMS treatment. Both adult and student mean knowledge and attitude scores increased with WRMS treatment but adult scores remained significantly higher than students. A notable exception existed between attitude scores of twelfth grade and adult users and non-users. Table 5 shows summary by item repsonse frequencies and x^2 values comparing adults and twelfth graders. Significant differences existed favoring adults over student WRMS non-users, however, those twelfth graders and adults using the WRMS showed no significant difference on any of the five items. The WRMS treatment appears to moderate the differences between 18 year old subjects and adults.

To determine the relationship existing between knowledge and attitude scores, Pearson correlation coefficients were determined for all students and adults studied. Table 6 shows correlation coefficients for students by grade.

Table 5 Chi Square Values and Summary Attitude Response Frequencies by Item for Adult and Twelfth Grade Users and Non-users

Item		WRMS Users %		Chi-Square		WRMS Non-users %		Chi-Square	
		Agree & St. Agree	Disagree & St. Disag.	x^2	P	Agree & St. Agree	Disagree & St. Disag.	x^2	P
1.	Adult	86.1	13.86	0.32	0.56	74.1	25.8	1.5	0.21
	12th grade	89.7	10.2			86.3	13.6		
2.	Adult	79.7	20.2	2.35	0.12	35.2	64.71	4.9	0.02*
	12th grade	66.6	33.3			64.1	35.8		
3.	Adult	21.2	78.7	0.04	0.83	16.98	83.0	7.0	0.007*
	12th grade	22.8	77.1			41.6	58.3		
4.	Adult	22.45	77.5	0.08	0.76	11.7	88.2	4.3	0.03*
	12th grade	25.0	75.0			31.25	68.7		
5.	Adult	94.17	5.83	0.01	0.89	95.6	4.3	4.3	0.47
	12th grade	94.74	5.26			92.3	7.6		

Table 6

Correlation Between Knowledge and
Attitude Scores for Students by Grade

Source	N	Pearson	Level of Significance	Mean Attitude
7th	115	.114	.12	15.29
8th	222	.182	.006*	15.81
9th	59	.345	.007*	15.71
10th	130	.294	.0007*	15.71
11th	48	.037	.800	15.89
12th	71	.452	.0001*	16.04

*Significant at >.05 level

A positive correlation existed between knowledge and attitude for students in grades 8, 9, 10 and 12. This relationship existed for 75% of the 13- to 18-year-old population. Table 7 describes correlation between knowledge and attitude for adults.

Table 7

Correlation Between Knowledge and
Attitude Scores of Adults

Source	N	Pearson	Level of Significance	Mean Attitude Score
Adults	203	-0.119*	0.09	18.01

*Not significant

Table 8 Summary of t-test Comparison of WRMS User with Non-user Attitude Scores by Students Grade

Question	Source	Group 7th $\bar{x}$	7th t	8th $\bar{x}$	8th t	9th $\bar{x}$	9th t	10th $\bar{x}$	10th t	11th $\bar{x}$	11th t	12th $\bar{x}$	12th t
(26) We really haven't thought about cutting down our use of water.	User	2.3	-.044	2.6	2.4*	2.5	.18	2.5	0.63	2.8	-0.29	1.6	-2.8*
	Non	2.5		2.3		2.5		2.4		2.9		2.2	
(27) Water reclaimed from waste is as good as any other water.	User	2.8	0.01	3.0	1.9*	3.3	3.0*	3.0	1.5	3.0	0.17	3.8	3.7*
	Non	2.8		2.7		2.5		2.7		2.9		2.8	
(28) Mankind has a right to free and unlimited use of water.	User	3.1	-1.5	3.3	-0.6	2.9	1.0	3.0	0.39	3.0	0.80	3.1	1.6
	Non	3.7		3.3		2.9		3.0		2.0		3.1	
(29) Nature has a way to solve supply problems before they get serious.	User	2.8	-1.8	3.0	-1.3	2.4	-2.0*	3.2	0.01	2.8	0.31	3.9	2.8*
	Non	3.5		3.1		3.0		3.2		2.7		3.2	
(30) It's the people who should do something about the water problem.	User	4.0	0.9	4.0	0.74	3.9	0.02	4.1	-0.17	3.8	-1.6	4.7	2.4*
	Non	3.7		3.9		4.9		4.1		4.3		4.2	

*Significant at .05 level of confidence

The relationship existing between knowledge and attitude for adults is not significant. It is of interest to note that at the .09 level of confidence a negative relationship exists. The more this population of adults knew, the less they tended to register concern for water issues. The mean attitude score for adults was relatively high.

Comparison of mean by item responses between WRMS users and non-users for the seventh through twelfth grade groups is shown in Table 8. Seventh, tenth and eleventh grade subjects using the WRMS compared with non-users showed no significant differences on any of the five attitude items. Significant differences existed in favor of ninth grade WRMS non-users on item 29 for twelfth grade non-users in two instances. A discernable pattern exists in that eighth, ninth and twelfth grade subjects using the WRMS tended to agree (high level of concern) with the statement "Water reclaimed from waste is as good as any other water." Twelfth graders appear to show a greater shift toward positive attitude than did other grades.

Summary of Results and Implications

There has been little research conducted in the application of interactive computer simulation to information dissemination and attitude shifts. The purpose of this study was to determine the effects of the WRMS, a multi-user interactive computer simulation, on the knowledge, attitude and their interrelationship for 13- to 18-year-old and adult subjects.

Comparison of 13- to 18-year-old subjects and adult WRMS users and non-users knowledge and attitude scores determined that:

A. 13- to 15-year-old WRMS users showed:
(1) higher levels of water resource management knowledge, and (2) higher levels of concern for water issues. For the total population of 14- and 15-year-old subjects, a significant positive correlation existed between knowledge and attitude scores.

B. 16- to 18-year-old WRMS users showed:
(1) Significantly higher levels of water resource management knowledge, and (2) significantly higher levels of concern toward water issues. For all 16- to 18-year-old subjects, a significant positive correlation existed between knowledge and attitude scores.

C. Adult WRMS users had a (1) significantly higher knowledge score, and (2) slightly higher level of concern for water issues. For all adult subjects, a slight negative correlation existed between knowledge and attitude scores at a 0.09 level of significance.

D. Adult mean knowledge and attitude scores were significantly higher than those of the total 13- to 18-year-old population; however, there was a trend for older students using the WRMS to approach adult attitude levels.

The WRMS is an effective water information dissemination tool, particularly at the senior high school and adult levels, and a method of increasing concern for water issues particularly with 16- to 18-year old high school students. Correlation between knowledge and attitude scores was generally positive for all students and negative for all adults. The ability of WRMS treatment to increase adult knowledge significantly, the initial high adult attitude scores and negative correlation between adult knowledge and attitude suggest that the WRMS may moderate extremely high levels of adult concern for water issues. The suggestion that the WRMS reduces extreme levels of concern for water issues is supported by Ramsey and Rickson's study (1976) of high school students' environmental knowledge and attitude. They found that high knowledge levels are related to moderate, as opposed to extreme, stands on pollution abatement. The potential of interaction with the WRMS being a moderator of extreme bias needs to be explored.

The application of the Water Resource Management Simulator as a public education tool has great potential. The simulator's ability to increase knowledge and concern for water issues prior to actual confrontation with water issues makes it a valuable asset in the public education arena. The current cost ($4500) inhibits widespread use; however, large school districts, and state and federal agencies, as well as universities, could make it available to a large segment of the general population.

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APPENDIX A: WATER RESOURCE MANAGEMENT KNOWLEDGE TEST

1. Water users can be divided into municipal, industrial, livestock, irrigation, and energy. Which of the following uses the most water?

   a. municipal/industrial
   b. industrial
   c. livestock
   d. irrigation
   e. not sure

2. Water in Oklahoma's rivers generally flows toward the

   a. Northeast
   b. Northwest
   c. Southeast
   d. Southwest
   e. not sure

3. A major aquifer in Oklahoma is the

   a. Perrniam
   b. Ogallala
   c. Nubian
   d. Hennessey Shale
   e. not sure

4. Water is used to cool coal and nuclear electrical energy generating plants. Which procedure uses the least amount of water?

   a. flow through in closed pipes
   b. evaporative cooling
   c. non-consumptive
   d. condensation cooling
   e. not sure

5. Water is used to cool coal and nuclear electrical energy generating plants. Which procedure returns the least water back to the surface reserve?

   a. flow through in closed pipes
   b. evaporative cooling
   c. non-consumptive
   d. condensation cooling
   e. not sure

6. Which of the following sewage treatment procedures returns the least polluted water back into the surface reserve?

   a. secondary
   b. flocculation
   c. primary
   d. tertiary
   e. not sure

7. Which of the following irrigation methods requires the least amount of water?

   a. sprinkler method
   b. percolation method
   c. flood method
   d. hydrologic
   e. not sure

8. Which of the following irrigation methods returns the most water back into the surface reserve?

   a. sprinkler
   b. percolation
   c. flood
   d. hydrologic
   e. not sure

9. Which would you consider the most feasible solution to Oklahoma's water problems?

   a. new sources of water
   b. new reservoirs and dams
   c. conservation
   d. drill more wells
   e. not sure

10. What percent of all water used in Oklahoma is used for irrigation purposes?

   a. 20%
   b. 50%
   c. 75%
   d. 90%
   e. not sure

11. "Dilution is the solution to pollution" means:

a. dilution reduces the amount of pollutant present
b. adding "clean" water reduces the concentration of pollutants
c. removal of pollutants from surface water
d. greater stream flow reduces the amount of pollutants
e. not sure

12. The greatest water pollutant in Oklahoma is:

a. salt
b. PCB's
c. silt
d. DDT
e. not sure

13. The most harmful consequence of little winter snowfall in the mountains is

a. snowmobiles are restricted to certain areas
b. it makes for poor skiing
c. wild game animals do not move from higher elevations to the lower elevations
d. spring snow melt and runoff will be insufficient
e. not sure

14. During which month of the year does irrigation in the Southwest demand the greater amount of water?

a. September
b. May
c. December
d. February
e. not sure

15. Most of the earth's water is stored in

a. precipitation and clouds
b. rivers and lakes
c. ground water and lakes
d. oceans and snowpack
e. not sure

TRUE OR FALSE (mark A for true, and B for false)

16. There are alternative forms of energy and water that we can develop to meet our needs.

17. The amount of ground and surface water available for use varies by geographic region.

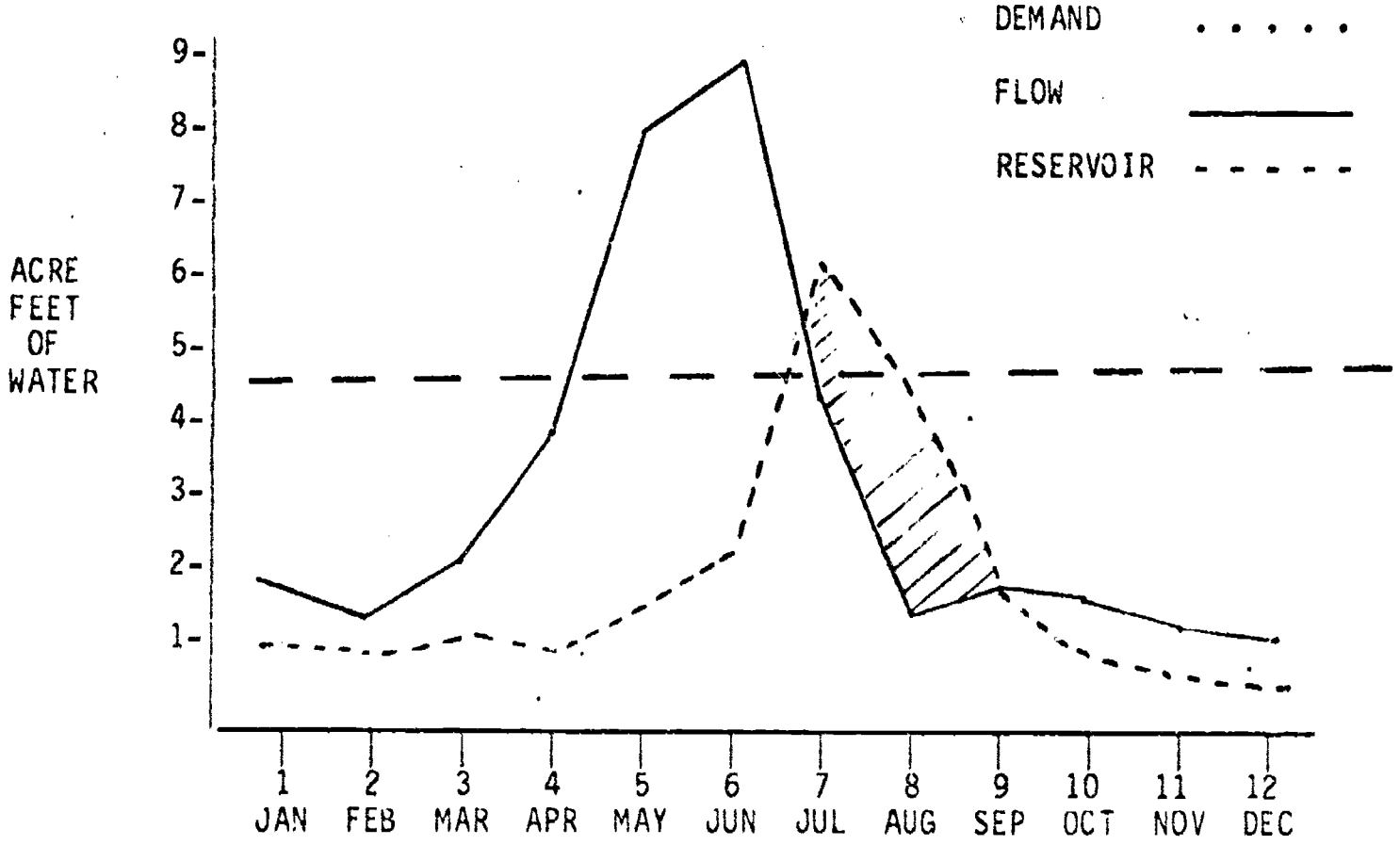
18. Where both ground and surface water are available to a community, the decision as to which will be used is made by the Oklahoma Water Resource Board.

19. We have little control over the amount of water available to us.

20. The demand for water by municipal, industrial, agricultural and energy users usually peaks at the same time stream-flow peaks.

21. The "life span" of a reservoir is related to the silt load carried in streams and rivers carrying water to the reservoir.

22. Water quality is subject to available technology, but the choice of technologies is made through public policy.



Use the graph above in answering Questions 23-25.

23. How is downstream water quality affected in the dry months of July, August, and September?

    a. remains the same
    b. lower concentration of pollutants
    c. higher concentration of pollutants
    d. less pollutants in August than in July
    e. not sure

24. The increased demand in July is probably due to

a. industrial users
b. municipal users
c. irrigation users
d. not sure

25. What action would you take to end the supply/demand problem July through September?

a. build a dam
b. initiate conservation practices
c. find new water supply sources
d. not sure

APPENDIX B: WATER CONCERNS SCALE

1. We really haven't thought about cutting down our use of water.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

2. Water reclaimed from waste is as good as any other water.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

3. Mankind has a right to free and unlimited use of water.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

4. Nature has a way to solve water problems before they get serious.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

5. It's the people who should do something about the water problem.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

The Impacts of Acidified Precipitation on Agricultural Crops

G. Harry Stopp, Jr.[1]

Abstract: *Acidified precipitation or "acid rain" is an increasingly important and critical environmental problem in the eastern United States. Sulfur and nitrogen compounds emitted from fossil fuel combustion combine with atmospheric moisture to form acids which fall to earth as low pH precipitation in rain or snow. The first evidence of large scale environmental damage from acidified precipitation in North America was reported in New England and eastern provinces of Canada. Lakes, streams and forests were suffering significantly from low pH precipitation. The problems, most spectacularly demonstrated in Nova Scotia and the Adirondack region of New York, have become part of public knowledge and now form a basis for public environmental policy. Current research indicates that acidified precipitation can also damage agricultural plants, with higher precipitation pH levels than is required to affect water or forest resources. The effects on crops can be direct, by contact with leaves or fruit, or indirect, by changing the pH and chemistry of the soil and soil moisture. The latter may be more long-lasting and critical than the former; damaged crops can be replanted but acidified soil may be irreversibly changed. Leguminous plants are affected because nitrogen-fixing bacteria do not nodulate normally in acidified soil and many grain plants that require "sweet" soil environments simply will not produce at expected levels.*

Background

Acidified precipitation is an environmental problem largely a function of energy demand and the resultant combustion of fossil fuels to supply that demand. Emissions of SOx and NOx from fossil fuel combustion react with moisture in the atmosphere to form sulfuric acid and nitric acid which are then returned to the surface in rain and snow.

The "tall stacks" policy of the U.S. Environmental Protection Agency, designed to alleviate intense air pollution problems in source regions by insuring that combustion effluent is released into the atmosphere at sufficient elevations (utilizing taller smokestacks) to take advantage of natural convection and the resultant dispersion and cleansing by the upper atmosphere, instead established a situation in which pollutant effluent is deposited downwind of pollution sources on unsuspecting regions which may or may not have their own local effluent sources. The most spectacular examples of this phenomenon involve the pollutants released into the air in

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cities in the industrial heartland of the United States (Chicago, Gary, Pittsburgh). The sulfur and nitrogen compounds from these cities are carried aloft by convection, transfered eastward by the prevailing upper-air westerlies, and deposited as acidified precipitation on the lakes and forests of the Adirondacks of upstate New York or the blue spruce stands of Nova Scotia.

As a direct result of this process, the pH of rain and snow in the eastern United States fell from a normal value of 5.7 to a range of 4.5-4.2 by 1975 (Galloway, et al., 1976). This is a result not only of activity at the large pollution sources such as the industrial centers mentioned above, but is affected also by the cumulative output of smaller polluters such as individual power plants and isolated fossil fuel burning industries. Emission experts predict a rise in the level of sulfur and nitrogen in the U.S. atmosphere and a corresponding drop in precipitation pH can be expected.

EMISSION PROJECTIONS FOR THE UNITED STATES

	1985	1990
Sulfur dioxide (millions of short tons)	14.2	15.6
Oxides of Nitrogen (millions of short tons)	17.1	18.2

(Global 2000, 1981)

The overall effects of acidified precipitation are still only generally understood and, as late as 1981, the United States Council for Environmental Quality recognized that "...little research has been undertaken on the effects of acid rain on large natural ecosystems..." (Global 2000, 1981) even though specific consequences were being uncovered by the scientific community as research on the phenomenon progressed. In Europe, where the effects of acidified precipitation are severe because of the more widespread use of coal as an energy source for both domestic and industrial purposes, the systemic impact of the problem is clearly stated:

> Soils and surface waters are affected: plant growth is retarded; ecosystems are changed; the biota in lakes and rivers are changed; some organisms die; microorganisms, pathogens and the soil fauna change their activity and living patterns; deterioration of buildings takes place as well as corrosion in a wide sense; and human health is affected. (Oden, 1976)

Widespread documented fish kills in Adirondack lakes and streams in the 1970s created an immediate need for considerable research into levels of pollution and the degree of biotic damage in lakes and streams in a very large region. Regular pH monitoring programs for lacustrine and alluvial water resources have been established in most states in the Eastern U.S.,

some funded by regional electric companies who, as primary sources of hydrocarbon combustion, have a vested interest in research that may affect public policy development with regard to acidified precipitation, and some supported by public agencies.

Lacustrine and alluvial research on the effects of acidified precipitation have been of primary importance in the United States, and the body of literature documenting these phenomena is significant and expanding rapidly. The most recent compendium on these phenomena was released by the U.S. Environmental Protection Agency in 1982 (Omernik and Powers, 1983) and its implications for a national problem rather than one of regional scope have, according to a spokesman for the Izaak Walton League, "...changed the nature of the politics of the acid rain debate" (New York Times, 1982).

Research activity concerned with the analysis of the impact of acidified precipitation on soil and non-aquatic plant systems has not been nearly as comprehensive and, as a result, less is known of the geographical extent or severity of the effects of acidified precipitation on these two segments of the environment. While there is general agreement that the latter set of effects will be predictably negative, the dearth of information about these phenomena is such that serious speculation about positive ecosystem-wide effects can be put forth by natural scientists (Lynch, 1981).

General Effects On Soils

Soil is the medium in which most important agricultural crops are grown. The condition of the soil can directly determine the productivity of any agricultural activity. Soil conditions that are particularly important for successful crop growth include soil texture, soil pH, and the nutrient capacity of the native soil.

Any soil is normally in a state of dynamic equilibrium with relation to its parent material (bedrock), the local climatic pattern, the local vegetation cover and, in the case of agricultural activity, local farming practices. The introduction of normal agricultural practices such as plowing, fertilizing, and crop rotation may cause a previously undisturbed soil to evolve toward a new equilibrium and, with sufficient time, a soil will adapt to the new norm established by the agricultural round. Any other significant change in the overall soil system, for instance the introduction of acidified precipitation, can create a need for a new equilibrium and may have an impact on all other segments of the soil/agricultural crop ecosystem.

The primary concern of scientists about the impact of acidified precipitation on agricultural soil focuses on the way in which soil pH determines the availability of nutrients or micronutrients to agricultural plants. Preliminary research indicates that the effects of acidified precipitation on nutrient availability can be quite varied. Dixit (1932) reports that while "...data on the influence of pH on electrophoretic

behavior of soil colloids and suspension stability are scarce..." his laboratory experiments did reveal a real pH dependence in the surface chemistry of some soils with significant clay content. Surface chemical reactions can have a direct bearing on mineral mobility, horizon development and, ultimately, the fertility of soil for certain plants.

The soil pH changes that can be introduced by acidified precipitation may be relatively small but any increase in soil acidity will create a situation conducive to an exchange of adsorbed cations on the soil colloids. The level of base saturation will be reduced and desorbed ions will be leached out of the soil. Calcium, a significant natural buffer against soil acidification and a mineral that is often added by farmers to "sweeten" the soil, will be leached out of soil by flowthrough of acidified water; the rate of leaching increases with the drop in pH of precipitation and with the amount of water that flows through the soil (Reuss, 1975). The depth to which such processes are active depends on the rate at which water moves through the soil profile; slower infiltration results in shallower effects but a more intense acidification in the upper horizons. In fact, the most significant effects of precipitation acidification on soil nutrient availability may be in the uppermost layers of the soil where the rate of mineralization of organic litter and humus will be retarded. Infiltration depth and rates depend upon many factors, including the rate of precipitation, the texture of the soil, the slope of the surface, and the rate of evapotranspiration (the combined effects of evaporation of water from the surface and water uptake by plants) at a given site. In addition to these specific effects, the introduction of acidified precipitation will upset the overall soil equilibrium and "...until a new equilibrium is obtained, the cycling of nutrients in the ecosystem will be retarded too" (Oden, 1976).

Overall, the impact of increasingly acidified precipitation will be the degradation of soil fertility. In soils with accumulated horizons, large amounts of heavy metals will dissolve as acidified water flows through and will be leached out of the upper soil horizons. All the processes of soil formation and maintenance, basically the breakdown of parent material (bedrock and organic deposits on the surface), will be enhanced and less productive soil types, not unlike the rapidly deteriorating soils of tropical environments, will result. This type of equilibrium in the soil will not support agriculture without the introduction of large amounts of fertilizers and soil-enhancing chemicals.

Specific Agricultural Effects

While most of the published information concerning the effects of acidified precipitation on agriculture is inferential, based on a general knowledge of agriculture, ecosystems, and acidified precipitation, some specific research has been pursued that indicates a real cause for concern for certain types of agricultural activity. This research has uncovered evidence not only of indirect influence on agricultural plants through

induced changes in the soil chemistry, but of direct effects on the foliar portions of plants also.

In a pioneering effort at North Carolina State University, D.S. Shriner (1977) found that acidified precipitation can have a negative effect on the growth pattern of soybeans (Glycine max). His work uncovered significant plant inhibition by acidified precipitation in both the root and foliar portions of this most important agricultural crop.

One of the important attributes of soybeans, and of most legumes, is the ability to host colonies of Rhizobium bacteria in nodules that are formed on the roots of soybean plants. Rhizobia can fix atmospheric nitrogen which then becomes available to the soybean plant; this reduces or eliminates the need for artificial applications of nitrogen by farmers and helps hold the production cost of soybeans at low levels. The ability to host rhizobia makes legumes an important cover crop or green manure that, when used in a regular cropping rotation, reduces the need for artificial nitrogen applications in non-leguminous crops that complete such a rotation. The ability of legumes, especially the highly profitable soybean, to host rhizobial colonies is critical to their success as agricultural plants and, when Rhizobium does not naturally occur in a soil, modern agriculturalists inject them into soils where legumes will be grown.

Under normal conditions, a soybean plant will support 62 nodules of Rhizobium japonicum (Pena-Cabriales and Alexander, 1983). This level of activity produces sufficient nitrogen for successful growth and maturity of soybeans for a commercially successful crop. In a greenhouse study, Shriner treated soybean plants (Glycine max "Lee") with simulated rain with a pH of 3.2. The result was a significant (> 65%) reduction of Rhizobium nodulation on all root systems and an accompanying, though not as large, inhibition in overall plant growth.

EFFECT OF 'RAIN' ACIDIFIED WITH H_2SO_4 ON RHIZOBIUM NODULATION IN SOYBEANS

Simulated Rain(pH)	Nodules/plant	Dry Weight/nodule
6.0	65	0.52mg.
3.2	24	0.51

(Shriner, 1977)

An assay of the soybean plants by the acetylene-reduction technique indicated a decrease in nitrogenase activity within the plant system proportionate to the degree of inhibition of nodule formation reported above. Overall plant growth reductions were also noted as a result of nodule inhibition but this phenomenon was irregularly recorded and the results are inconclusive.

Subsequent research (Alsop and DuBay, 1983) demonstrates some of the "bottom line" effects of acidified precipitation on soybean rhizobial colonies and these results, although preliminary, have negative implications for agriculture. The results of that research are below:

EFFECT OF ACIDIFIED PRECIPITATION ON SOYBEAN YIELD

Precipitation pH	Soybean Yield (g/meter row)
5.2	219.4
4.2	219.4
3.7	204.1
3.2	203.1
2.7	206.1

(Alsop and DuBay, 1983)

In a field experiment in Virginia, soil pH samples were taken in soybean fields where convential tillage was practiced. As expected, the effects of acidified precipitation were greatest near the surface (Figure 1). Soil pH increased with depth, as Dick (1983) had demonstrated in a nineteen-year study carried out in Ohio that did not specifically address the impact of acidified precipitation on soil, but the rate at which pH decreased with depth varied with the soil constituents and with soil texture and grain size. This simply reflects the variable rate of infiltration of water into the soil that is dependent on soil texture, precipitation rate, and evapotranspiration rates.

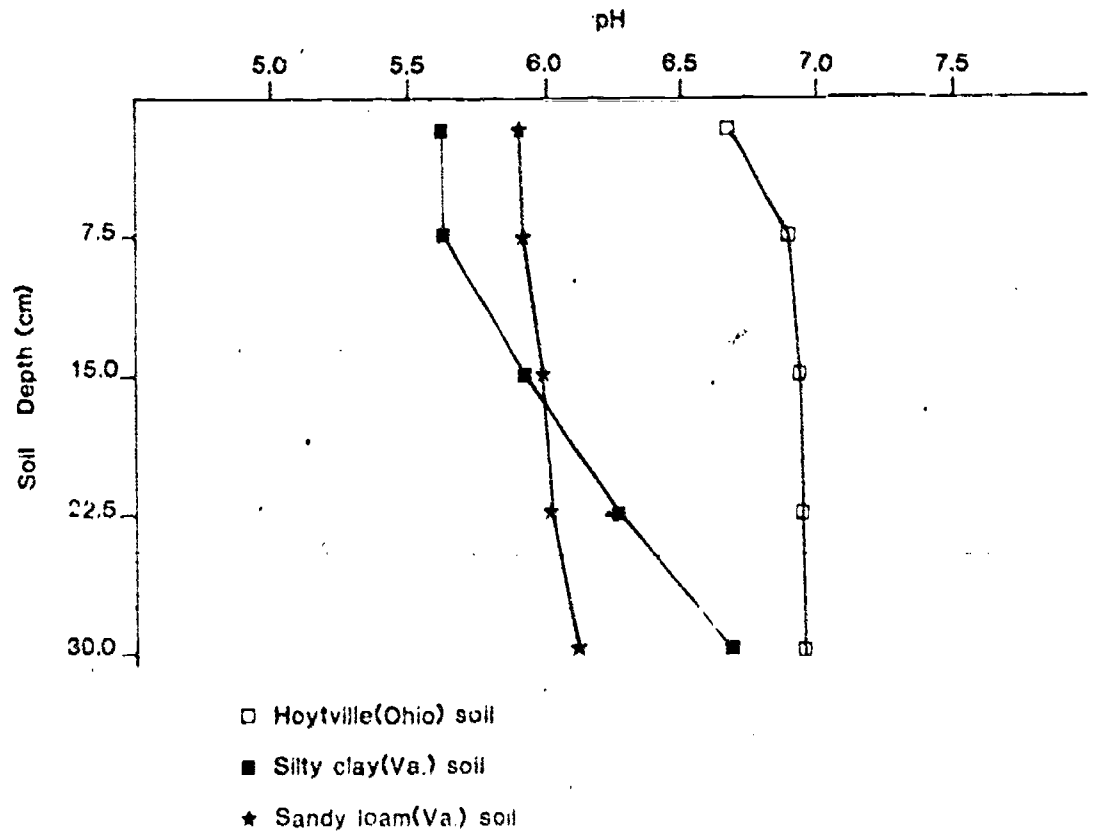

Figure 1
pH Variability with Depth of Soil in Convential Tillage Situations

Obviously, precipitation (in this case acidified precipitation) infiltrates more rapidly through horizons where soil particles are coarser (sandy loam) and the effects of acidified precipitation are dispersed vertically more rapidly in that medium than in a soil with a large proportion of clay. The Virginia data were collected during a six-month period while soybeans were actively growing and therefore do not reflect the effects of an annual round of precipitation as do Dick's figures but they do add the dimension of soil texture, which was not included as a variable in the Ohio project, and the processes and relationships which create the different rates of soil pH change with depth should remain active on a yearly basis.

The effects of variable rates of infiltration and the resultant differences in changes in soil pH with depth demonstrated in Virginia also established different levels of negative impact on Rhizobium nodulation in soybean plants. In the Virginia example, where the mean precipitation pH was 4.2 during the test period, nodule retardation was as follows:

RETARDATION OF ROOT NODULATION IN SOYBEANS SUBJECT TO ACIDIFIED PRECIPITATION

General Soil Type	Precipitation pH	%Nodule Retardation
Silty Clay	4.2	39%
Sandy Loam	4.2	57%
Silty Clay Loam	4.2	52%

(Stopp, 1983)

The rates of nodule reduction in this example are not as great as those reported by Shriner above but the precipitation pH average, based on analysis of actual precipitaion rather than utilizing a controlled simulation of precipitation as Shriner did, is not as acidic as was the pH 3.5 precipitation introduced in his laboratory experiments. The rates of nodule retardation in the Virginia example are significant, however, and would result in a loss of over 50% of available nitrogen for the soybean plants on the average.

Foliar Effects

Direct effects by acidified precipitation on agricultural plants may occur when low pH moisture is deposited on leaves, flowers or fruit. Acidified precipitation on these plant surfaces can erode portions of the plant anatomy which are important barriers to disease and fungus, thus increasing the vulnerability of the plant to these problems. In the case of fruit or plants whose leaves are the ultimate agricultural product, damage to the surface which is merely unsightly can reduce the marketability of the crop and negatively affect overall agricultural production.

An examination of the leaf surfaces of kidney beans (Phaseolus vulgaris) with a scanning electron microscope after exposure of the leaves to simulated precipitation with a pH of 3.2 revealed extensive degradation of the cuticular waxes. Cuticular waxes act as a physical barrier to fungi and bacteria of all kinds and significantly increase the efficiency of leaves to retain moisture during dry periods; erosion of these waxes affects the plant health negatively. The effects, however, apparently are determined by the timing of the application of acidified precipitation.

When kidney bean plants were subjected to acidified precipitation, halo blight (caused by Pseudomonas phaseolicola) flourished but only until subsequent applications of acidified precipitation were forthcoming. When simulated precipitation of pH3.2 was applied to blighted kidney bean plants, the acidified precipitation significantly decreased the incidence of blight (Shriner, 1977). Similar results were reported for development of a bean rust (Uromyces phaseoli) on kidney beans. Apparently, plant diseases, which are themselves living, are as negatively affected by acidified precipitation as are the plants. In the case of crops like kidney beans and soybeans, the foliar effects of acidified precipitation may be negligible although, as mentioned before, reduction of cuticular waxes by low pH moisture may have a negative impact on the plant's ability to resist drought. When the appearance of fruit or leaves is important (as with tobacco and most vegetables and fruits), the discoloration caused by cuticular wax erosion and blight or rust infestation even for a short time can be critical and may reduce marketability and agricultural profits.

Conclusions

It is an unfortunate fact that acidified precipitation is a very real factor in the environment of North America; it is even more unfortunate that emission experts predict increasing acidity in precipitation and a more geographically significant distribution of the problem. Gregory Wetstone, senior staff attorney for the Environmental Law Institute in Washington, D.C. has stated that:

> Once the cumulative loading of acids ....has exhausted the environment's limited neutralizing capacity, severe effects follow very quickly with the addition of small, previously inconsequential, quantities of acid. (Wetstone, 1981)

Given this unfortunate circumstance, it is encumbent upon the scientific community to determine accurately and fully the effects of acidified precipitation on the ecosystems that comprise our environment; it is especially important to reach this determination for the systems upon which human survival depends most critically. Agriculture, though insulated from our daily lives by the agribusiness conglomeration of food processors, wholesalers and retailers, is perhaps the most critical system upon which modern society depends and, as has been demonstrated in the text above, acidified precipitation can have significant negative effects on

agricultural plants and on the agricultural plant environment.

The information reported here makes two points very clear: 1) acidified precipitation does have a negative impact on certain agricultural plants, in a direct way by af[illegible]ing the plant and leaf surfaces, and in an indirect way by modify[illegible] the chemical properties of the soil, the basic medium for plant growth; and 2) there is a real need for more specific research on agricultural [illegible]lants to determine the range and severity of effects brought about by [illegible]cidified precipitation. Are the effects of acidified precipitation both negative and positive as was indicated by research on kidney bean leaf surfaces? Are the same effects, the erosion of leaf surface waxes, harmless in some plants but severely damaging in others? Is acidification of the soil a permanent condition to which a new chemical equilibrium must evolve or do the pH changes induced by acidified precipitation simply percolate through the soil with no residual effects? Are the effects of acidified precipitation on the soil cumulative, creating a scenario where continuous application of low pH water lowers soil pH to new, unreported and unexpected levels? Harvey (1979) reports that the effects of acidified precipitation on lakes are irreversible, that "...if you take an acid lake and you lime it, you do not now have a normal lake; you now have [illegible]limed, formerly very acid lake...." Can we expect similar results with the soil?

Agricultural productivity is too precious to mankind to leave such questions unanswered. At the present state of science, these questions are not only unanswered but are uninvestigated. Given the promise that acidified precipitation will continue to be an important variable in our environment and the implications for agriculture that can be documented, it is imperative that a large research effort, supported by public and private sources, be launched to remedy the present dearth of knowledge and the resultant lack of understanding about the effects of acidified precipitation of agricultural productivity.

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What Do Teachers Want to Teach about a Current Environmental Issue? Acid Rain

Harriett Singleton Stubbs[1]

Abstract: *This survey sought to determine teaching materials desired by educators when introducing the topic of acid rain into the curriculum. This survey was sent to a random sample of 871 Minnesota science teachers (minus physics teachers). The data was returned by 68.8%, or 593 teachers. These educators, who introduced the current environmental topic of acid rain into their curriculum, indicated utilization of certain curriculum materials in 1981.*

Of the 559 teacher respondents, 77.8% have introduced the topic this year; of the 22.2% who have not, 12% say they will teach about acid rain next year; 10% have not and will not introduce the topic. Teachers rank-ordered a list of available curricular materials available on the topic, and selected in order: a 16mm film, informational packet, reading assignments with questions, and laboratory activities.

These data may have implications for curriculum developers, information disseminators and others in this field, as well as classroom teachers and students.

The Importance of This Environmental Topic

Acid rain is not a new problem. Robert Angus Smith (1872), in England in the 1850's, started a monumental work, Air and Rain, The Beginnings of a Chemical Climatology, describing rain made acid by pollutants present in the air. Much research in the topic has occurred since that time. Scandinavian researchers have been monitoring and recording information on acid precipitation since the 1950's (Cowling, 1980; Gorham, 1981). In this country, knowledge of acid rain and its effects has expanded over the past ten years (Likens, et al., 1979). But scientific research efforts were not matched by educator effort at the secondary level. An article in Current Science (Likens, 1973) stimulated students across the United States to collect and test precipitation, but few science teachers or students seemed to continue further classroom study. The question is "Why?"

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In a Report to the President's Council on Environmental Quality, scientists associated with the National Atmospheric Deposition Program in 1978 stated unequivocally that acid precipitation was one of two major environmental problems in the United States (Galloway, et al., 1978). President Carter in August, 1979, allocated ten million dollars per year for ten years for interagency research on the problem. Yet a search of the environmental and science education literature, as well as discussions with scientists[2] and science consultants in State Departments of Education across the country[3], revealed no mention of curricula having been developed to include this topic prior to 1979.

The Need for Curriculum Materials

That a need for such materials existed was clearly evident from a preliminary questionnaire administered by the author to 143 secondary teachers in a school district of West St. Paul, Minnesota, in the spring of 1979. Of the junior and senior high school teachers responding, 90% did not include acid rain in their curriculum. Most in fact indicated that they had never heard of acid rain. It is not surprising, then, that student responses to a similar survey would reveal similar results. Over four-fifths (83%) of the students responding to the survey had never heard of acid precipitation, 79% of the 185 students had never heard of acid rain, and only 2% had ever studied anything about it in school.

Need for Education on Environmental Issues

"The Belgrade Charter (was) developed at the International Environmental Education Workshop (1976), and defined the goal of environmental education as '...knowledge, skills, attitudes, motivation and commitment to work...toward solutions of current problems and the prevention of new ones.'" (Blum, 1981). At the 20th General Conference of Unesco in 1978, a plan was approved to help member nations incorporate environmental education into both formal and non-formal public education ..."with a view to providing a better understanding of environmental problems and teaching people how to foster the preservation and improvement of the environment. Priorities during 1979-80 were given to developing environmental education, training personnel, and conducting research on interdisciplinary approaches to environmental education" (Stapp, 1981). Support was given to innovative activities to develop teaching and learning methods, materials, and mass media, as well as to establish a means to develop these goals regionally and nationally.

Patrick (1980, p. 5), in a speech to the Board of the Biological Sciences Curriculum Study (BSCS), described a "great need for better instruction about science in the general education of citizens". This is reiterated by Bybee, Harms, Ward, and Yager (1980), who assert that education "is to ready students for future roles as concerned and responsible citizens prepared to deal with critical societal issues. To do so, they need the knowledge and

attitudes that will lead to personal actions and public policies that result in some resolution of problems."

In addition, Bybee stated..."there is an obvious need for education about the basic nature of science-related problems...There is also a need to improve understanding of the role of science...as it leads to new knowledge that may improve human life." "[Students] must gain experience in evaluating dilemma situations...and [be] encouraged to think through the implications and consequences of decisions relative to different courses of action...[C]urrent information about societal issues and science...is not contained in most science curricula presently available" (Bybee, 1977, 1979a, 1979b). Bybee, et al., (1980) listed many issues: population, food, energy resources, and pollution that are causing "a rethinking of the goals and objectives of science education."

Gennaro and Glenn (1975) believed that science and social studies teachers, working together, can use strategies that emphasize value resolution of science-based societal issues, thus being beneficial to both science and social studies teachers and students. They (1979) also stated that teachers should help students develop skills for improved decision-making.

Hurd, et al., (1980), in a review of biology teaching, stated that concepts must be put into a "socially relevant and personally meaningful context for students. Societal issues must be a primary focus of biological education" (p. 393). It is stressed that in-service teacher programs be interdisciplinary; economics, sociology, science, ethics and politics should be included and values incorporated (p. 409). Harrison (1981) suggested that it is necessary to have an interrelationship of science, technology, and society and that this then requires better education.

The literature cited suggests it is necessary that educa... consider incorporation of current environmental problems in scien... social studies, and environmental studies. In addition, causes, effects, implications, and possible solutions of these problems must be considered in order to attain a more educated populace that can make better policy decisions.

> Scientific and environmental awareness, knowledge, and understanding are cultural imperatives in all countries. The citizens in a free society must understand the advantages and limitations of scientific and environmental changes in order to participate effectively in public policy making" (Thier, 1981, p. 103).

Acid Precipitation is a Major Environmental Issue

In a review of a three-year study of world problems, January 1980, eighteen world leaders from the Brandt Commission stated: "The strain on the global environment derives mainly from the growth of the industrial economies, but also from that of the world's population. It threatens the survival and

development opportunities of future generations. All nations have to cooperate more urgently in international management of the atmosphere and other global commons, and in the prevention of irreversible ecological damage." The staffs of the Council on Environmental Quality, the State Department and fourteen United States federal agencies repeated these findings in the Global 2000 Report to the President (1980).

Bigeleisen (1980) suggested that in the 60's the environmental movement addressed the cause, effect, and remedies of many different problems. He stated, however, that..."we may find these concerns were simple; we now confront qualitatively different concerns which already are testing both our science and our making of public policies. Instead of being local, they are global; instead of being susceptible to local or national solutions, they demand international collaboration; instead of being obvious, the problems are subtle, intricate and unprovable; instead of cause quickly leading to effect, the two are separated by decades, the putative consequences becoming apparent after their causes are gone" (p. 68).

Over three hundred years ago, Evelyn in 1661 and Graunt in 1662 suggested a relationship between plant growth, people's health and industrial emissions (Gorham, 1981). It was not until the past ten years in the United States that much attention was paid to acid precipitation (Likens, 1979). Cowling (1982) asks: "Why did it take so long for acid precipitation to be recognized as an important environmental problem?"

The Swedish Environment '82 Committee writes:

> Signs of acidification and its environmental effects are appearing in the eastern U.S. and Canada, the Federal Republic of Germany, Belgium, the Netherlands, Denmark, Poland, Britain and a number of other countries in Western and Eastern Europe." (1982, p. 8).

A Swedish review of the acidification problem written in June 1981, states:

> Scarcely more than a decade has passed since we first began to discern the dimensions of the acidification problem. Perhaps, when all is said and done, it is not really so remarkable that acidification could go on largely unnoticed for years--right up to the end of the 1960s. In contrast to environmental influences of many other kinds, acidification is a furtive process--in its early days almost unnoticeable. Our senses of smell and taste are not capable of distinguishing between acidified and unaffected lake or well water. The clear limpid water in an acidic forest lake can also, in many cases, lend it a deceptive beauty. And the trees growing in an acidified forest area look just like trees anywhere else, at least as long as the acidification is moderate. That the fish have died in thousands of lakes is something we have known for a good

> many years. But not until recently have we been able to establish that drinking water from springs and wells may, in consequence of acidification, contain sufficient amounts of toxic heavy metals to be a threat to health. That forest trees standing on acidified land may begin to show slower growth is so far only a suspicion--it will be at least another two decades before we know for certain." (Swedish Environment '82 Committee, p. 8, quoting SNV, 1981: Forseveneng av mark lochvatten. Monitor 1981. Statens naturvardsverk, Solna.)

Under the direction of the United Nations Economic Commission for Europe, the Convention on Long-Range Transboundary Air Pollution was signed by 33 nations in Geneva, 1979. As of June, 1982, only 13 of the member nations had ratified the Convention. (At least 24 signatures are required.) The 1979 Geneva Convention states that the signatories to the Convention shall exchange information, consult, monitor, and research (p. 103) as well as "seek to bring closer together their policies and strategies for combating, (reducing and preventing) air pollution, including long-range transboundary air pollution." (Report of the European Conference on Acid Rain, 1981, p. 113).

To celebrate the 10th anniversary of the 1972 United Nations Conference on the Human Environment held in Sweden, and to stress the importance of the signing of the Convention, the Swedish Government sponsored the 1982 Stockholm Conference on the Acidification of the Environment. Because the author was invited to attend as an observer, and the following information seemed most significant and pertinent to this study, it is included.

Two expert groups composed of individuals known internationally for their expertise met and dealt with the ecological effects of acid precipitation, and strategies and methods to control emissions of sulfur and nitrogen oxides. Each of the groups then formulated recommendations to be presented to the Ministerial Conference held several days later. Attending the Ministerial Conference were delegates from 22 different nations and representatives from five major international organizations. Representatives of many international non-governmental organizations (NGO's) attended as observers.

A few of the statements pertinent to the world-wide atmospheric deposition situation from the recommendations and conclusions of the Ministerial Conference, agreed upon by all attending nations, are the following:

> Acid deposition is a major environmental problem needing further national and international cooperation.
>
> Canada and the United States are developing a bilateral agreement to take action for controlling transboundary air pollution.

> The acidification problem is serious and, even if deposition remains stable, deterioration of soil and water will continue and may increase unless additional control measures are implemented and existing control policies are strengthened.
>
> Further action is needed to reduce air pollution which should include: sulfur emission and nitrogen oxide reduction; use of the best available technology; minimizing the waste products; supporting research, continuing and developing monitoring programs, and developing and implementing energy conservation.

Particularly applicable to this study is Point #7:

> The Conference recognized the value of developing a continuing public dialogue and the role of non-governmental organizations in this regard in order that scientific information is made available in an appropriate form.

Cowling (1981) has asked--"Why has it taken so long for the phenomenon of acid precipitation to be recognized as a major environmental issue?" and, in addition, we as educators might ask: "And why has it taken so long for this subject to 'spread abroad' and to reach the classroom?"

What Teaching Materials Do Teachers Want to Teach about a Current Environmental Issue?

In the fall of 1981 a survey of 871 science teachers in the State of Minnesota was made. Part of the survey had questions dealing with the introduction of acid rain into the classroom and the use of materials relating to acid rain. Replies from 593 secondary science teachers are summarized in Table 1. (Physics teachers were not surveyed because there was no component part of the curriculum developed for physics teachers.)

Respondents who have introduced the topic and those who will introduce the topic of acid rain: The responses to question #40, "Have you introduced the topic of acid rain in your classroom?" were important in this study. because it was this question which divided the science teacher population into user and non-user groups. Only 559 responses were tallied since only those respondents who answered both questions #40 and #41 were considered in the following statistical analysis. Of the 559 respondents, 435 or (77.8%) answered "yes", they had introduced the topic of acid rain into their classroom; 124 or (22.2%) replied "no", they had not.

The same 559 respondents answered question #41: "How likely are you to discuss acid rain this school year?" Almost 90%, 487 or (87.1%) responded "I will"; 72 or (12.9%) responded "I will not." From the 435 who answered "yes" they had introduced the topic this year, 487 or about an 11% increase will teach the topic next year. Of the 124 teachers last year who did not introduce the topic, 57 are still not going to, but 67 will teach about

Table 1: Acid Rain Teaching Materials Which Have Been Used and Which Will Be Used in the Classroom, Rank-Ordered by Percentage.

I have used this in my classroom (Rank-ordered by percentage)			I will use this in my classroom (Rank-ordered by percentage)		
Question	Curriculum Item	Percentage	Question	Curriculum Item	Percentage
#44	Slide/cassette	12.6%	#43	16 mm film	47.0%
#47	Reading	12.1%	#50	Informational packet	46.5%
#50	Informational packet	11.0%	#47	Reading	43.5%
#46	Lab activities	8.8%	#46	Lab activities	37.8%
#49	Tests	7.2%	#49	Tests	35.7%
#42	TV tape	7.1%	#42	TV tape	32.0%
#45	Overhead transparencies	6.3%	#44	Slide/cassette	30.0%
#43	16 mm film	6.0%	#45	Overhead transparencies	26.9%
#48	Computer	1.5%	#48	Computer	16.8%

acid rain. Therefore, according to this self-reporting data, more than half of this group of teachers will introduce acid rain into their curriculum. However, 10.2% have not and <u>will not</u> introduce the topic (Table 2).

Table 2: Respondents who <u>have</u> introduced the topic and those who <u>will</u> introduce the topic of acid rain (N=559)

		Have you introduced the topic of acid rain in your classroom? (Question #40)		
		HAVE	HAVE NOT	
How likely are you to discuss acid rain this school year? (Question #41)	WILL	420	67	487
		75.1%	12.0%	87.1%
	WILL NOT	15	57	72
		2.7%	10.2%	12.9%
		435	124	559
		77.8%	22.2%	100.0%

Almost 80% (435) of the life, earth, physical, environmental science, biology, and chemistry teacher respondents introduced the topic this year. Of those 20% who had not, about 11% say that they will teach about acid rain next year and the remaining half have not and will not introduce the topic. It would be informative to survey these teachers to determine what variables are unique in this group. If the originally planned case study approach had been feasible, some important information may have been gained about this teacher population.

The percentage of West St. Paul teachers (10%) who included acid rain in their curriculum, Spring, 1979, as reported in the pilot study, is quite different from the percentage of Minnesota science teachers (almost 80%) who introduced the topic in 1981. Student response in 1981 is not available. It most probably would be quite different from the 1979 pilot study data in which 79% of the students who responded had never heard of acid rain. During this 3 1/2 years, acid rain has become increasingly covered by the media. Debate over the Clean Air Act in Congress and Canadian-American relations have been important factors for this coverage, in addition to many local influences.

What Teaching Materials Do Teachers Use to Teach about a New Topic?

If a new topic evolves about which the teacher knows little or nothing, how does this particular topic get into the classroom? How can curriculum developers so design curricular materials so that teachers will be willing to use this information in the classroom? How can it be proven valuable to the teacher, so that a teacher will include the topic in the classroom curriculum with resultant student knowledge?

These data from 593 teachers showed that 47.7% of the teachers wanted a 16 mm film, first and foremost, to teach about this particular issue. The informational packet was rated second. (Perhaps teachers needed information for themselves, and could obtain it through both the film and informational packet.) In the survey instrument the following ranked third. The question read "reading assignments of appropriate reading levels with accompanying questions as a resource on the topic of acid rain." 45.3% requested this reading. Laboratory activities designed for their particular subject, which would take one to two days of class time, were requested by 37.8%. In 1981, 593 Minnesota science teachers indicated by rank-order that they needed: a 16 mm film, an informational packet, reading with questions, and laboratory activities, to teach about acid rain (Table 3).

In summary, teachers have asked for a 16 mm film, informational packet, reading assignment, and laboratory activities, in that order, to teach about a current environmental issue, acid rain. Will these same selections of materials apply to other curricular areas which are new and could be placed in the classroom? Further research on other topics needs to be followed, for this would be important: to the curriculum developer who needs to know where time and money should be spent; to the teacher who needs current information in order to give instruction to classes; and to the student who needs objective information about current environmental issues.

Atmospheric deposition, and more specifically acid precipitation, is a current, multi-disciplinary environmental issue of the 1980's. Many fields of science will be required and involved in the research of the problem. The dimensions of science, technology and society have been addressed by many, but McConnell (1982) suggests that a new relationship of science as a "part of social policy, and of technology, as part of science policy" is necessary in education for the 1980's and the future. Decision-making, with "resolution of conflict between people and groups that have different values, different images of the future, and different definitions of trade-offs, benefits and costs", will be a necessity.

It seems that indeed, broad perspective is needed - to view the interconnectedness of the social, political, economic, and environmental systems of all countries - and to reach consensus - toward the solution of future global environmental issues.

Table 3: Frequency of classroom use of various acid rain resources by Minnesota science teachers by percentage*

Acid Rain Resources	Definitely will not use	Probably will not use	Probably will use	Definitely will use	Have used	N.A.
Slide-cassette	9.1	13.3	26.0	20.7	9.9	20.9
Reading assignments	3.0	5.2	31.9	30.9	9.8	19.2
Information packet	3.4	3.7	31.5	33.6	8.9	16.9
Lab activities	6.9	8.4	30.2	27.7	7.1	19.7
Tests	8.3	8.9	30.5	26.5	5.7	20.1
TV tape overview	10.1	12.0	27.7	23.6	5.6	21.1
16 mm film	3.9	6.9	29.0	36.3	4.9	19.1
Transparencies	9.4	15.2	29.0	19.7	4.9	21.8
Computer simulation games	22.4	23.4	18.5	13.0	1.2	21.4

* Rank ordered by "have used" category

Endnotes

[2]Personal communications with Ellis Cowling, Gary Glass, James Galloway, Eville Gorham, Harold Harvey, Gene Likens, Hans Martin, George Rejohn, 1979; Finn Braekke, Svante Oden, 1980.

[3]Letters were sent to all State Departments of Education east of the Mississippi River, 1979.

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Merging at the Crossroads: New Vehicles for Environmental Education

Charles H. Yaple[1]

Abstract: *The merger of society and technology, for purposes of creating environments which provide optimal living conditions for all inhabitants of Earth, will not come about unless increased attention is given to securing human motivation and commitment. The premise is advanced that an environmental ethic or conscience to guide the human spirit is the necessary catalyst for accomplishing the merger of society and technology; and that the Christian Church might serve well as a vehicle in fostering the acceptance/practice of that ethic by a critical mass of humankind.*

By way of supporting the preceding premise, findings from a five-year study of the Christian Church and its involvements with environmental education in the United States are presented. Findings indicate that the Church was not heavily involved with environmental education in the past. However, an opinionnaire study of a randomly sampled group of church officers, clergy and members of the Religious Education Association showed strong support for the Church to actively assist with environmental education. The opinions expressed by those church professionals correlate closely with opinions expressed by members of the Conservation Education Association and the National Association for Environmental Education.

The paper concludes with argumentation suggesting that the Church and other religious organizations may be willing and able allies of environmental education if approached in a diplomatic fashion.

The theme, "Crossroads: Society and Technology," for the 1983 National Association for Environmental Education (NAEE) conference suggests that:

1. there is a need to harness society and technology together for purposes of creating environments that provide optimal living conditions for all inhabitants of Earth.

2. society and technology have not traveled mutually supportive paths in terms of creating environments that provide optimal living conditions for all inhabitants of Earth.

3. society and technology may not merge at the crosroads but separately continue on to create a global environmental junkyard.

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If the last scenario is to be prevented from materializing, it appears that some catalyst is necessary to bring about and maintain the marriage of society and technology. The question is, "what agent, institution, or untried force can perform the nuptial ceremony?"

The following suggests the premise that an environmental ethic or conscience is needed to guide the human spirit, and consequently both society and technology; and that the Chrisitian Church might serve well as a vehicle in fostering the acceptance/practice of that ethic by a critical mass of humankind. As stated some time ago by Richard Baer:

> ...until we recognize that man's spirit itself is the ultimate front line of the environmental crisis, we will continue to nibble away at the edges.(Baer, 1974)

The reader may at this point be wondering, "what is an environmental ethic?" Writing nearly thirty-five years ago, Aldo Leopold observed that:

> An ethic, ecologically, is a limitation on freedom of action in the struggle for existence. An ethic, philosophically, is a differentiation of social from anti-social conduct. These are two definitions of one thing.(Leopold, 1949)

The term "ethics," coming from the Greek "ethikos" and "ethos" and having the meaning "custom" or "usage", was employed by Aristotle as including both the idea of "character" and "disposition" (Reese, 1980). Environmental ethics, then, deal with the evolution of a society composed of people of such character and disposition that they willingly insist, as part of societal custom, that "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community" (Leopold, 1949). Isn't this the essence of what environmental educators are ultimately trying to convey to their students and bring about as a societal norm?

Environmental Education has been defined as:

> ...the educational process dealing with man's relationship with his natural and manmade surroundings and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, economic impact, and urban and rural planning to the total human environment. (United States Office of Education, 1977)

The definition succinctly illustrates the varied and somewhat awesome task confronting those who attempt to resolve our environmental dilemma. Billions of dollars have been spent in providing environmental legislation, technology, and education; yet we still suffer from polluted water, toxic wastes, acid rain, and other forms of environmental degradation. It appears that either the present mix of legislation, technology, and education is inadequate or that some ingredient is still missing or needs

to be more strongly emphasized.

Robert Roth of The Ohio State University may have touched on that ingredient when he wrote about the aims of environmental education. Roth said that the aim of environmental education is to develop a citizenry that is:

1) knowledgeable about the complex interrelationships of the biophysical and socio-cultural environments.

2) aware of both the associated environmental problems and alternatives for solving those problems and

3) motivated or committed to working toward solving environmental problems in such a way as to create environments that are optimal for living.(Roth, 1971)

Much effort has already been expended by educators attempting to implement aims one and two. However, without "motivation and commitment" from a majority of the citizenry all the legislation, technology, and education in the world will fall short of ensuring an earth capable of sustaining life for its inhabitants. How, and from what source(s), can the ingredients of motivation and commitment be obtained?

Seeking an answer to the preceding question led this writer into a five-year study of one potential institution - The Christian Church. Traditionally, the Church has been a guardian and source of teaching on ethics, values, and lifestyles and in so doing has influenced human motivation and commitment for nearly 2000 years. In light of this history it seemed important to understand the past, present, and potential influence of the Christian Church on human behavior as it relates to the environment.

The main thesis tendered for the research effort was that the Christian Church, as a shaper of human behavior, can and should play an important role in promoting motivation and commitment for the resolution of environmental problems and the evolution of creative environments that are optimal for living. And if it attends in a serious, vigorous and systematic fashion to the implications of its central symbols and the findings of environmental science, the Church may significantly assist in bringing about the aims of environmental education as outlined by Roth.

The purpose of the study was to describe the past, present, and potential environmental education involvements of the Christian Church in the United States. The four-fold objectives of the study were to: 1) analyze the central tenets of Christianity and determine if they obligate the Church to be involved with environmental education; 2) determine the shape of church involvement with conservation and environmental matters prior to the first Earth Day; 3) determine the present scope of church involvement with environmental education; and 4) analyze the opinions of church

professionals and environmental educators towards future church involvements with environmental education.

In order to address the first objective, a thorough analysis of the Biblical foundations of Christianity was conducted. Findings suggested that old and new testament themes of a) stewardship; b) faith in God as both sovereign creator and savior; and, c) God's plan for unity between himself, humankind, and nature do obligate the Church to be actively involved in preserving the earth.

The second study objective was accomplished through documentary analysis. Findings indicated that the spirit of capitalism, fueled by the Protestant Reformation and the advent of the Industrial Revolution, engulfed not only the minds of Americans in the 18th and 19th centuries, but their churches also. Thus, the Church played little part in the conservation movement of the early 1900's or in the rise of environmentalism in the 1960's. Religious concern for the environment found some expression in the writing and activities of inspired individuals such as Thoreau, Muir and others.

Study objective three, pertaining to present church involvement with environmental education, was completed through development and administration of a mail questionnaire survey and documentary analysis. The survey instrument collected data pertaining to church involvement with environmental education in terms of "Educational program emphasis," "Direct work with environmental problems," and "Allocation of resources committed to environmental education." Subjects selected were regional and national church officers whose positions were likely to make them familiar with the environmental activities of their denominations. Church denominations participating in the survey were The American Lutheran Church, The Episcopal Church, The Roman Catholic Church, The Southern Baptist Convention, The United Methodist Church, and The United Presbyterian Church.

Survey results revealed that environmentally-related issues receiving most attention through church educational programs are world hunger, lifestyles, land stewardship, conservation of energy, and environmental ethics. Use of the printed word is the most popular form of addressing these issues. Direct programmatic outreach efforts are most apparent with world hunger and lifestyle education endeavors. Personnel and monetary resources allocated to environmental education are not substantial and appear to be assigned on a "special need" basis, although one denomination has created a national office of Environmental Justice and Survival. Clergy appear to receive training in environmental matters primarily through incidental exposure in various courses while in seminary school.

The final study objective related to the opinions of church professionals and environmental educators towards the role of the Church with environmental education. The objective was addressed through the development and administration of a nationwide mail opinionnaire survey. Subjects were 739 randomly selected members of the Conservation Education

Association (CEA), National Association for Environmental Education (NAEE), Religious Education Association (REA), and chief executive church officers (Bishops, etc.) identified from the directories of the six church denominations participating in the study. Subjects were asked to respond to a series of Likert-scale type statements concerning church relationships with environmental education. Data gained from an overall response rate of 64 per cent were subjected to statistical testing utilizing the chi-square test of significance and Cramers V test of association. Significance was established at the .05 level of confidence.

Results of the opinionnaire survey (Tables 1 and 2) indicated that subjects were quite positive in most cases about the Church being involved with environmental education. Of the four groups surveyed, Church officers, followed by subjects from the REA, NAEE, and CEA, were most supportive of church involvement. Environmental issues receiving strongest support for church involvement were world hunger, land stewardship, environmental ethics, population, lifestyles, and nuclear energy.

Questioned as to specific ways in which the Church should be involved with environmental education, subjects were most supportive of ways that did not involve the Church in complex technological matters. Strongest agreement among subject groups was for the Church to: a) be involved with teaching environmental responsibility; b) provide environmental training in seminary schools; c) be active in community environmental education; and d) make public position statements on environmental problems.

The preceding suggests considerable interest in environmental education by members of the clergy, church officers, and religious educators. Environmental groups would do well to remember recent research findings concerning the power of the clergy to influence people. "For the fourth time in a row, a national survey has shown that members of the clergy are ranked highest among professional groups in terms of 'honesty and ethical standards' by the American public" (Dunham, 1981). The importance of that finding by the George Gallup pollster organization is that clergy, if duly educated and motivated, could be valuable community environmental education teachers. Muth and Hendee found, in their research on "Technology Transfer and Human Behavior," that:

> ...the flow of new information in any social system is not random. Certain individuals are sought out for information, opinions, and suggestions about many things, and it is by them that innovations are most effectively diffused throughout a social system. But only a few key people in a community have such influence. (Muth and Hendee, 1980)

TABLE 1

COMPARISON OF AGREEING OPINIONS TOWARDS STATEMENTS CONCERNING CHURCH INVOLVEMENT WITH ENVIRONMENTAL MATTERS[1]

Statements	REA[2] %	CHURCH OFFICERS %	CEA[2] %	NAEE[2] %
1. Part of the mission of the Church should include a concern for the teaching of environmental responsibilities.	98.5	99.1	91.6	99.1
2. See Table 2 for statement #2.				
3. The Church should make advocacy or public position statements concerning environmental problems.	85.1	90.6	63.8	74.6
4. The Church should be concerned with the technological, economical, and political aspects of environmentaal problems as well as the moral/ethical consideration.	84.5	79.6	42.6	72.8
5. The Church should write and publish educational materials concerning environmental issues.	80.1	85.3	65.5	73.1
6. Church staff should actively participate in community environmental education.	79.4	84.6	79.6	80.0
7. The Church should employ at the national or state/regional level, professional environmental education resource people.	48.5	38.5	53.3	67.1
8. Seminaries or clergy training schools should provide instruction which relates religious and environmental issues.	89.6	93.2	86.6	91.4
9. Public schools should be most responsible for environmental education.	57.9	69.3	83.4	61.1

1. Figures are a composite of "Strongly Agree" plus "Agree" categories for each group.

2. REA (Religious Education Association), CEA (Conservation Education Association), NAEE (National Association for Environmental Education).

TABLE 2
COMPARISON OF AGREEING OPINIONS TOWARDS
CHURCH INVOLVEMENT WITH ENVIRONMENTAL ISSUES[1]

Statement 2

The teachings of the Church should deal with the following issues:

	REA[2] %	CHURCH OFFICERS %	CEA[2] %	NAEE[2] %
World Hunger	99.5	99.1	95.0	96.4
Solid Wastes	78.6	78.9	62.0	68.8
Toxic Substances	81.8	87.8	61.4	72.5
Air Pollution	87.1	89.6	63.8	71.3
Noise Pollution	80.4	77.0	62.0	63.8
Nuclear Energy	92.8	95.7	61.1	72.6
Conservation of, or Alternative Energies	88.6	91.4	75.0	80.1
Land Stewardship, Preservation of Natural Resources	92.8	99.2	95.1	96.4
Endangered Species	76.0	72.1	72.4	84.4
Population	91.8	93.9	81.9	90.2
Environmental Ethics	95.9	92.2	93.4	97.5
Water Pollution	88.6	90.3	67.2	75.1
Urban Environmental Planning	82.5	83.5	62.1	67.6
Life Styles	91.2	91.0	77.6	89.1

1. Figures are a composite of "Strongly Agree" plus "Agree" categories for each group.

2. REA (Religious Education Association), CEA (Conservation Education Association), NAEE (National Association for Environmental Education).

The task confronting those interested in furthering environmental education entails involving all groups and institutions within society that can help, as paraphrased from Lynton Caldwell, "internalize an ecological conscience in a critical mass of humankind!" (Caldwell, 1980) The Church and other religious groups are likely sources of assistance in bringing about "ecological conscience" and need to be included in planning environmental futures. Perhaps it is time for some environmental organizations to consider the creation of sections on Religion and Ethics within their ranks. As a beginning, these sections might be charged with encouraging various religious organizations to become affiliates. The considerable concern for environmental education expressed by members of the Religious Education Association, in the study just described, suggests that organization as a potential candidate.

Recent completion of an exhaustive study of its mission perspective has prompted the 32 Protestant and Orthodox denomination National Council of the Churches of Christ in the U.S.A. (NCCC) to be "more pluralistic in the way it extends its compassion and services" (Pohl, 1983). A powerful force in the civil rights movement of the 1960's, the NCCC may now be receptive to actively supporting environmental education endeavors.

Strong evidence exists to suggest that Americans are searching for new visions of the future and that they are receptive to religion playing an important role in defining those visions. The Connecticut Mutual Life Report on American Values in the '80's: The Impact of Belief convincingly reveals that U.S. citizens are dissatisfied with the ability of their elected leaders to solve political and economic problems and that this has precipitated a return to religion and traditional values. Authors of The Connecticut Mutual Life Report (CML Report) discovered that

> the impact of religious belief reaches far beyond the realm of politics, and has penetrated virtually every dimension of American experience. This force is rapidly becoming a more powerful factor in American life than whether someone is liberal or conservative, male or female, young or old, or a blue-collar or white-collar worker. (Pollock, 1981)

The report also identified a cohesive and powerful group of approximately 45 million "intensely religious" people who are likely to vote often and to become highly involved in their local communities. The CML Report concludes that "these Americans have been able to inject religious and moral issues directly into political discourse, extending their influence far beyond that which their numerical strength alone would suggest" (Pollock, 1981).

Aldo Leopold cried that "there is as yet no ethic dealing with man's relation to land..." but that it was "an evolutionary possibility and an ecological necessity" (Leopold, 1949). The time may have arrived for Leopold's land ethic to take hold if environmentalists will move from their field studies and laboratories to join with those who march to a calling

from beyond the physical dimension. As stated by Thomas Harblin, the

> ...nexus of science and religion can help man to direct the 'ecovoluntary' process towards goals more likely to yield continued life than those of present American culture. (Harblin, 1976)

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1. Five copies of each manuscript should be submitted to the Editor of Monographs in Environmental Education and Environmental Studies. Attach a cover sheet including author names, title, institution, address, and telephone number. Both the cover sheet and the first page should contain a brief title of the article. To facilitate anonymous refereeing, author names should appear only on the cover sheet. Authors should retain a complete copy of the manuscript for their files. An abstract of less than 200 words should accompany each manuscript (on a separate sheet).

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4. Manuscripts should not normally exceed 30 pages. Longer manuscripts can be considered, but only with prior approval of the Editor.

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