DOCUMENT RESUME

ED 229 282 SE 041 924

AUTHOR Sacks, Arthur B., And Others
TITLE Current Issues in Environmental Education and Environmental Studies. Volume VIII. Selected Papers from the Annual Conference of the National Association for Environmental Education (11th, Silver Bay, New York, October 15-20, 1982).
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.; National Association for Environmental Education, Troy, Ohio.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE Aug 83
CONTRACT 400-78-0004
NOTE 309p.
AVAILABLE FROM Information Reference Center (ERIC/IRC), The Ohio State Univ., 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212 ($7.75).
PUB TYPE Collected Works - Conference Proceedings (021) -- Information Analyses - ERIC Information Analysis Products (071) -- Reports - General (140)

EDRS PRICE MF01/PC13 Plus Postage.
DESCRIPTORS Attitude Measures; Citizen Participation; *Conservation Education; Curriculum Development; Elementary Secondary Education; Energy; *Environmental Education; *Global Approach; Higher Education; Instructional Development; *Literature Reviews; Nonformal Education; Postsecondary Education; *Program Descriptions; Science Education; *Teacher Education; Training Methods; Undergraduate Study
IDENTIFIERS Acid Rain; *Environmental Education Research

ABSTRACT

Provided in three major sections are selected papers presented at the 1982 Conference of the National Association for Environmental Education. The first part contains four invited addresses on environmental issues and two symposium papers related to the Global 2000 Report to the President. Topics of addresses focus on education/citizen participation, acid rain, and the Reagan Administration's environmental policy. The seven essays that follow give the practitioner's perspective on environmental education programs, approaches, and issues. Included in the final section are 14 research and evaluation papers. These are presented in four subsections focusing on: (1) environmental history (Unsung Heroes of the Environmental Movement); (2) environmental education research problems and issues, including an analysis of 10 years of research reported in volumes 3-12 of the Journal of Environmental Education; (3) inservice teacher education; and (4) four additional research/evaluation papers: a summary of arguments against use of values clarification in public education; an investigation of relationships between sex-role identification and degree of environmental concern, knowledge, and personal commitment; technique for facilitating citizen participation; and a discussion of photovoltaics in the soft energy path. Appended is a list of the "Selected Papers" volumes in the "Current Issues" Series. (JN)

CURRENT ISSUES

in Environmental Education and Environmental Studies Volume VIII

Selected Papers from the Eleventh Annual Conference of the National Association for Environmental Education

Edited by

Arthur B. Sacks
Louis A. Iozzi
Richard J. Wilke

with a Foreword by
Reid A. Bryson

The National Association for Environmental Education
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Published by

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The Ohio State University
College of Education and
School of Natural Resources
1200 Chambers Road, 3rd Floor
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August 1983

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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This publication was prepared with funding from the National Institute of Education, U.S. Department of Education under contract no. 400-78-0004. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or U.S. Department of Education.

Preface to Volume VIII: Changes on the Horizon

The Eleventh Annual Conference of the National Association for Environmental Education (NAEE) was held 15-20 October 1982 at Silver Bay, New York. Approximately 250 individuals from 31 states, the District of Columbia, Canada, West Germany, and India participated. We were especially pleased that Dr. Desh Bandhu, President of the Indian Environmental Society and Secretary of the Asian Environmental Society, and Swami Yuktananda, Founder of the Center for Value Orientation and Environmental Education in Calcutta, were both able to attend.

The essays in this volume represent the best of the Conference papers submitted for editorial consideration. Current Issues has been designed to provide both environmental applications -- the practitioner's perspective -- and the findings of original research and scholarly analysis -- the researcher's perspective. Our goal has been to integrate in one Volume the exploration of issues facing environmental educators with sound environmentally-related research and scholarship. The volume serves a community which consists of elementary and secondary educators, those associated with non-formal educational establishments -- public agencies, nature centers, non-governmental environmental groups and organizations -- and environmental scientists and researchers associated with colleges, universities, and research establishments in the public and private sectors. This community is represented in the membership and sectional structure of NAEE.

The make-up of the editorial staff and manuscript reviewers who have kindly volunteered their time and talent have been selected so as to insure that the breadth of interests and expertise is wide enough to accomodate NAEE's diverse membership and the wide range of papers presented at our annual Conference.

Last year the Current Issues format was slightly altered. In addition to a section on Environmental Education Applications -- The Practitioner's Perspective, and a section on Research and Evaluation -- Refereed Papers, Volume VII included a section of Invited Addresses and Symposia. We have continued this approach and are pleased to be able to provide our readers with the addresses presented at the Eleventh Annual Conference by Robert F. Flacke, Commissioner of New York State's Department of Environmental Consercation; the Honourable John A. Fraser, member of the Canadian Parliament for Vancouver South; David Hawkins, Senior Staff Attorney with the National Resources Defense Council; and Senator Gaylord Nelson, Chairman of the Wilderness Society. In addition, we are pleased to be able to include presentations from an invited symposium on Global 2000.

This year we have also been able to continue the practice of inviting a guest "Foreword" from a figure prominent among the environmental community to comment on environmental education and important relevant issues. This year we feature Professor Reid A. Bryson, Director of the Institute for

Environmental Studies at the University of Wisconsin-Madison. Dr. Bryson is internationally recognized for his work in meteorology and long range climatic forecasting. He was one of the nation's small core of distinguished scholars who first realized the need for both interdisciplinary environmental studies and for new mechanisms and institutions designed to engage in such study. We are most pleased that Professor Bryson accepted our invitation.

Although the Current Issues series has met many of the needs of NAEE, the proceedings format necessarily has never fully been able to capture the potential of possible publications from an organization such as ours. Though the editorial staff has sought over the years to enhance the publication's quality, raising editorial standards by developing a mechanism for peer review, still, as a conference proceedings, Current Issues is limited, open only to those able to attend the annual Conference and present papers, panels, and symposia. Those in the environmental community who have much to offer, but who have not been members of NAEE, or who are members and have been unable to attend, particularly in difficult financial times, have been unable to reach NAEE's membership through our own professional publications.

NAEE's Publications Committee therefore this year sought to remedy this situation with a change in NAEE's overall publication strategy. The Committee's three-part recommendation was adopted by the Board of Directors at Silver Bay:

In addition to an annual Conference proceedings (Current Issues) and a periodic newsletter (the Environmental Communicator), the Publications Committee would develop a monograph series. Papers would be published either occasionally and/or as an annual review of the best work representing research, theory, and practice in environmental education and environmental studies. Papers would be solicited by an editorial board representative of NAEE's sectional structure. All papers would be subject to peer review. Membership in NAEE and attendance at NAEE Conferences would not be required for authors publishing in the monograph series.

We believe that this array of publications will better serve NAEE membership and the environmental community at large. We believe that this new venture represents the direction of "maturing influence" to which Professor Bryson refers in his Foreword.

We could not close this Preface without a vote of appreciation to John Disinger, Associate Director of the ERIC Clearinghouse for Science, Mathematics and Environmental Education at The Ohio State University, for his very able assistance. ERIC has supported NAEE and Current Issues since its beginnings, and there is little doubt that NAEE owes ERIC, The Ohio State University, and John Disinger more than it can repay. Likewise, we wish to acknowledge the support of the institutions which are the academic homes of the editors: The Institute for Environmental Studies of the

University of Wisconsin-Madison; The Institute for Science, Technology and Social Science Education of Rutgers-The State University of New Jersey; and the College of Natural Resources of the University of Wisconsin-Stevens Point. Their positive contributions in staff time, facilities, and supplies and expenses continue to make a quality Current Issues effort a possibility.

Arthur B. Sacks, Chair, NAEE
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Editors, Current Issues VIII

December 1982

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1983 Conference — Crossroads: Society and Technology

Crossroads: Society and Technology has been identified as the theme for the Twelfth Annual Conference of the National Association for Environmental Education, scheduled for September 30-October 5, 1983, at the Hoyt Conference Center, Eastern Michigan University, Ypsilanti, Michigan. Subthemes are:

Ecological Effects of Technology
Culture and Technology
The Built Environment
Technology and Resources

For information concerning the program, contact the Conference Program Chairperson:

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Each of NAEE's three sections is participating both in conference planning and in the organization and presentation of pre-conference activities. Contact:

For the Environmental Studies Section - Dr. Richard L. Perrine, Engr. 1, Room 2066, University of California, Los Angeles 90024; (213)825-2636;

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For the Non-formal Education Section - Mr. Edward McCrea, 10718 Ashby Place, Fairfax, VA 22030; (202)343-7116.

Other conference-related information, including registration information, may be obtained from:

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The editors would like to thank those listed below who have graciously volunteered their services as reviewers for the Current Issues series. Reviewers are selected from within NAEE ranks and from without in an attempt to bring a broad scope of scholarly and professional expertise to bear upon submitted papers.

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Contents

Research and Evaluation — Refereed Papers

Environmental History: Unsung Heroes of the Environmental Movement

Environmental Education Research

Inservice Teacher Education

Other Refereed Papers

FOREWORD

Foreword

We, in Madison, Wisconsin, were recently told that natural gas prices were soon going up twenty percent. As a consequence, I bought a new furnace forty percent more efficient than the one I had. That should handle this increase and the next increase of about twenty percent and in the meantime pay for itself. Since the new one is rated at ninety-seven percent efficiency, that tactic won't work after the second increase. Since I think that the prices will continue to rise, all I have done is buy time until the increased cost comes home to roost.

Let me give another example of a similar situation. Some years ago California passed quite strict emission control laws for automobiles. The pollution levels decreased in some areas, and stopped increasing in others, but there are indications that while the emissions per car were reduced, the numbers of cars has increased enough to bring the pollution levels back or start them increasing again, albeit with a somewhat different mix of pollutants. The controls bought time. When will another tightening of the standards be necessary?

Consider the following thought experiment. It is said that one of the main problems with feeding the world is poor distribution. Let's take a conservative estimate that fifty percent more people could be fed by an optimum distribution system. Without a dramatic increase in production of food, the world would be in the same position it is now in twenty to fifty years. Then what? Have we simply bought time? Will production actually increase fast enough to extend the time before we cannot feed everyone indefinitely? Ken Watt (University of California -- Davis) estimated a loss of one to two acres of U.S. farmland per person of increased population. Another estimate I have heard is that the U.S. loses about four hundred fifty acres of agricultural land per hour. Whichever estimate or modification thereof that one uses, simple calculation shows that it will not be many decades before there will be no food surplus to distribute, or export to pay for oil, computer games, foreign automobiles, etc.

The comments about my furnace show that there are limits to technological fixes. No system can be one hundred percent efficient in any case. The comments about California automobiles illustrates that the technological fix of pollution is only a temporary palliative to be outstripped by the continued increase of source numbers. One must remember that the total input of pollutants into the environment is equal to the population times the per capita consumption or use of resources times the production of pollutant per resource unit used. The last term in this simple relationship is the one most often tackled with technological fixes; however, since there is a limit short of perfection, the pollutant input can never be zero, and ultimately, if population rises, pollution will also rise (since we cannot use zero resources per capita).

What does that have to do with environmental education? Simply put, for the environmental movement to really mature we must go beyond short-term alleviation of the symptoms of the environmental problematique. We must base our environmental education on a set of fundamental paradigms and focus on the primary variables. The "Ooh-ah, what a mess!" days are over. Now let us get down to the analysis-in-depth, long-term solution work. That is what "Global 2000" is all about, and where NAEE and Current Issues can be a strong maturing influence.

Reid A. Bryson
Director, Institute for
Environmental Studies
University of Wisconsin-Madison

December 1982

INVITED ADDRESSES

Address to the Eleventh Annual Conference of the National Association for Environmental Education, 17 October 1982:

Education and Citizen Participation — New York State's Approach to Environmental Education

Robert F. Flacke[1]

Good afternoon. On behalf of Governor Hugh Carey, I am pleased to extend a warm welcome to New York and, in particular, to our beautiful Adirondack Mountain Region.

Here in Silver Bay, we have only to look out the window to remind ourselves of why we got into the environmental protection business in the first place, and to reinforce our hopes for the future. For New Yorkers, these lakes and mountains provide a continuing inspiration. And to our visitors from across the country, I am happy to be here to share your first glimpse of one of our most unforgettable and compelling regions.

It is especially gratifying that your agenda includes field study of the Lake Placid Olympic facilities which will give you a close-up of both the resources and the special problems that characterize the Adirondacks.

You have taken upon yourselves an ambitious week's work in your theme, "Global 2000 -- Which Path to the Future?" Your leadership was exactly right in deciding that environmental issues require the perspective of a decade or more.

As you probably know, operating within that long view is a luxury that we in government do not usually have. However, I am pleased to have this opportunity to let you know how New York is approaching the years before the end of the century: what goals we have set for ourselves; and what our estimate is of the future of this state's environment. And to underline the fact that, like you, we see education as an important aspect of the effort to maintain our rich environment and high quality of life.

The great diversity of New York's resources raises both special opportunities and unique problems. A large portion of the state's land is wilderness or near-wildreness, like the Adirondack Region. A small -- but significant -- portion of the state is so highly urbanized that the concept of environment takes on a totally different meaning from other parts of the state. The remainder of New York boasts a varied landscape of rivers, roling hills, lakes, and flat, fertile agricultural land.

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[1]Commissioner, New York State Department of Environmental Conservation, 50 Wolf Road, Albany, NY 12233.

We have an abundance of water -- almost unbelievably varied fish and wildlife -- some natural gas and minerals -- miles of timber and other resources -- mountains, farmland, ocean beaches, a seaway canal and two Great Lakes, as well as harbors and important marine resources.

We also have acid rain; lakes and rivers which are still recovering from earlier pollution; chemical contamination found in some fish and wildlife, and some groundwater supplies; development pressures on farmland and wetlands; growing pains in our natural gas production; and numerous other environmental problems to confront in a time when our economic base has been shrinking.

We acknowledge the problems, but, at the same time, we look to our natural resources as our hope for the future. This means that my Department's constituency includes not only environmentalists and preservationists aware that New York's beauty and diversity demand protection, but also far-thinking businessmen who know that clean water, clean air, abundant timber, and other renewable resources, natural beauty and outdoor recreation are all resources that will support economic stability and growth into the next century.

Earlier this year, the Department of Environmental Conservation (DEC) issued a publication entitled, "A Challenge for the 80's". We listed our principal goals and explored strategies to meet these goals. It took us two years to develop these goals and strategies, with an advisory committee and many hours of discussion with the general public.

And that two years of intensive discussion with the public, along with the very concrete evidence of strong public pressure brought to bear this year on Congress not to accept further reductions in federal environmental programs, has led me to conclude that the environment is no longer the concern of only an esoteric few. Your efforts and ours have brought home to millions of ordinary citizens the fact that environmental problems are everyone's problems, and their solutions benefit everyone. I think this is a real achievement, and one of which both environmental educators and New York's state government should be very proud.

Some of the goals we articulated in the challenge are pretty ambitious:

--proper management of hazardous waste and cleanup of hundreds of old dump sites;

--resolution of the national and international acid rain problem;

--securing the resources to reconstruct our water supply and sewer infrastructure;

--protection of the state's groundwater resources;

--sound management of timber and wildlife resources, as well as preservation of prime farmlands; and

--appropriate development of the state's energy resources.

However, the public's interest and support give us confidence that even these far-reaching goals can be achieved.

As environmental managers, we will continue to rely upon the work of environmental educators to meet increasingly sophisticated communications challenges in the future. We know now some things that we didn't know 12 years ago when my Department was founded -- environmental problems are almost never simple, and there are no "quick fixes". Invisible contamination can be as great -- or greater -- a problem than visible smoke or waterborne solids, unsightly junk or noise.

Announcing and explaining environmental problems to a sensitive public carries with it the risk of provoking unreasonable fears, fears which may actually hinder a solution.

Developing workable solutions for environmental problems becomes immeasurably harder when many segments of the population want to be included in the process.

Obtaining public support for proposals or projects aimed at solving environmental problems is a staggering job when the proposal, as it nearly always does, requires costly controls, changes in someone's business operation, or additional recordkeeping; or demands siting of a facility which citizens regard as dangerous or obnoxious; or inconveniences large numbers of people.

And the educational challenge is even greater when the proposal is designed not to correct an existing and acknowledged problem, but to prevent the development of a problem in the future.

DEC's efforts to respond to this challenge include the use of Department-produced publications and media announcements; working with the press to ensure accurate news; state-sponsored learning facilities which offer "hands-on" natural resources experience, sometimes the first such experience participants ever have.

In addition to these efforts to transmit the Department's message, however, we are developing, sometimes with noticeable growing pains, a citizen participation program which reaches out for two-way communication. During the past two years, we have assigned citizen participation specialists to each of our nine regions and to every central office program, to develop and maintain consistent contact with interested groups and individuals, and to help bridge the gap of understanding that often prevents resolution of critical environmental dilemmas.

We are relying upon the communications and human relations skills of our citizen participation experts to bring together the citizens (whose support is essential if environmental programs and projects are to be effective) and our professional staff (who are assigned the responsibility of developing and overseeing our environmental solutions).

We want these contacts to be fruitful for both sides, offering our experts access to information about the localities where they are working which cannot be found in the usual sources, and clarifying for citizens the rationale behind the Department's decisions and actions.

We hope the outcome will be not only more effective government programs, but also private efforts to do things which government is not able to do. Bringing about this desirable state of affairs is one of the greatest challenges now going for an environmental department, and is reflected in another of the goals stated in our challenges publication, "Involvement of peoplein meeting environmental objectives, recognizing that government's resources will not be sufficient". Developing this productive partnership is our principal environmental education goal for the remainder of the century. What we need is a corps of environmental educators trained not only to promote the public's appreciation of our natural resources, and to point up environmental problems, but also to bring people together to resolve conflicting interests.

This ought to offer the people you train a challenge big enough for their best efforts, a stimulus which will bring some top-notch people into the field of environmental education.

The stakes are high -- not the extinction of an occasional obscure species, as some would like to argue, but the economic and environmental future of millions of people. Together, we must foster and maintain consciousness of this fact, so that it will not be possible for shortsighted interests to cheat our citizens of their birthrights.

Address to the Eleventh Annual Conference of the National Association for Environmental Education, 17 October 1972:

Acid Rain: The Canadian Perspective

The Honourable John A. Fraser[1]

You have asked me to address the problem of acid rain from a Canadian perspective. It is simply this: acidic precipitation falling in central Canada and the Maritime Provinces threatens the life of thousands of lakes, rivers, and streams. Canada is huge: Ontario, Quebec, and the Maritime Provinces encompass a large part of it. These vast reaches of terrain are highly susceptible to acidic percipitation, because, in scientific terms, the soil and water bodies just do not have the buffering capacity to resist continued acidic loadings.

In these areas about one-half the depositions originate in the United States. In parts of Ontario depositions originating in the United States account for about seventy percent of the total. Lest you think that we Canadians are placing the blame on our neighbour, let me dispel that notion: about twenty-five percent of the acid rain ravaging the New England States originates in Canada. We do not consider it a question of who is doing what to whom. We are doing it to each other. Put in stark terms, it is the worst environmental hazard to ever face my country. We believe that the same is true for the United States, although in proportional terms the portion of the United States that is at risk is not as great as the portion of my country that is threatened. On the basis of the scientific information available to us, we believe that if present loadings are not significantly decreased, great numbers of water bodies in Canada - and in the United States - will be ecologically dead in a period of fifteen to twenty years. We know the damage that is being done is real. For all practical purposes it is irreversible. There is not much time to act. We do not know everything, in scientific terms, about the acid rain phenomena, but we believe that we know enough to take action. We do know this: Canadians cannot solve the problem all on their own. You cannot solve the problem on your own. And, because of this, we have asked Americans to enter into a joint Canada/U.S. Agreement under which effective acid rain prevention and abatement strategies will be devised and implemented. We know we have allies in this cause among you, but we have enemies as well. And in Canada there is a growing fear that on this issue there is very little political determination in the United States to do anything about it. In fact there may be something worse - political determination to do nothing about it.

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[1]Member of Parliament, Vancouver South, House of Commons, Parliament Buildings, Ottawa, K1A 0A6, Canada.

Now you can ask: if all of this is so, why can't something be done about it, and, why are we just hearing about it now? A brief chronology of events is helpful.

In 1972 the United Nations Conference on the Human Environment was held at Stockholm. A Swedish scientific paper presented at that conference stated that acid rain was causing fish kills and the acidfication of hundreds of lakes to the point where they could no longer sustain aquatic life. Potential forest and crop damage was noted. The effects of corrosion to physical objects was identified. The report called it an environmental diasaster to Sweden. But the report went on to say:

> "A similar situation might possibly exist within certain regions of Canada and the North Eastern parts of the U.S.A."

It then asserted:

> "A detailed study of the likelihood of such a development is a matter of urgency."

I quote this to emphasize that in scientific and governmental circles the warning had clearly been issued.

Subsequently scientific studies done in North American began to attract attention. A Canadian, Dr. Harold Harvey, reported that fish kills in Ontario lakes were linked to acid rain. American scientists, Likens and Coghil, published reports in 1974. By 1976 and 1977 the Government of Canada and the Government of Ontario were aware that rain in southern Ontario was falling with pH values of 5 to 4 and lower. A Canadian Fisheries ministry referred to it as an "environmental time bomb". But, except for some desultory press reports, there was little public perception of the problem. However, Canadian and U.S. scientists were beginning to collaborate, albeit quietly.

In the autumn of 1978 a then minority Conservative government in Ontario was forced by the combined New Democratic and Liberal party opposition to establish a legislative committee to consider the effects of acid rain in Ontario. In the spring of 1979 the Liberal government of Canada was replaced by the Conservative Party and, among other things, I was appointed Minister of the Environment. A political decision was taken to launch an aggressive campaign to, first, publicize the phenomenon and its dangers; secondly, to pursue with all haste negotiations with President Carter's administration for a Canada-U.S. acid rain abatement agreement along the lines of the Great Lakes Water Quality Agreement. As this campaign opened, the International Great Lakes Water Quality Board submitted a report which dealt in part with acidic precipitation.

It stated:

> "Virtually all of Eastern Canada and portions of the United States are experiencing annual sulphate loadings

1 to 3 times the level at which acidification begins to take place in susceptible aquatic ecosystems. Southern and Central parts of this region appear to be experiencing loadings as high as 10 times their assimilative capacity. As a result, acute acidification of some lakes has already occurred and many more are showing serious signs of stress. The most susceptible lakes may be irreversibly harmed within approximately 10 years and less susceptible lakes within 15 years ...".

The acidity of precipitation in the Northeastern U.S. and Eastern Canada is generally 10 to 40 times greater than normal ... In general, about two-thirds of this acidity can be attributed to oxides of sulphur and about one-third to oxides of nitrogen..."

Let me emphasize some of the words I have just quoted: "loadings 1 to 3 times the level at which acidification begins to take place." "Southern and central parts... (with) ...loadings as high as 10 times their assimilative capacity..." "10 to 40 times greater than normal..." "...irreversibly harmed..."

These findings were not dreamed up by public relations firms, or high-priced lawyers hired by environmental groups. These findings were published by scientists, both American and Canadian, based on data and information. As Minister I was convinced that, unless officials and scientists were either lying to me or were somehow grossly negligent, there was a problem of awful magnitude that required a strong political response. Others were of a like mind. Very rapidly a consensus formed in Canada that included both the federal and provincial levels of government and which crossed political party lines. That consensus was clear: stop acid rain.

I have been asked repeatedly by Americans how did we get a consensus so fast? The answer to both questions is that in Canada the fight against acid rain has been to a considerable degree lead by politicians. I have no sense of false modesty that prevents me from saying that on this issue in Canada we have had that rare phenomenon; politicians actually leading public opinion. The effectiveness of the campaign is illustrated by the fact that less than one year after it commenced, of people polled in Ontario, our most populous province of 8 million, over 80% knew about acid rain and its consequences.

Industry and utilities in Canada are not by nature more altruistic than in the United States. The difference was that the province of greatest emissions is Ontario, which is also a province at great risk. The chief executive officers of these corporations and utilities live continually with the concern and sometimes the wrath of their immediate friends and neighbours. But, again, because of political determination at all levels and within all parties, the kind of campaign industry has waged in your

country could not get going because there just was not, and is not, any political home to go to. In Canada industry is no longer wasting time asking whether there should be a clean up. They are asking how soon, to what degree, and, please let us know what the rules are.

I do not want to mislead you - there is some grumbling, and sometimes hot arguments - but they are over methods and the time frame of clean up, not over the principle of clean up. For example, most of you have heard of International Nickel Company of Canada, or Inco as it is known, at Sudbury, Ontario. Inco is the single greatest emission source in Canada. Inco, naturally, has been the focus of criticism. Yet Inco will have cut its emissions by 45% by 1983. But what illustrates my point is a letter from Dr. Stuart Warner, Vice-President, Occupational Health and Environment of Inco, to the Director of the Energy and Minerals Division of the United States General Accounting Office. Dr. Warner's letter was in response to this question: whether Congress should take regulatory action now or wait until better scientific information on acidic precipitation becomes available? Extracts from Dr. Warner's letter are of interest:

> "I believe some action should be taken now but it must be recognized that further steps may be required in the future."
>
> "Given sufficient time, science might develop a fairly incontravertible understanding of acidic precipitation, although such an outcome is far from certain. (After all science isn't very good at predicting if it will rain in Washington tomorrow let alone predicting what substances the rain will contain or stating how they came to be there). If this should happen those groups whose positions are no longer supported by science will fall back on their basic economic, political, and emotional arguments and the real controversy will begin."
>
> "Why not lay the ultimate arguments on the table now instead of avoiding dealing with them until scientific uncertainty is reduced to a tolerable level?"

Then he delivers the clincher, the bottom line of logic. Dr. Warner turns the allegation of scientific uncertainty on those who presently propound it most vociferously:

> "Imagine for instance, that science could demonstrate clearly that emissions from coal-fired power plants in the U.S. Midwest were causing damage in Canada and the Northeastern United States. Surely no one believes that the inhabitants, industries, elected officials, utilities and coal interests in the midwestern states would say, 'Thank you for bringing this matter to our attention; we'll set it straight immediately.'"

The point is that these comments come from a Canadian operation whose senior officers have accepted the reality that something must be done. From a strictly scientific position Dr. Warner adds:

> "I have seen no scientific argument advocating increased emissions of SO_2 and NO_x. I have seen many arguments that even present levels of emissions are too high. The minimum response I expect from someone who places great weight on science would be to ensure that no increase in emissions would be tolerated. This is not what we are seeing in the U.S.."

Let me return to my chronology. In 1979 I met with Mr. Doug Costle of the Environmental Protection Agency to discuss a possible Canada-U.S. acid rain abatement agreement. Discussions continued steadily and useful progress was made. My party was defeated in the general election of 1980. However, my successor, the Honourable John Roberts, the present Minister of the Environment, continued the negotiations. The result was a U.S.-Canada Memorandum of Intent signed between our two countries in August of that year.

The Memorandum of Intent is a serious document. It recited that Canada and the U.S. "share a concern about actual and potential damage resulting from transboundary air pollution... including the already serious problem of acid rain" and "share also a common determination to combat transboundary air pollution in keeping with their existing international rights, obligations, commitments and cooperative practices, including those set forth in the 1909 Boundary Waters Treaty, the 1972 Stockholm Declaration on the Human Environment, the 1978 Great Lakes Water Quality Agreement, and the 1979 E.C.E. Convention on Long Range Transboundary Air Pollution."

The Memorandum of Intent went on to say:

> "In particular, the Government of Canada and the Government of the United States of American intend:
>
> 1. to develop a bilateral agreement which will reflect and further the development of effective domestic control programs and other measures to combat transboundary air pollution;
>
> 2. to facilitate the conclusion of such an agreement as soon as possible; and,
>
> 3. pending conclusion of such an agreement, to take interim actions available under current authority to combat transboundary air pollution."

As an annex to the Memorandum it was agreed to establish technical and scientific work groups "to assist in preparations for the conduct of negotiations on a bilateral transboundary air pollution agreement."

The Memorandum of Intent used words that reflect many decades of cooperation between our two countries. But it does something else: it reiterates in plain language that anyone can understand the long-standing common-law tradition of both our countries that you must enjoy and use your property in such a way that you do not damage your neighbour.

When President Reagan visited Ottawa in March 1981, he made it clear that his administration considers it is bound by the Memorandum of Intent. Indeed working groups were established and various meetings and exchanges of information, data, etc. have taken place.

I would like to report that all is going well. I would like to tell you that in a spirit of cooperation and mutual concern for a common problem Americans and Canadians are setting an example to the rest of the world in solving transboundary pollution problems. I would like to tell you that Canadians and Americans, who boast of the reciprocal goodwill that results in the longest undefended border in the world, are joining together in common cause to eliminate a scourge that threatens both their countries. I would like to tell you that the common heritage of language, literature, law and freedom that in wartime put together a superb and brave military force of Canadian and American soldiers serving in a single command for special operations still binds us together in mutual respect and joint action. I would like to say such things - as President Reagan did to the Canadian House of Commons in March 1981. But I can't. I deeply regret that I cannot say these things because, in fact, the negotiations are going very badly.

The negotiations are going very badly because the United States Administration does not accept that enough is known to establish a regime of controls. Canadians involved in the negotiations say that there is constant interference by the Administration in the process. Raymond Robinson, formerly an Assistant Deputy Minister in the Department of the Environment and presently Executive Chairman of the Canadian Federal Environmental Assessment Review Office, in a recent speech to the Seventh symposium on Statistics and the Environment conducted by the National Academy of Sciences charged that "despite substantial agreement among the scientists within the (work) groups (established under the Memorandum of Intent) in the production of draft reports, we were treated to the sight of non-experts re-writing the conclusions and unhappy scientists being quietly reassigned." He stated that there have been "major turnovers in the U.S. membership of one group and three U.S. chairmen in succession in another."

He went on to observe: "This pattern of external interference or inadequate support of the work has continued over the past year and a half. Our (Canadian) scientific experts have attended scheduled meetings and had virtually no one turn up on the United States side or had people arrive whom they had never before seen." He commented that the meetings are usually held in the United States because of lack of travel money on the U.S. side. Mr. Robinson asserts that "our people have occasionally succeeded in laboriously putting together a draft only to have it greatly

changed by United States officials who had not been involved in the discussions that produced it."

Under the Memorandum of Intent there are five work groups, each with Canadian and American co-chairmen. Work group 1 concentrated on the effects of acidic precipitation on a variety of receptors - lakes, fish, forests, wildlife, crops, buildings and man himself. This group was to come up with a target loading for sulphur on the basis of European and North American data. After much work there was basic agreement among the Group 1 scientists that a loading of 20 kg of wet sulphate per hectare per year would protect moderately sensitive lakes and rivers. Mr. Robinson says that at the "eleventh hour" the U.S. side reversed itself and refused to accept the previously agreed figure. It was on the basis of this figure that Canada proposed in February 1982 to reduce Canadian sulphur emissions by 50% east of the Saskatchewan-Manitoba border with similar action in the United States. In June 1982 the Administration compeletely rejected the proposal. Again, the reason was not enough is known about acid rain.

Now, it is interesting, and also a little peculiar, that at the twenty-one nation conference on acid rain in Stockholm in the summer, the United States representative endorsed a sulphur loading target approved by that conference that is nearly twice as strict as that rejected by the U.S. side of the work group. As Mr. Robinson remarked: "...It is very clear that the Memorandum of Intent -- supposedly defining agreed intent - is currently masking two different intents - one to resolve the problem - the other to dissolve it - make it disappear in a torrent of alleged scientific doubts." It is impossible not to ask why a United States representative would approve target loading objectives in Europe that other United States representatives would reject in North America on the terribly questionable pretext that not enough is known about acid rain. To ask the question is to answer it and the answer is disturbing, because it raises the question of the bona fides of the actors in the piece.

At the same Stockholm Conference the official representatives of all countries, including the United States, signed a Ministerial Statement. Paragraph 5 of the Statement read:

> "It was noted that in North America the Governments of Canada and the United States are developing a bilateral agreement which will reflect and further the development of effective domestic control programmes and other measures to combat transboundary air pollution and are taking interim actions available under current authority."

That Statement was approved by the United States delegate yet - as I have shown -- all the indications are that everything possible is being done to avoid or postpone "measures to combat transboundary air pollution."

Paragraph 11 stated:

> "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 policies are strengthened."

Now that Statement is the result of delegates from twenty-one countries who accepted the scientific findings of 107 acid rain experts assembled at the conference including Americans and Canadians. How can anyone reconcile the United States signing that Ministerial Statement and then insisting that no "additional control measures" be implemented and refusing to strengthen "existing policies?"

I do not believe it can be reconciled in any rational way. There are words to describe such conduct and none of them are particularly flattering. But what amazes me is that the people perpetrating this hokum must think the rest of us can't figure them out.

No one in Canada has said we know everything about acid rain. What we find so difficult to accept is the apparent determination of some people in the United States to fight in every way possible to put off taking action. When one considers some of the propaganda put out by special interests in the U.S. over several years, and tie their comments with the difficulties within the negotiation proceedings, it becomes harder and harder to believe it is all coincidence. Let me give some examples:

> On May 28, 1980, Mr. William Poundstone, then Executive Vice-President of Consolidation Coal Company, appeared before the U.S. Senate Energy and Natural Resources Committee. He issued a press release and I quote from it:
>
> > "It is not clear that acid precipitation does in fact cause acidification of lakes, particularly in the eastern U.S., or cause other severe ecological damage."

He then said:

> > "It would be unwarranted, unjustified and unwise for the nation to embark on a course of regulatory controls based on scant, conflicting and inconclusive data."

Did he really believe this - or was he setting out the first line of defense against doing anything - or, at least - reaching for room for indefinite delay?

Here is an excerpt from "Perspective on Acid Rain" put out by the Edison Electric Institute in 1981:

> > "It is not surprising to find tomatoes are acidic but most people are surprised to learn that a delicious

pear can be more acidic than a tomato or that bananas are nearly as acidic. All of these have pH values well in the range of the rain that is the subject of scare headlines in the popular media."

How does one respond to such supercilious nonsense? Who wrote this trash? And who, among the vast number of hardworking, capable and intelligent executives of industry and utilities, would ever admit to trying to make an argument with such trivia? None of them - but someone hired public relations flacks to grind out this inane foolishness.

Here is another from the Consolidation Coal Company in 1980:

"There are a host of natural as well as man-made sources of these compounds (sulphates and nitrates) including lightning, volcanoes, sea spray and organic decay of vegetation."

Tell that to the Scandinavians!

Then there is the conspiracy theory, first promulgated by Mr. James M. Friedman, legal counsel to Cleveland Electric Illuminating Company. His thesis is that the acid rain issue was dreamed up by Prime Minister Trudeau and the present Liberal Government of Canada to get our minds off energy issues, or the constitutional debate, or federal provincial relations, etc.

He says: "The political and economic causes of the acid rain issue on the Canadian side of the border must be evaluated against the intensive program of energy resource and economic nationalism orchestrated by the Canadian Government." As I have said before, Mr. Friedman, and for that matter both Republicans and Democrats in Congress, may criticize aspects of Canadian policy. He and they have every right to do so. So do millions of Canadians.

However, after linking the issue to energy policy he then links it to "Federal-provincial tensions over the status of the constitutional powers of each level of government" and talks of "political and economic conflicts which have encouraged the Canadian Government to seek external issues which might unify Canadian constituencies. The acid rain issue is clearly one of these."

Mr. Friedman continues:

"However, it should be clear that whatever the atmospheric or chemical causes of acid precipitation, if any, may be, the causes of the acid rain political controversy are clearly traceable to carefully planned Canadian national energy objectives and the intense domestic Canadian controversy over federal and provincial control of natural resources and energy."

Mr. Friedman's thesis, that acid rain is a puff invented by the present Liberal Government, is still with us. Consider this from Fortune Magazine, September 20, 1982:

> "Canada's evident eagerness to sell electricity to the U.S. has aroused some suspicions about its approach to the acid rain problem, which the Canadian Government has lately ballyhooed into a major diplomatic issue."

The articles continues:

> "Canadian electricity may have a lot to do with the hysteria over acid rain",

Huffs Congressman Clarence J. Brown, an Ohio Republican and gubernatorial candidate in this November's election:

> "Keeping utilities from burning high sulphur Ohio coal would eliminate one source of competition for the Canadians."

There is now a new approach by some in the United States, not just to misrepresent the Canadian position but to assert that Canadians have no right to dare express their concerns, not just to the Administration, but to the American people. Business Week, October 18, 1982, reports U.S. officials as saying:

> "The draconian approaches used by the Canadians are not going to fly. If the U.S. engaged in the same type of activities in Ottawa, it would be a national outrage."

Now let me respond.

Mr. Friedman's conspiracy thesis is clever but it just is not so. The acid rain issue was not raised by the present Liberal Government. It was raised by a Conservative Government of which I was a minister. We were openly pro-American. The government I served was working to restore tattered relations with your country. We were increasing our armed contribution to NATO, supported you over Afghanistan, supported the Olympic boycott and limited grain shipments. I am, as all Canadians are, a little embarrassed at the American outpouring of gratitude to Canada when we got your hostages out of Iran. Embarrassed because, frankly, we just assumed you'd have done the same for us. But we did it and I was a member of the cabinet that made that dangerous but necessary decision. The point is: it was a Conservative Government, not Mr. Trudeau's government, that commenced the campaign to stop acid rain. The present Liberal Government continued that campaign - and with our support.

The Canadian policies Mr. Friedman refers to and about which many Americans complain were not Conservative Government policies nor are they presently Conservative policies. Mr. Friedman could have found all this

out by simply telephoning any former Conservative cabinet minister, including myself, before inventing, for the purposes of his clients, a wholly erroneous and, indeed, irresponsible interpretation of the Canadian concern about acid rain.

Of course Canadians are interested in selling electricity to Americans. The great James Bay project in Quebec was planned on the assumption that some of the electricity generated would go to the U.S. At that time, in the late 1960's and early 1970's, the then government of Quebec had never heard of acid rain.

As for our draconian methods - like speaking directly with Americans, like establishing a Canadian Coalition Against Acid Rain office in Washington - subject to American law - what's draconian about that? As for the notion that if we were causing you great harm and you said so publicly in Canada there would be national outrage, that is a view from the dark ages. We are a democracy, quite accustomed to free speech, and, I might add, much more aware of what Americans think and say than is often realized. Americans would not even have to say it in Ottawa. We hear and read most of what you say in Washington. If the situation were reversed, and you told us about it, publicly, in Canada, I would be the first to plead your cause.

Kathleen Bennett of the Environmental Protection Agnecy was in Ottawa this week just past. In a television broadcast she said, referring to tall stacks:

> "It's precisely the kind of unintended side effect that we've got to avoid this time as we devise the program to solve the acid deposition problem."

That is very strange thinking.

The tall stacks stopped a local problem but caused another, sending the fallout many miles away in the form of acid rain. Just how a reduction in emissions at source would create another catastrophic environmental problem I don't know, and I have certainly never heard Ms. Bennett's argument put forward like this before.

Ms. Bennett says, "we have now passed regulations that now limit the credit that can be given for the height of the stack, and so in the future this will, I think, take care of this problem and, gradually, as older plants are replaced by new plants, this will have a very important effect."

This would be all very well if we had an unlimited period of time in which to act. But we don't. Our lakes, and yours, are dying now. It will take many years to "gradually" phase out older plants. There is an almost dream-like lack of urgency to Ms. Bennett's musings.

Ms. Bennett said the reason the E.P.A. is not supporting additional calls for added regulatory programs right now is that "we cannot guarantee that they will solve an environmental problem." This is her line and she probably believes it.

It is not shared, apparently, by the American scientists who attended the Stockholm meeting.

Let's face it: if tomorrow her own advisers say, "Well, we've got to concede that emissions are causing acid rain and it's doing terrible damage," the next argument we would have thrown at us is that no one can afford to stop it. If, as Dr. Warner pointed out, that will be the next issue - it's already one of the arguments - put it on the table now and deal with it.

The differences between Canada and our many American allies with the Administration are very serious. They cannot be solved by escalating the rhetoric. If there is in fact a significant body of U.S. scientific opinion that the science is too preliminary for any action, then both countries should refer this issue to an independent scientific forum. Perhaps the present conflict needs the services of an effective mediation approach. In addition, I am of the view that both sides should reconsider transferring the whole matter to the International Joint Commission under circumstances that preclude any suspicion of manipulation from certain interests within and without government who for various reasons are opposed to action.

U.S. Administration concerns over the size, tangle and cost of bureaucracy is one of those reasons. Economic cost and worker dislocation is at the base of industrial intransigence. But we just cannot sit back and do nothing, and if the process we are committed to under the Memorandum of Intent isn't working, then if good faith is there, let us find another process in another forum.

Canadians believe there is enough scientific evidence to act. We know it will be costly. It will be very costly in Canada also. The need for more research is indisputable. Within the last few weeks more scientific studies confirm the present damage and potential damage to forest growth. On September 17, 1982, a Canadian scientific study, to quote from the press report, said, "the testing has already yielded the hardest scientific evidence yet that acid rain retards forest growth." On October 13, 1982, the American Museum of Natural History reported a University of Vermont study saying the same thing. No responsible politician, faced with what we do know, can ever justify to future generations that they did not act because they did not know everything.

In August my wife and I spent some days hiking in the mountains of New Hampshire. In the Lakes of the Clouds Hut there is a plaque which reads:

> "This room is dedicated to the memory of Ted Fuller Hutmaster 1943 Lakes of the Clouds who was killed in action with the United States Army near Saarlantern - Roden, Germany, December 9, 1944."

Ted Fuller left a poem behind him; written a far distance from the land he loved, but which was ever in his thoughts:

> "The rugged ridge-tops call to me,
> From the land of clear air
> where a man is free;
> The moon that's shining above
> me I know,
> Is also shining on steep Munro."

Last summer the pH level of fog on those rugged ridge tops was 3.71 - the rain 4.18.

I have often said we hold this beautiful land as trustees for those who will come after us. Dr. Jay D. Hair of the U.S. National Wildlife Federation put it this way:

> "We have not inherited this land from our fathers; we are borrowing it from our children."

And then he added that some among us are not just borrowing - but stealing - from our children.

Thank you.

Address to the Eleventh Annual Conference of the National Association for Environmental Education, 18 October 1982:

Acid Rain: Environmental Politics in the Modern Era

David Hawkins[1]

The acid rain controversy is a typical example of environmental politics in the modern era. It is not fashionable to argue that we really don't need clean water, clean air, or lakes and streams where fish can live. Instead, the savvy representative of industries whose polluting practices are being challenged, argues, "Wait. We don't understand the problem. We must do research before we act."

This response is clever, because as with clean air and water, it doesn't seem reasonable to be against research. As environmental educators you have the opportunity to equip your students to respond intelligently to this argument.

As a former teacher, and now I suppose you could call me an environmental advocate, I hope that your students are learning the difference between evaluating scientific findings based solely on academic criteria and evaluating the implications of those findings for public policy. In other words, when to focus on the holes in the science and when to focus on the cheese.

In the politics of acid rain there is a concerted effort by industry and the Administration in Washington to focus all of our attention on the holes in our understanding of the problem. Two weeks ago, Anne Gorsuch, Administrator of the U.S. Environmental Protection Agency, gave a speech on acid rain to the Pittsburgh Chamber of Commerce. In her talk she gave a new label to our understanding of acid rain - "the dominant theory." Her message was we don't know enough to take control action now. Regulation, she said, must await a sound diagnosis of the problem.

As a general principle it is hard to argue with wanting a "sound diagnosis," isn't it? But like all good ideas it can be carried too far. The Administration's posture on acid rain reminds me of the doctor who was visited by a clearly sick patient with an obscure disease. The doctor, not having a sound diagnosis, said, "Take two aspirin and call me in ten years."

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Tonight I'd like to discuss why many believe we have a sound diagnosis of the acid rain problem and why waiting to act would be a mistake.

Those who argue that we can afford to wait fail to acknowledge the cumulative nature of the acid rain - or more accurately, acid deposition — phenomenon. Like many natural processes there is an accumulation phase and an effects phase.

Effects of damage to many lakes and streams show up only after a number of years of accumulated deposits of acidifying compounds.

Much of the discussion on acid deposition does not seem to recognize this. People claim there is no trend toward increasing acidity of rain over the last twenty years, implying that we can therefore safely continue at current rates for another 20-30 years. Well, it doesn't work that way, does it? If there is an imbalance between the amount of acid reaching a lake and that lake's buffering capacity, the longer that amount of acid continues, the worse off the lake will be.

Just think of your own body. If you take in twice as many calories as you burn off in a day, the longer you continue that, the more weight you'll gain. And when you start to reduce calories it will take you that much longer to get back in shape.

Now, lakes and streams, unlike your body, don't show the effects of the imbalance right away. Before the lakes go acid and fish start dying the buffering capacity or alkalinity of the lakes starts getting used up. For quite a number of years a lake which is suffering from acid rain may show little or no increase in acidity. But after its buffering capacity is used up the increase in acidity rapidly begins.

That's why you can't place much comfort on the fact that there are still a lot of lakes in the Adirondacks and elsewhere in the Northeast that are not yet experiencing increases in acidity. This would be like the guy who jumps off a twenty story building and as he passes the fifth floor, yells out "so far so good!"

The lakes and streams that have already gone acid are just the top of the problem. They went first because they had the least buffering capacity and were the most sensitive. You all know that canaries were once placed in coal mines as early warning systems. When the canaries died the miners knew they too were threatened. The lakes that have already gone acid are the canaries in the coal mines. There are many more lakes and streams which started out with greater buffering capacity and have not yet gone acid. But these lakes are losing that buffering capacity with every year that goes by.

The sensitive waters are not just in the Adirondacks.

According to a survey done for Congress' Office of Technology Assessment, 23 of the 27 states east of the Mississippi contain areas sensitive to acid deposition. Over 9,000 lakes and 60,000 miles of streams in these areas are classified as sensitive to acid deposition based on low buffering capacity in the waters themselves and in the surrounding soils and geology. These figures represent half of the lakes and streams in these areas.

Most of these lakes and streams are not acid now. But many of them are losing their buffering capacity. They are passing the fifth floor on the way down. The Office of Technology Assessment survey estimates that 3,000 lakes and 23,000 miles of streams have already had their buffering capacity lowered so much that they are now ranked as "extremely sensitive" to further acid deposition or have already gone acid.

The Pennsylvania Fish Commission has recently released a survey of trout streams in Pennsylvania. Of 40 streams in the survey, 36 streams have lost on average over half of their buffering capacity in the last 20 years. In case you're wondering, no streams that could have been affected by mining, agriculture or other land management practices are included in this survey.

The Commission survey concludes as follows, and I quote:

> "Does this mean that by the end of this century - assuming that sulfur and nitrogen oxide emissions are not soon dramatically reduced - that we will have lost our most important trout species from most of our typical smaller mountain streams? There is considerable evidence supporting this frightening forecast."

Let's look for a moment at some other problems. The threats to soils and forests that may occur if we delay control action also concern us a great deal. Even to a greater extent than lakes, the complexity and inertia of the forest system acts to disguise what is probably happening now in parts of the Eastern U.S.

To borrow a phrase from Mrs. Gorsuch, the "dominant theory" up until recently has been that, since no reduction in growth in forests has been documented either in the U.S. or in Norway which has completed an 8-year study, we don't have to worry about forests now. However, recent work in Germany (with consistent observations in the U.S.) is challenging that view. According to work by Ulrich in West Germany, acid deposition impacts on forests go through several phases. In the first phase forest growth may actually be stimulated due to the nitrogen added by deposition. This first phase may have lasted for 10-20 years in Germany and we may still be in this phase in the U.S. However, during this period acids are accumulating in the soil, available nutrients such as calcium, magnesium and potassium start leaching, and metals such as aluminum start to build up.

When the pH of the soil drops below five, aluminum is mobilized in a form that is toxic to roots. Root damage in turn leads to build-up of heavy metals in leaf and bark tissues, to loss of the tree's buffering capacity,

and to increased susceptibility to pest attack. In Germany these effects are now manifesting themselves in the widespread dieback of tree crowns in many of Germany's larger forests.

The evidence of damage is now strong enough in Germany that just last month the West German government issued a report concluding that the link between sulfur emissions, acid deposition and forest damage is "unequivocal." This conclusion led the West German government to begin drafting a new regulation which would cut emission levels from coal-fired powerplants in half.

You may recall that the German government has since changed hands. There is a certain allegorical flavor to the fact that the head of the new government is a man named Kohl and that he has replaced the former environment minister, whose name in English means "tree." However, I don't think that good science and a sound diagnosis will be ignored just because a new Administration has taken office.

What about the argument that we are reducing SO_2 emissions now even without a new acid rain control program? Well, the argument is factually wrong. After a brief downturn due to the 1970 Clean Air Act, SO_2 emissions are once again growing. EPA has calculated future emissions east of the Mississippi with and without a new acid rain control program. With no new control program, eastern and midwestern utility emissions alone are projected to increase by nearly 2 million tons a year between now and 1995. Not until the year 2010 are these utility emissions projected to get back down even to today's levels.

When you add in other SO_2 sources in the east and midwest the increases are even larger. According to a study done for the utility industry this spring, total eastern and midwestern SO_2 emissions will be 3-5 million tons more per year in the year 2010 than they are today.

Now what about all the apparent inconsistencies between various observations and the dominant theory, as Ms. Gorsuch calls it? It is a pattern of debate that has been going on for several years. Some have called it "informational haze." I think the arguments are a classic example of the rhetorical technique of the altered or distorted perspective.

One of these perspectives I would call the global or satellite perspective. If you get far enough away from a difficult subject, and squint, you can make it disappear. For example, concerned about urban crowding? Well, show a picture of the earth from 24,000 miles up and you can't tell there are any people living in Manhattan or Japan. Examples of this technique in acid rain are comparisons of man's SO_2 emissions to global natural SO_2 emissions, or references to acidity in Polar ice caps or isolated rainstorms in Pago Pago.

The other perspective I would call the ant's perspective. The technique here is to get your listener so extremely close to the subject that you

hide a recognizable object in a blizzard of detail. If you could talk to an ant walking on the side of an elephant you could easily convince him that he was not on an elephant at all - that he was climbing the North face of the Eiger Mountain in an earthquake. There are many examples of this technique in the acid rain debate. The Electric Power Research Institute's much ballyhooed Three Lake Study in the Adirondacks is one. The differences in the acidity of the three lakes are easily explainable. Carl Schofield explained them this afternoon. But if you don't bother to explain the differences you can make the observations appear confusing. Here is Adminstrator Gorsuch's rendition of this argument:

> On a recent research trip to the Adirondacks, EPA Acting Assistant Administrator Dr. Courtney Riordan visited a number of lakes in the region. Some had the properties of "dead" lakes -- the liquid in them was crystal clear, and the decline of aquatic life throughout could be observed easily. Within a relatively close distance, however, he observed lakes of similar size that were not acidic. Instead, they supported a rich aquatic life. At this stage, we have only hypotheses that might explain such differences. We need more precise evidence about what is actually happening before we can assign causes with confidence. Naturally, we also need a better understanding of what is happening to evaluate proposed "solutions" with confidence.

A third technique I call "fun with logarithms." To play this one you just take advantage of the general public's confusion about logarithms, especially fractional ones. For example, the utility industry is fond of citing a calculation by the Rennsalaer Polytechnic Institute that even if emissions and deposition were cut in half, this would "only" raise the pH of the rain from 4.2 to 4.5. This leaves the average listener feeling, "is that all? I guess it isn't worth the effort." Of course a positive change of 3/10 of a point on the pH scale precisely cuts the acidity in half.

While all of these debating techniques provide useful material for opponents of acid rain control measures, they have not persuaded the vast majority of experts in the field that there is any flaw in their conclusions, first, that acid deposition damages lakes and streams, erodes materials and poses a risk to forests, and second, that reducing SO_2 emissions will be effective in preventing further damage.

Thus an international acid deposition conference last June in Stockholm attended by 22 governments, including the U.S., issued an official report concluding:

> "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.... The Conference considered the establishment and implementation of concerted programs for

the reduction of sulfur emissions to be a matter of urgency."

In concluding, just a word about the costs and jobs impacts of an acid rain control program. The most recent study done for EPA last month estimates the costs of the 8 million ton reduction program passed by the Senate committee in August. That study calculates that the program will result in an average electric rate increase of 2.8%, with the highest state at 7.8%.

Regarding jobs, there have been claims that the bill will cost scores of thousands of jobs in every coal mining state in the midwest and Appalachia. The analyses done for EPA say something very different. In 1995 with the Senate bill, total coal production in the midwest and Appalachia is projected to be 73 million tons higher than it was in 1980. Reductions below 1980 levels are projected for Ohio, Indiana, Illinois and possibly Maryland. But these reductions are offset by increased production in all other eastern coal-producing states including Pennsylvania, West Virginia, Virginia, Kentucky, and Tennessee.

However, even these production shifts don't have to occur. The Senate bill allows sources which use innovative controls until 1995 to achieve their emission reductions. This was intentionally designed to give sources now burning high-sulfur coal the time to prove out and apply less expensive emerging control technologies. One of these technologies is known as limestone injection. In testimony before the House Committee last year a high EPA official said this technology had been demonstrated to the point where further government development funds were not needed and industry could carry out its full commercial demonstration.

In short I believe we are seeing science misused in the politics of acid rain because of an underlying concern about the social and economic consequences of doing something to control acid rain. While no one wants to pay more for any goods or services, we believe we can persuade the public that the increased costs of a control program are reasonable and that it is important to act now to start solving the problem. You as educators can play a critical role in this process - both in the classroom and by reaching the opinion shapers in your communities.

Address to the Eleventh Annual Conference of the National Association for Environmental Education, 19 October 1982:

The Reagan Administration's Environmental Policy

Gaylord Nelson[1]

By far the most significant environmental development of the past decade does not involve any single piece of important legislation that has passed but rather involves a changing public attitude toward our environment and resources. Earth Day 1970 gave millions of people the opportunity to express their concern. Finally a broad concensus had been reached -- an agreement, an understanding that we as a nation had seriously compromised our environment and that something had to be done about it. Earth Day and other expressions of concern forced the issue into the political arena, demanded the attention of the political leadership at all levels, and finally made the issue part of the political dialogue of the country. This last step was vital because the major resource decisions must be made through the political process at all levels of government, and hard political decisions are only made by politicians when they recognize that there is a broad constituency of support. This public support has been the driving force behind the achievements of the past few years. No other period in history is comparable to it.

We added more wilderness areas, wildlife habitat, parks, lake shores and sea shores than in any other period, including the Alaska lands bill, the largest project of its kind in the history of any country. I am pleased to note that The Wilderness Society led the Alaska fight for 15 years and that Chuck Clusen, Conservation Director of the Society, served as coordinator of the Alaska Coalition of organizations which won the congressional battle last fall.

During this same period we made dramatic gains in controlling air and water pollution. We passed the strip mining act which mandates the appropriate contouring and restoration of the disturbed land. We have made a modest start in the direction of controlling toxic substances, the use of herbicides and perticides, managing solid wastes and recycling resources.

These gains are commendable, indeed, standing alone, they are enormously impressive. Nonetheless, when measured against the task ahead, we have only made a small beginning.

Our resource problems are global as well as national and thus require international cooperation on an unprecedented scale. If we are to live in harmony as passengers on the "Spacecraft Earth," as Adlai Stevenson once described our planet, then we must understand, respect, and cooperate with

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each other. We have a long way to go. At the Congress of Vienna in 1814-15 when Prince Metternich was informed that the Russian Ambassador had just dropped dead, he paused for a moment or two and then asked: "What can have been his motive?"

We ask the same question today of the Soviets that Metternich did, and they ask the same of us. Some day, and it cannot be too soon, the two superpowers must succeed in de-escalating the arms race and begin cooperating on a global basis with all other countries in the vital enterprise of better husbanding those resources which determine whether we will survive on this planet and in what condition.

If we each were asked to compile a list of the most important matters that confront us in the world, the list would be long with much duplication. It would include such matters as war and peace, world hunger, discrimination, justice, jobs, free speech, free association, freedom to worship, indeed, freedom in its broadest sense, and many more.

It would be difficult, if not impossible, to rank these matters in the order of their importance. We would not agree with each other and we would find it difficult even to resolve the priorities for ourselves.

However, there is one issue that stands alone, above all others. Right now at this moment in history and in the long haul into the next century and the centuries thereafter, no other issue is more relevant to the physical quality of life for the human species than the status of our resources and the quality of our environment.

The purity of that fragile, thin curtain of air surrounding the planet; the quality of the water in our rivers, lakes and oceans; the status of our soil, forests and mineral resources taken all together will determine how and in what condition we will live.

This resource base is being overpressured nationwide and worldwide. The United States is by far the largest consumer and user of world resources and the largest polluter of the air, rivers, and oceans. We must set the example for proper use and conservation both as a matter of survival and responsible leadership.

The Global 2000 Report to the President last year outlined in stark detail the enormous dimension of the problem here in the United States and worldwide. This report took three years to prepare. It said in greater detail what other reports and books have been saying for thirty or forty years or more. The question is whether we will heed it before it is too late.

A few random sentences from the Report will give you the flavor.

> "Indeed, the problems of preserving the carrying capacity of the earth and sustaining the possibility of a decent life for human beings that inhabit it are enormous and close upon us."

"Nonetheless, given the urgency, scope, and complexity of the challenges before us, the efforts now underway around the world fall far short of what is needed. An era of unprecedented global cooperation and commitment is essential."

And finally,

"Encouraging as these developments are, they are far from adequate to meet the global challenges projected in this study. Vigorous, determined new initiatives are needed if worsening poverty and human suffering, environmental degradation and international tension and conflicts are to be prevented."

All the major environmental issues require a political solution at the state, national and international level. Without it the Law of the Commons prevails and everyone participates in the depletion and dissipation of our irreplaceable capital assets until we are finally bankrupt.

Obviously, nothing significant can be achieved in the political arena until we have the leadership and public understanding necessary to make tough political decisions. One would think that no rational society would complacently contemplate the dissipation of the substance of its survival. Nonetheless, that is what is happening. There are many reasons for it. We have been raised to believe there are no limits to growth because there are no limits to our abundance; so unrestrained exploitation has become a way of life. We act on what we believe; and when what we believe is wrong, we make major mistakes.

The other side of that coin is, simply, that ignorance is the cause of our folly. Thus, education and understanding is a necessary prerequisite to effective action. There is an additional obstacle. Political administrations are strongly oriented to short-term planning and quick fixes because their warrant of political authority is short. This short-term perspective is reinforced by the political constituency which wants easy, quick solutions and tends to reject significant sacrifices to achieve distant goals.

Whatever else we may do, we must confront the resource issue head on and make it a cause that is heard, understood and affirmed throughout the nation.

We must make it understood that we do live on a planet with finite resources and hence a finite capacity to support life.

Our chances of success in the future are enhanced by the fact that it is easier to teach a new generation to think anew and adapt itself and its institutions to a radical change in the perception of reality than it is to disentangle an old generation from its false ideas and mistaken notions.

Tragically, at this precise moment in history when the circumstances demand not just a continuation of past policies, but a vigorous expansion of our address to the whole spectrum of resource issues, we have an Administration that is turning the clock back because it is either blind to the problem and ignorant of the consequences or recklessly prepared to dissipate the resources of future generations for short-term political gain and illusory economic benefits.

We are witnessing a wholesale dismantling of the environmental achievements and gains of the past decade and a half. It is being done by a series of executive and administrative actions without review by Congress and beyond the view of the public. Their techniques and tactics involve non-enforcement, weak enforcement or perverse enforcement of the law by administrators and lawyers who were appointed for the specific purpose of frustrating the will of Congress and the vast majority of the people as repeatedly expressed through public opinion polls.

Under the guise of getting rid of unnecessary rules and regulations, they are undermining the capacity of the private sector to comply with the law.

By massive budget cuts they have seriously crippled the Environmental Protection Agency, and their proposed budget for next year will effectively destroy its capacity to administer and enforce the major responsibilities within its jurisdiction.

Recently Chemical Week, a McGraw-Hill publication, an industry magazine, carried an editorial titled, "We Need a Credible EPA." The editorial stated, in part:

> ...and the prospect of deep and continuing budget cuts in the face of a growing workload has hurt morale throughout the agency.
>
> Normally, the sight of a regulatory agency in turmoil is not calculated to bring tears to industry's eyes. But an ineffective EPA is not what the chemical industry needs. What it needs and what it expects from the Reagan Administration is an agency that will discharge intelligently its responsibility to the American people.
>
> That means cleaning up and protecting the environment... Without an effective EPA, industry's contribution to pollution, which has been diminishing, is bound to grow again. In the long run, the American people will not stand for that.

These are words from a conservative industry journal, not the words of those "environmental extremists" that Interior Secretary Watt regularly attacks as part of his daily ritual.

The laws administered by the EPA cut across the panorama of the whole environmental thrust of the past two decades -- laws carefully considered and passed by ten Congresses and signed by five Presidents with overwhelming public support.

A simple tabulation of the laws administered by the EPA tells the story -- the Clean Water Act, the Clean Air Act, the Toxic Substances Control Act, the Hazardous Wastes Act, the Pesticide Control Act, the Safe Drinking Water Act, the Compensation and Liability Act.

As pointed out by the National Wildlife Federation in its report on the EPA, the Acts represent:

> ...the environmental safety net which protects each citizen from the by-products and wastes of our high-technology society. This includes over 55,000 chemicals (with 600-1,000 additions per year); 50,000 plants discharging wastes into U.S. rivers and streams; another 40,000 firms discharging toxics into our municipal sewer systems; over 160 million tons of air pollutants such as sulphur oxides, carbon monoxides, nitrogen oxides, soot and other particles; billions of gallons of municipal sewage and storm water run-off; and approximately 20,000 hazardous waste facilities, the repositories for the over 40 million tons of hazardous wastes generated each year... Without effective public control of these wastes our public health and the health of our basic biological support systems (air, water, soil) cannot be maintained.

Next year's proposed EPA budget will be slashed in half. The Federation Report concludes, "accepting the Administration's proposal means the destruction of the country's institutional capacity to understand and manage the environment..."
Recently Russell train, President of the World Wildlife Fund, wrote an article published in the Washington Post entitled, "The Destruction of the EPA." Judge Train is a conservationist with a distinguished national reputation. He was administrator of the Environmental Protection Agency under Presidents Nixon and Ford. Indeed, his Republican credentials are impeccable. Here is what Mr. Train had to say, in part:

> The Environmental Protection Agency is rapidly being destroyed as an effective institution in the federal government...As one who served two Republican Administrations from 1969 to 1977 and who voted for President Reagan, I must record my profound concern over what is happening at EPA today. The budget and personnel cuts...will destroy the Agency as an effective institution for many years to come. Environmental protection statutes may remain in full force on the books, but the agency charged with their implementation will be a paper tiger.

What is at stake here is mind-boggling in its implications and, as of now, only superficially appreciated by Congress and the public. This is so because the budget process is being widely used as an instrumentality for de facto repeal of laws without congressional debate or thoughtful public dialogue. Only when it is all over with and irreparable damage is done, only then, too late, will society be presented with an environmental debt too large ever to pay.

The EPA case is presented at some length here because it illuminates in brilliant colors and stark detail the attitude and the philosophy of this Administration respecting the vital issues of resource management and environmental quality. This example is the pattern, not the exception. The same methodology of techniques and tactics for frustrating the law and distorting its intent is being vigorously pursued across the board in the administration of the laws respecting national parks, wildlife refuges, BLM grazing lands, wilderness areas, Alaska lands, national forests, the Endangered Species Act, the Surface Mining Act and the Land and Water Conservation Fund, just to name a few.

If the laws administered by the EPA are the heart of the resource-environmental issue, then its soul is the wilderness, the wildlife refuges, the parks, the national forests, the wild creatures, the fragile landscapes with their scenic beauty. The picture respecting the administration of these public lands under Secretary James Watt is as bleak in its own way as the situation of EPA under Anne Gorsuch.

Secretary Watt is making an all-out attack on practically all established public lands management policies.

Mr. Watt's objections to the conservation policies of the past twenty years are substantive, not cosmetic. While he talks the language of conservation, he is, in fact, attacking the goals and objectives forged out of a remarkable, indeed historic, bipartisan effort involving many Congresses, many Presidents, broad public consultation and years of work.

Mr. Watt has repeatedly charged that the leaders of national conservation organizations are extremists while he is in the mainstream of the environmental movement. Mainstream, indeed! Mr. Watt and the industries he represented at the Rocky Mountain States Legal Foundation have opposed all major conservation legislation of the past decade.

What, one must ask, is "extremist" about additions to the National Park System, the Clean Air Act, the Clean Water Act, the BLM Grazing Act, the Wilderness Act, the Alaska Lands Act and the Strip Mining Act? This is a sample of the so-called "extremist" activities of conservation leaders over the past few years.

Who really, are these "extremists" Mr. Watt keeps walking about? Is it that group of radical "extremists" who passed all of this "extreme" leglislation that Mr. Watt did battle against while in the private sector and now in the public sector? Is he talking about Senator Baker,

Republican Majority Leader; or is it Senators Eastland, Stennis, Mansfield, McClure, Mathias, Packwood, Cranston, Domenici, Hatfield, Proxmire and others who supported these measures? Can he be referring to Presidents Johnson, Nixon, Ford, and Carter who signed the legislation?

All of this legislation overwhelmingly passed both Houses of Congress and is broadly supported in every public opinion poll.

Take the case of the 1964 Wilderness Act which passed the Congress with one dissenting vote. It was overwhelmingly supported by liberals and conservatives, Republicans and Democrats alike. What is extremist about this concept? Shouldn't we try to save here and there a few remnants of nature's work untouched and undisturbed? Is not a million years or ten thousand years of evolving landscape and fragile beauty worthy of our most attentive stewardship? More to the point, why should any question be asked about it at all? Isn't it enough that wilderness is part of us and our heritage and gives us a thread of communication with what went on before us?

Nonetheless, Secretary Watt has carried on a year-long campaign to open the wilderness areas for gas and oil drilling on the argument that the national security requires it and the law mandates it. He is wrong on both counts. First, the best available geologic studies clearly indicate that only about 1 percent of the gas and oil potential is located in designated wilderness areas, and if off-shore potential is included it contains less than one-half percent. Second, Mr. Watt's claim that he is mandated by law to issue leases is an interpretation of the law rejected by all previous Interior Secretaries for the past 18 years under both Republican and Democratic Administrations.

The Adminstration's broadside attack on the nation's environmental achievements is being done under the guise of getting the government off your back and under the illusion that it will help balance the budget and get the economy going again. Ironically and tragically, their policies will achieve none of the above. Indeed, they will exacerbate exponentially the very problems they seek to cure. Not even the reputation of voodoo economics should be tarnished by association with the concept of these policies.

Recently I spoke at a conference organized around a theme entitled, "The Economy or the Environment, Need We Choose?" That is a question increasingly raised in recent months. Those who would dramatically weaken environmental protection claim we must choose. They are dead wrong by every rational standard of measurement.

When we use the word "environment," I assume we use it in its broadest context to include all physical resources -- air, water, soil, minerals, forests. They are all part of the environment and inseparable from it. The appropriate generalization to be made, I think, is that the economy and the environment are inextricably intertwined. But it is vital to understand that while you can have a country rich in its resources with a

poor economy, you cannot have a rich economy in a country poor in its resources or its access to them. That, I assume, is axiomatic. Jeremy Rifkin recently stated the proposition simply and clearly as follows: "The ultimate balancing of budgets is not within society but between society and nature." By "nature," of course, he is referring to all of our natural resources.

Dozens of examples easily come to mind which demonstrate the universality of the principle involved in Mr. Rifkin's statement. One or two briefly argued make the case -- air and water.

There is a national controversy over the Clean Air Act, with the Administration seeking to weaken it and conservationists, with others, seeking to strengthen it.

What do we mean by clean air and clean water? What general principles should guide us in setting air and water quality standards? Quite simply, the standards should be set at a level that will assure that air or water pollution will not impair health or result in any significant adverse economic or ecological damage. We are a long way from achieving that standard.

Will it cost too much to achieve that standard? is the way the question is usually formed. The proper way to test the question is to ask how much will it cost society not to meet that standard? The answer is that we can pay the cost of meeting the standard, but there is no way for future generations to pay for our failure.

All across the nation, fresh water lakes are being sterilized, made lifeless, by acid rain caused by sulphur oxides from burning fossil fuel and nitrogen oxides from auto emissions. Some three hundred lakes have been rendered sterile in New York, and thousands of others are being degraded in Canada, the Rocky Mountains, Wisconsin, Minnesota and elsewhere.

Can anyone tell us what the monumental economic and recreation loss to the nation will be unless we move now to save our lakes from acid rain?

What is the economic value of the protein sources in the oceans and the water in our rivers? Has the loss of those resources been factored into the economic equation in the debate over clean water standards?

Is it not much cheaper to clean up the Mississippi River and keep it clean than to leave it dirty so that every city, every village and every industry from Minneapolis to the Gulf of Mexico takes out dirty water, launders it and returns it polluted again?

These and one hundred other questions can be asked, and every time the answer will be that it is far better for the economy and cheaper to maintain a clean environment than a dirty one.

In the short run, some very modest temporary benefit to the economy might result from relaxed air and water quality standards, but it would be dangerous and enormously expensive. If we do that, it simply means we are borrowing capital from future generations and counting it on the profit side of the ledger.

Quite apart from the ethical questions involved, there is simply no way that a future generation could replace the capital we borrow from them because we cannot restore a polluted ocean or a polluted lake.

The ultimate test of Man's conscience is his willingness to sacrifice something today for a future generation whose words of thanks will not be heard.

SYMPOSIUM: GLOBAL 2000

Going Beyond Global 2000

Richard J. McNeil[1]

The Global 2000 Report to the President (CEQ 1980) warns us clearly of a great transitional period to come. Educators, and particularly environmental educators, can help to ease that transition by understanding it and helping others to understand it better. We can work toward recognition and identification of important goals and of resources to meet those goals. We can expose those myths and mindsets which inhibit clear thinking and decision-making. We can help develop and teach new ways to think and act about our environment and about our relationships and responsibilities to it.

The Importance of the Global 2000 Report

The Global 2000 Report was the U.S. government's analysis, based on a 3-year interagency study, of projected changes in world population, resources, and environment through the end of this century, assuming the continuation of most current trends and policies.

Although inevitably flawed, and much criticized, The Report was the first attempt by a government to examine in an orderly and comprehensive way the future (possible futures) of our planet and its inhabitants. The conclusions are in substantial agreement with other major attempts to consider such global issues. Evidence from other sources also indicates that, while we cannot yet model such complex systems very well, and we cannot predict in detail many potential problems, the interlocking nature of resources and the increasing rate of resources loss and environmental damage together suggest an increasingly difficult period ahead.

Warts and all, The Report is an important statement. But it is easy to be either overcritical and gloomy about the projections or to be overenthusiastic about our government's interest in and ability to help deliver us safely to a happier, safer future. The documented pollution of air and water, loss of soil, extinction of biota, destruction of rainforests, are real. And they represent not only future threats but present realities. However, nature is resilient and has many built-in homeostatic mechanisms. Barring those few most devastating but perhaps unlikely possibilities (such as all-out nuclear war), I believe that the world 30 to 50 years from now can be a better place to live in than

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today's world -- a little safer, a little more just, with resources more wisely managed and shared a little more equitably, with prospects for the future more than a little better, with people more sensitive to each other and to the values of other living things and to natural systems and processes. All this is possible, with attention, concern, good decisions, and hard work.

Overemphasis on Technical Aspects

It is easy to see the great difficulties in trying to produce sufficient food for a hungry and more crowded world. It is easy to document the diseases associated with polluted air and water. And it is possible to document technological gains as measured by the additional food produced through hybrid seeds, irrigation and artificial fertilizers, and the additional lives saved by vaccines and antibiotics. We certainly welcome the work of scientists, engineers, and technicians when they can improve our health and safety and add to our years. And we will need many more of these highly trained and educated people to help us negotiate the great transition we are now undergoing.

But it is too easy to overemphasize the technical aspects of our problems. We forget that much of the environmental damage we complain about represents side effects of technology. We do not always realize that some technologically caused problems cannot be corrected by the addition of more technology. And we fail to recognize that, at a more fundamental level, a most serious need is for greater attention to social questions.

I try to teach my students that, just as each habitat has a carrying capacity for the organisms that might live there, each social system, each institution, also has a carrying capacity. A village government can only adequately supply services to a limited number of people. A legislature can only consider carefully a limited number of bills. A marriage can only deal with a limited number of crises. A public interest group can only respond adequately to a limited number of environmental issues. And when the burden gets too large the social system or institution may break down or at least may not be able to do its job well. In the mining boom town the village government finds itself unable to provide adequate water supply or garbage removal, or control over construction or protection against crime. The overburdened legislature carelessly and thoughtlessly creates laws which increase rather than alleviate problems. The marriage dissolves, or it no longer provides the support and satisfaction it once did. The public interest group neglects important issues.

We know far too little about the carrying capacities of our social systems and about the limiting factors which control those carrying capacities. When we examine them carefully we find that many of our so-called environmental problems could be redefined as social problems. Why do people die of starvation when world agricultural production is sufficient to provide 3000 kcal per person per day? Why do we drive a 2000 lb. car a few blocks to a store to buy a single loaf of bread (double-wrapped and then bagged)? Why do we overheat and overlight a building which may be

completely unused for hours or days at a time? Why do you and I eat steaks and go to fancy resorts while others dig for food in garbage heaps and sleep on the streets in cardboard boxes?

Besides carrying capacity and limiting factors we can recognize many other elements of social issues which are central to resource management and which deserve greater attention. How do we compromise between needs of present and future generations? How can policy decisions consider not only the number of resource users but the strengths of their feelings? How can participation in and control over controversial decisions be truly shared? How can different ethical perspectives be reconciled?

Recognizing Important Goals

We know that we, like all organisms, need certain basic items such as sufficient food of adequate quality, clean air to breathe and water to drink, warm and dry housing and clothing to protect us from environmental extremes. But adequate housing does not necessarily mean a split-level ranch-style house in suburbia. My son may "need" transportation to school but he does not need a car. A bus or a ride with a friend may do as well. My daughter may need stimulation, excitement, a sense of accomplishment. But she does not need a home video computer and Pac-Man game cartridge. A hike up a mountain or a horseback ride may do better. We must learn to distinguish between needs and wants and we must learn to distinguish between needs and ways to meet those needs.

We must recognize that we have real needs beyond the animal needs of food and shelter. We "need" to learn much more about our needs and how to satisfy them, about security, opportunity, dignity, tranquility, esthetics, peace, risk and danger, adventure, surprise, choice, freedom.

Recognizing Important Resources

Just as we must carefully determine our goals, we need to learn to recognize important resources which are now being given insufficient attention. The Global 2000 Report is properly concerned with vital resources such as soil, water, and tropical forests. But it is entirely possible that other, neglected, resources have values as high and status as precarious.

What are pesticides and other toxic chemicals doing to nitrogen-fixing organisms? What are the dangers to decomposers? What is the health of the ozone layer in our atmosphere? How vital is the sediment-carrying (i.e. nutrient-carrying) capacity of rivers as they feed our aquatic hatcheries and nurseries? How can we measure the value of and the risk to, information, diversity, pattern? (The Report did carefully address the issue of endangered species.) It seems to me that we must begin to assess more carefully the value of those most neglected and least understood of natural resources -- natural processes and homeostatic mechanisms.

Myths, Models, and Mindsets

It seems to me that an urgent task for environmental educators is to probe our minds and to attempt to discover what myths we use to explain the behavior of our surroundings, what models or world views we carry to help make our lives more rational, what mindsets we have which obstruct clearer visions of a better future.

We cannot here discuss at length any of these ideas. But we should remind ourselves that some myths are helpful; models are necessary; mindsets can be protective. I list here only some which I believe may obstruct our transition (Some are overstated for emphasis or clarity):

- Western culture is the best of all possible cultures.
- Science and technology can be our saviors.
- Our problems stem from a single (or dominant) cause (economic, political, religious, environmental, behavioral ...) and therefore a single powerful answer or solution is possible.
- Nature is fragile.
- Professionals, with credentials, have the answers (are the only ones who have the answers, have all of the answers).
- All games (all activities) must have winners and losers.
- Physical power, confrontation, control, domination are appropriate approaches to dealing with environment (and with other people, organizations, nations).
- We have no responsibility to other people, other organisms, the future, nonliving things (others have no rights; there are no rights).

Armageddon

In the Bible, Armageddon refers to the final and conclusive battle between good and evil (Rev. 16:14). Here I mean simply any vast, decisive conflict or upheaval. Such a condition could arise in many ways:

1. current "normal" political process -- competition, national defense, personal ego, selfishness, possibly psychosis in a leader, perhaps all of the preceding coupled with technological accidents, mistakes and failures.
2. pressures resulting from resource scarcity -- especially over water, energy, metals, common resources of the oceans, Antarctica, the moon and outer space.

3. resource management techniques producing undesirable side effects for others -- nuclear explosions for engineering projects, weather management, use of toxic chemicals or radioactive materials, water control projects.

4. internal riot, insurrection, political and social upset caused by resource shortage or overcrowding or both.

5. disease -- in a crowded world with poor sanitation but rapid transportation.

6. inadvertent upset of a natural system -- a pesticide tanker accident at sea, a change in the heat balance of earth, damage to atmospheric layers shielding earth from excess ultraviolet radiation.

Big Brother

It is not difficult to describe a world with increasing surveillance, improved data collection and storage technology, and the use of centralized information storage to control income tax, military draft, suppression of dissident organizations, management of farm production, birth control, access to parks and recreation areas, resource extraction. We now see rapid increase in the use of behavior-changing and -controlling drugs in schools, prisons, hospitals. We see the centralization of authority and the acceptance of increased regulation as well as examples of the misuse of power.

All of this is, of course, possible with benevolent leadership and the best of intentions if only it is tolerated by a citizenry willing to abdicate political power. And a more crowded world makes such steps more likely.

George Will (1976) provides a clear example of present behaviors which can give us a glimpse of one possible future:

> The Legislature of India's second most populous state, Maharashtra (population 55 million), has endorsed (75 to 1) compulsory sterilization for couples who have more than two children, if the husband is under 55 and the wife is under 45. The choices are: vasectomies, tubeotomies, or prison.
>
> Maharashtra politicians are just a step ahead of politicians in many of India's 21 other states. Punjab already has decreed that a fourth child can bring a three-year prison sentence. And the central government has declared that government employees can be denied jobs, housing, medical care and drinking water if they have more than two children.

Plastic World

Sometimes it seems that all the world is being replaced by plastic. We see plastic trees on the streets of Los Angeles and in our shopping malls; the Dutch have invented plastic seaweed to replace real seaweed destroyed by oil spills; our cemeteries are decorated with plastic bouquets; our athletes play on plastic grass; our clothing, toys, carpets, windows are made of plastic.

But by "Plastic World" I also mean all of the other ways that we are controlling nature or replacing it with technology: indoor farms and swimming pools, domed tennis courts and stadiums, mass entertainment programmed and planned for passive audiences, mass production of goods and services -- everything from cars and haircuts to furniture and "art" -- safe and managed and manicured nature, control of fire in our wildernesses, guided tours to avoid hazards, proposals to destroy grizzly bears in our national parks.

While some of us think that "Plastic World" is an unhappy option, others find it to be the best of all possible futures. To some of us it is Eden.

Utopia and Eden

Utopia implies a grand design, a plan. Utopians have always been pictured as dissatisfied dreamers who would substitute some highly planned future for our present style, which they see as chaotic. But Utopia tends to be overplanned, overcentralized and represents an attempt to produce an orderly and surprise-free world. Most Utopian plans depict high-technology futures, although there are exceptions. Dangers from Utopia include the possible environmental damage which usually accompanies high-technology, and the damage to people which comes from overcentralization, bureaucratization, overplanning.

Eden tends to represent the "back-to-nature" aspirations of a different kind of people, who tend to see technology as usually a negative influence and who try to turn their backs on most of modern life. Eden implies fitting ourselves into a less controlled, less managed, less engineered environment. As Jerome (1974) points out, the danger with Eden lies in overromanticizing it. "Back to the land" can mean dirt floors and leaking roofs, hot sun and bitter cold, hordes of insects in the summer and a 30 yard walk through the snowdrifts to an outhouse in the winter, crop failures in the summer and bad hunting and fishing in the autumn, a sick baby and no car and 20 miles to the nearest physician.

Best-of-all-possible-futures

My best-of-all-possible-futures is somewhere between Eden and Utopia, perhaps a little closer to Eden. It has untamed nature but it also has hot showers and bookstores. It has earthquakes and disease, floods, blisters, and mosquitos. It has junk food and plastic toys, blizzards and droughts. And it cannot properly be described except in the most general terms because it cannot result from the plan of a person or a group.

It must come from the ideas, goals, values, struggles of diverse people. It must be partly planned and partly spontaneous. It must result from compromise, from trial and error, disagreement and discord, cooperation and competition, and from participation by people with a real sensitivity to the possible wishes of those who follow.

The possible future can be more nearly just. It can have near-universal peace. It can provide plenty of good food, clothing, shelter, education, dignified employment, health care, for nearly everyone. If we were to survey every human culture, I believe we would find almost universal agreement on a few possible goals. I believe they would include at least these five:

1. equitability -- a reasonably equitable distribution of resources or of access to resources;

2. sufficiency -- a reasonable ratio between resources and people; all real needs met, including food, shelter, job, health, education, security, choice, culture, mobility, participation;

3. sustainability -- concern for the future; ways of living which can be sustained permanently;

4. stress (adventure) -- frequent doses of physical stress and danger, of circumstances which test and make more fit our physical and mental abilities;

5. love -- for all other people, but also extending to a care and concern for all living things.

All these elements are requisite to my Eden or Utopia.

Undergoing Transitions

Almost all great transitions entail major human suffering. I see it as the task of environmental educators to help to guide the transition we are now undergoing, to find ways to ease the anguish of those most likely to find it difficult, to try to make it a gentle revolution.

The revolution is under way. The Global 2000 Report offers evidence both that this great transition is in progress and that it is unlikely to be smooth. The sooner we begin our efforts the less abrupt the transition will be; we could then sense it not as a painful discontinuity but more as a gradual change.

It is easy to see signs of hope around us. Environmental issues are now legitimate subjects for discussion. We are still naive but at least we can openly air our concerns. Today 144 nations have environmental and natural resources agencies. France has elected office-holders under the banner of

an environmental party. In Papua New Guinea villagers have refused to develop along Western lines, choosing instead more traditional systems. In some areas they are starting butterfly farms, harvesting spectacular tropical species on a sustained-yield basis. In India, the Chipkos, the tree huggers, place their bodies before the loggers and protect the forests they depend on for firewood, erosion control, and water supply (Shepard 1981). Sweden has an Under-secretary of State for Disarmament while Austria has what has been called the world's only full-scale model nuclear reactor -- built but never operated because of citizen intervention.

Conferees at a Cornell conference on undergoing this transition point to the three D's -- decentralization, demystification, and democratization -- as important strategies to consider. Decentralization in such areas as industry, agriculture, population distribution, and government will result in alleviating the frequent diseconomies of excessively large scale and will allow us not only to recoup many of the resource costs of overcentralization but also to renew our sense of interest in and concern for our communities and our neighbors. Demystification will help us to see that we are competent to understand the workings of government or of a nuclear reactor. We will learn that in science, technology, economics, education, we can become well informed and can make useful contributions to dialogues about our future in those areas. Democratization will allow us once again to participate fully in the operation of our government and in our other social and political systems. We will again become franchised, empowered to participate in decisions which vitally affect our future.

New Ways to Think and Act

Many of our old myths and models no longer work well. We have to create new ones. And we need to think in new ways if we wish to free ourselves for the creative efforts needed in envisioning new futures. A flat-earth model was superseded by a round-earth model. And even that has been modified as our knowledge becomes more sophisticated. So, too, we must develop new metaphors and new styles of thinking.

Holistic ways of thinking allow us to see interconnections, to emphasize patterns, to see the values of cooperative aspects of our behaviors. We can learn to think in terms of systems, and at even larger scales in space and time. Lovelock (1979) proposes Gaia as an actual or metaphorical organism encompassing the entire earth. If we see ourselves as organs within a single organism we are forced to review our role and our relationships with other parts of this vast system. Ferguson (1980) and Capra (1975, 1982) are among the leaders in showing us new and holistic ways of viewing our world.

Piercy (1976) and Callenbach (1975) are examples of many who have used fiction to give us useful ideas about possible futures and to help us to learn how to stretch our imaginations. Brown and Shaw (1982), Valaskakis, et al. (1979), and Gribbin (1979) offer more studied, think-tank approaches

to viewing the future. I note these particular samples because I have found them interesting and helpful. They will lead you quickly to many others. Finally, the Council on Environmental Quality and the United States Department of State (CEQ 1981) offer a substantive government response to The Global 2000 Report, produced primarily by the authors and consultants involved in the earlier work.

We need not only to stretch our imaginations but to find a difficult balance between types of behaviors. We must begin to cultivate flexibility. We must find creative ways to make use of the natural tensions between individual and group activities, between cooperation and competition, between dominance and submissiveness, control and acceptance, Western activism and Eastern passivism, independence and interdependence, planning and spontaneity.

We need to search for models in other cultures and to create deliberate experiments in life styles, group dynamics, leadership styles, systems of government, ritual, ceremony, celebration.

Environmental educators can be prime instruments in helping others to learn to celebrate life, to see that our transition to a new world can be a great adventure, one which we can share as we work to produce a world in which all creatures can share in that celebration.

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The Global 2000 Report to the President*

Bette Hileman[1]

In his 1977 environmental message to Congress, President Carter directed the Council on Environmental Quality and the Department of State, working in cooperation with other agencies, to make a study of the probable changes in world population, natural resources, and environment through the end of the century.

This was the beginning of what was a three-year effort to look at these issues which resulted in a comprehensive three-volume publication that has been translated into many languages and has sold half a million copies. It was the first time the U.S. government studied natural resources, population, and environment from a long-term, global perspective and attempted to make connections among them.

The conclusions of the study are summarized in the following:

> "If present trends continue, the world at 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today.
>
> "For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be no better. For many, it will be worse. Barring revolutionary advances in technology, life for most people on earth will be more precarious in 2000 than it is now -- unless the nations of the world act decisively to alter current trends."

These statements, strong as they are, have generated much controversy. Generally, the Global report has been ignored or deprecated by the Reagan administration. The President's Council on Environmental Quality is devoting a great deal of its very limited resources surviving the Reagan budget cuts trying to find weaknesses in the report. In some ways, the debate between those who essentially agree with the report and those who

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*This article is adapted from an article by the author in Environmental Science and Technology, Vol. 16, No. 3, P. 151A. Current Issues has been granted permisison to publish the article.

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disagree is similar to the age-old debate between "doomsday prophets" and "cornucopians." This debate was started by Malthus and has continued to the present.

Population

In the section on population, as in most topics of the Global 2000 Report, high, medium, and slow growth projections are made. All three predict that if present trends continue, the increase in the world population will be of unprecedented magnitude. The world will gain more people in the next 25 years (1.88 - 2.22 billion) than it acquired in the last quarter century (1.56 billion). The medium growth projection forecasts that the population will grow from 4 billion in 1975 to 6.35 billion in 2000, an increase of more that 50%, while the rate of growth will decline only marginally from 1.8-1.7% per year. The poorest countries will experience 90% of this growth and by the year 2000 will have 78-80% of the world's population compared to 72% in 1975. Another way to describe the population growth is to say that a population equivalent to the entire world population in 1930 will be added in the next 20 years.

Since the Global report was written, many countries have taken censuses or released new data on fertility and mortality. The latest census figures have changed the predictions for some individual areas. For example, Africa is growing somewhat faster, and Latin America somewhat slower; but overall the world population still seems to be increasing at about the rate cited in the Global Report.

Per Capita Income

The Gross National Product (GNP), which represents the total goods and services available to a society, is also discussed in the Global 2000 Report. GNP per capita is expected to increase by about a third. In some areas such as in the great populous nations of south Asia -- Pakistan, India, and Bangladesh -- little or no growth in per capita GNP is projected, while in some developing countries, especially in Latin America, the GNP per capita is expected to rise substantially. The large gap that already exists between the rich and poor nations will widen. The authors of the report caution, however, that projecting GNP is extremely difficult because it is dependent on so many variables. They say that the GNP data are particularly subject to error for the less developed countries because the contributions of the traditional sector cannot be accurately represented. For example, in countries where a great many goods and services are exchanged by barter, it is hard to estimate their value.

Food Supply

If food were distributed uniformly, the world might be able to feed itself adequately in the year 2000. The Global Report forecasts a 90% increase in total food production for the 1970-2000 period, which translates into a 10-15% per capita rise. However, the bulk of the increase is predicted to occur in countries that already have relatively high per capita

consumption. The real price of food is projected to rise 30-115% over 1969-1971 prices, and in most cases the increased food supply will go only to those individuals who can afford to pay for it or grow it themselves. The per capita consumption of food in South Asia, the Middle East, and the less developed countries (LDCs) of Africa is expected to improve little, if not actually decline below present inadequate levels. In some African countries, food production per capita has been declining in recent years.

Another factor that will make it difficult to feed the people of the year 2000 is that the population will be somewhat older than that of today. As a population ages, the food requirements increase sharply. Also, higher incomes in some parts of the world will cause eating habits to shift to a more diversified diet -- from one of starches and cereals to one that includes meat and other animal products. This kind of diet is more expensive and requires a larger amount of grain to sustain it.

The World Bank estimates that because of rapid population growth, the number of malnourished persons in LDCs could increase from the current figure (400-600 million) to as many as 1300 million by the year 2000. Throughout history, there have been hunger and malnutrition somewhere in the world. But more people are malnourished today than the total population of the earth prior to about 1650. Not only has the number of malnourished people increased, but the kind of malnutrition that is most prevalent has also altered. As National Academy of Sciences Past President Phillip Handler observed: "The character of malnutrition has changed markedly in the last 40-50 years. The classical deficiency diseases -- beriberi, scurvy, pellagra, rickets, sprue -- have almost disappeared ... Instead, there is marasmus and kwashiorkor, both forms of general protein calorie insufficienty and iron deficiency anemia... Malnutrition now reflects lack of food, not lack of scientific understanding."

Environmental Aspects

The Global Report also predicts that in 2000, each arable hectare will have to support 4.0 persons instead of the current 2.6 persons (first half of last decade), and this will be accomplished through the increased use of fossil fuels, irrigation, and pesticides. The Report goes on to say that the race to provide food for a rapidly growing world population will have, and already is having, harmful effects on the environment. Improper farming practices are increasing erosion and depleting the nutrients of topsoils. In summary, the Report noted: "Evidence is accumulating that agricultural and grazing lands in parts of Africa, Asia, the Near East, and Latin America are already under such heavy stress that they simply cannot be expected to retain their present productivity through another two decades of intensifying human and animal population pressure." In LDCs there has been a great increase in the number of free-ranging animals; this has led to overgrazing, one of the leading causes of desertification. It is already a serious problem in Rajasthan, India, for example, where sharp increases in the amount of land under cultivation have reduced available pasture land.

Gerald O. Barney, study director for the Global Report, recently made a speaking tour of China. One of his important points was that the "most serious threat to China's future is not the Soviet Union, but soil erosion." He said that the 2000 mile-long Yellow River in eastern China annually carries two billion metric tons of soil -- an increase of 50% more than it was carrying 30 years ago. This sediment is deposited on the riverbed at a rate of four inches a year and causes the river's delta to extend into the ocean at the rate of 2/3 of a mile a year. Lands in the upper part of the watershed that were once productive are now barren and rocky, and dikes have to be continually raised on both sides of the river in order to prevent frequent flooding. For China's nearly one billion people, projected to grow 20% by the year 2000, every cubic yard of productive soil is of vital importance.

Even in the U.S., soil erosion is a current problem, although it has not resulted in a decline in overall productivity. In 1975 soil losses on U.S. crop land amounted to almost 3 billion tons, an average of about 9 tons per acre, according to the Department of Agriculture Soil Conservation Service. It has been estimated that soil losses must be cut in half if crop production is to be sustained indefinitely.

In order to increase food production in the LDCs by the year 2000, much greater use of pesticides will be needed. The other more modern and more costly methods of integrated pest management -- the use of natural enemies, crop rotation, insect sterilization, and hormones to eradictate pests -- will probably be too expensive for these countries. However, the heavy use of pesticides always results in the development of pesticide-resistant pests. Consequently, these will undoubtedly cause considerable problems, especially because the world is expected to rely more and more on monocultures (single species), which means that an entire crop being grown in many different countries could become vulnerable to a single resistant pest.

Irrigation will also have to be used much more extensively by 2000 if food production goes up as expected. By 1990, the irrigated area of the world is projected to rise from 223 million to 273 million hectares. It is estimated that about half of all the irrigated lands of the world have already been damaged by salinization, alkalinization, and water logging. Damaged lands can often be repaired; but the repair is expensive, and much of the injury has occurred in the LDCs -- countries which can least afford to pay for it. In Pakistan, for example, out of a total of 15 million hectares of irrigated land, about 11 million suffer from salinity, water logging, or both. Soil degradation from irrigation is expected to continue in many areas unless irrigation practices are changed.

Deforestation

One of the most serious problems that has resulted from the effort to expand crop growing areas has been deforestation. It has also been caused by logging operations and the building of highways when forests are cut at

a rapid pace. Logging and farming usually go hand in hand. Loggers take out the large trees and are followed by farmers who burn the rest of the vegetation and begin to grow crops.

There is a great deal of controversy about the exact rate of deforestation, but no disagreement about the severity of the tropical forest resource problem. The Global Report states: "Twenty-two years ago, forest covered over one-fourth of the world's land surface. Now forests cover one-fifth. Twenty-two years from now, in the year 2000, forests are expected to have been reduced to one-sixth of the land area." This statement may be somewhat exaggerated. A 1981 Food and Agricultural Organization (FAO) publication indicates that tropical deforestation is going on at about half the rate mentioned in the Global Report.

Even if the FAO estimates are lower, they do not mean that rapid deforestation is not taking place. In certain countries, the pace of deforestation is particularly severe. In Haiti, for example, only 9% of the original forests remain. Thailand has lost forests so rapidly that even the most optimistic estimates of the rate of destruction offer no hope of significant forest stands beyond 1993. For the countries of the Ivory Coast and Nigeria on the west coast of Africa, the situation is also serious. More than 70% of the forest area The Ivory Coast had at the beginning of the century has already been cleared. In India, Sri Lanka, and Burma, nearly two-thirds of the original area of tropical moist forest has already been converted to other purposes.

Another study points out the seriousness of the tropical forest problem. A 1980 National Academy of Sciences report states that an area of tropical lowland forest about the size of Delaware is permanently converted to other forms each week, and an area about the size of Great Britain every year. This report goes on to say that "no more than scattered remnants of undisturbed tropical lowland forest are likely to survive into the 21st century," chiefly in western Brazilian Amazonia and Central Africa. Because 90% of the population growth by the year 2000 will take place in the tropics, tropical deforestation will continue at a rapid pace unless serious measures are employed to halt the process.

The Creation of Barren Land

Where extensive tracts of tropical forest can be converted to crop land on a sustainable bases, species extinctions and timber losses still occur, but food production increases. Some areas, such as parts of the Amazon basin, can be and are being used for modern agriculture with appropriate soil technology. Much tropical forest land, however, is not suitable for raising crops, especially not on a continuous basis.

In many tropical forests, most plant nutrients are held in the living biomass of the diverse forest flora. In an unaltered tropical forest, dying plants fall and decompose, and the enormous mass of living vegetation recycles the nutrients very rapidly. If the forest is cut, burned over, and planted with crops, the nutrients are quickly washed off or deeply

into the soil by the heavy rains and out into the streams and rivers. Many of these forest soils can maintain crops for no more than two or three years at a time, and no system is now in use that will sustain their productivity. After a few years of cultivation, tropical forests soils often lose their ability to support crops or forest. If the land is allowed to lie fallow for about a decade while a secondary forest grows back, the species composition is often different and biological diversity much more limited.

In some tropical forest areas, a slash and burn method of agriculture has been practiced for centuries. After clearing, the land is burned, and crops are grown for a year or two. Then the land is allowed to lie fallow for about a decade while a degraded forest develops. After this the whole process is repeated. With the traditional slash and burn method, crops can be grown. In recent years, however, farmers have shortened the fallow periods in many areas because the populations have expanded so rapidly. The result has often been barren land.

Other environmental effects of deforestation in tropical areas are flooding, increased erosion, decreased water supplies, and sometimes drought. The loss of forest may also increase temperatures. According to the Global Report: "When the forest is razed, the heat that has fueled the evaporation-transpiration process instead raises the air temperature, usually to the deteriment of seed germination, plant survival, ... and human comfort." In addition, the loss of forest can cause an increase in atmospheric dust that some climatologists believe can prevent moist air from rising and inhibit precipitation.

Loss of Species

Probably the most serious environmental effect of deforestation in tropical areas is an increased rate of species extinction. The Global Report states that "the rain forest areas modified by deforestation can be expected, with few exceptions, to include a negligible number of species that were present in the virgin forests." Many tropical forests contain species that not only do not exist outside of these forest, but are unique to that particular area. Madagascar's forests, for example, contain species found nowhere else, which represent a museum of the cretaceous and paleocene biota of Africa. A majority of tropical forest expecies can exist only in a primary forest, and they regenerate very poorly. Tropical moist forests are believed to be the most complex and perhaps the most fragile ecosystems in nature.

If deforestation continues at the present rate, many species will be lost and a large portion of those lost will never have been described or catalogued. According to a recent NAS report, about two-thirds of the species (about 3 million) exist in the tropics. Only about one-sixth of these are known to science at the present time. The report goes on to say that "it is not unrealistic to suppose that, within the next two decades, as many as a million species of plants and animals could disappear in the tropical forests."

Maintaining a high level of species diversity is important not only for preserving an interesting and beautiful world -- few would argue that the world would be better without the many exotic animals that live in the tropical areas of Africa, for instance -- but a high level of species diveristy is important for our food supply as well. When a new plant strain is needed to improve a crop, a wild strain with needed characteristics is often crossed with a cultivated variety. This depends upon the existence of a large number of wild plant strains of that particular crop -- a number of strains of corn, for example.

Losing a million species of plants and animals could well threaten our own survival. As W. Frank Blair, professor of zoology at the University of Texas observed: "Every living species is potentially significant in one way or another for the survival of our own. The bioshere is not static; it is a dynamic, evolving system. Maintenance of the genetic diversity existent in the system maximizes our options for solving critical problems as they arise." In our race to feed the burgeoning population during the next few decades, we should not destroy the biosphere and therefore the ability to feed ourselves after that. Russell W. Peterson, president of the National Audubon Society, made a similar statement at an international public hearing in June: "The gradual loss of biological diversity would be every bit as serious over the long run as the sudden catacysm of nuclear war, ocurring not with one big bang, but as the result of numerous nibbles on the earth's fabric of life.... A million nibbles today, even more nibbles tomorrow, the cumulative impact growing until the fabric of our planet is rendered tattered and useless."

The Global 2000 Report discusses several other subjects such as water supplies, energy supplies, fisheries, and nonfuel minerals. The environmental effects of the projections are also covered. There is no area in which serious problems are not foreseen.

Many criticisms have been made of the Global Report. Some observers find fault with it on the basis of developments in the U.S. They say that because life seems to have been improving here over the last 200 years, it will continue to do so throughout the world. They cite trends within the U.S. such as longer life expectancies, declining death rates, decreases in the number of sick days in industry, growth in the amount of corn produced per acre. These observations may be true, but most of them are not global trends, and many are unrelated to the ideas discussed in the Global Report.

In contrast, Garrett Hardin, author of "Tragedy of the Commons," has pointed out that the trends of the past 200 years are not nearly as important as the developments of the past 25 years and that what we see taking place before our eyes is even more important. He could cite as an example China with nearly one-fourth of the world's population, only 7% of the arable land, and very severe problems feeding itself at the present time. By giving strong economic incentives for couples to have only one child, China is desperately trying to stabilize its population because it believes that the country has no hope until the population is brought

under control. Recent changes in agricultural policy that pay farmers more if they produce more have undercut family planning in China's countryside. It is once again individually profitable for farm families to have numerous children.

Some critics of the Global Report have an entirely different philosophy than that of the Chinese leadership. They have stated that there is no reason to believe that the earth does not have the capcity to support tens of billions of people. The basic conflict about the Report seems to be between those who believe the earth has nearly unlimited resources to support a continually expanding number of people, and those who think the resources are limited and that we have almost exhausted the planet's capacity to support life in a satisfactory way. Recently some of the world's leaders have expressed deep concern about the global predicament. President Daniel Arap Moi of Kenya, in opening the Nairobi Conference of the United Nations Environment Programme, said, "The issue before us today is not that of human well-being, but of human survival. Through thoughtless projects of development and over-exploitation, worsened by consequences of mass poverty and infinite malpractices, havoc has been spread across the whole spectrum of the natural environment. There is no doubt whatsoever that continuation of the current trends will lead to total collapse. Those trends must be halted; and where possible reversed."

To those who say that past developments in this country indicate what the world's future will be, we might compare the earth to a ship sailing in a foggy sea with poor navigational instruments. From certain observation posts, the trip might seem pleasant with no sign of impending danger; but if cliffs ahead cannot be seen, quite suddenly the ship will be dashed on the rocks and destroyed. The question is whether we as a nation, or as a world, have radar sufficiently accurate to detect the dangers waiting on the course we have chosen and whether we will see them in time and have the courage and conviction to avert disaster.

ENVIRONMENTAL EDUCATION APPLICATIONS — THE PRACTITIONER'S PERSPECTIVE

An Evening with the Greats

Kelly Gifford[1] and Thomas Tanner[2]

The paper provides imaginary interviews with Aldo Leopold, Edward Abbey, and Henry David Thoreau, focusing on three questions: "What do you consider wilderness?" "What are some of your most memorable experiences?" "Your experiences sound lonely. How do you react to such solitude?" The responses of the three writers are documented with references to their works.

As was my custom, I invited to dinner one winter evening three men whose lives I had admired since their written words had seasoned my admiration for nature. Each in his own way had a land ethic, a philosophy that represented a different part of America, each in a different time. As we finished dinner and settled in front of the fire, I put to Henry David Thoreau, Edward Abbey, and Aldo Leopold the first of three questions. "Gentlemen, what do you consider wildness, or wilderness?"

The first to speak was Leopold. "Wilderness? Wilderness is the raw material out of which man has hammered the artifact called civilization. Wilderness was never a homogeneous raw material. It was diverse, and the resulting artifacts are very diverse. To the laborer in the sweat of his labor, the raw stuff on his anvil is an adversary to be conquered. So was wilderness an adversary to the pioneer.

"I belive the midwest is the ultimate wilderness. No living man will see again the long-grass prairie, where a sea of prairie flowers lapped at the stirrups of the pioneer. No living man will see again the virgin pineries of the Lakes States, or the flatwood of the coastal plain, or the giant hardwoods" (1966:264-65).

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Note: Permission to reprint quotations was granted by: Harold Natson Company (Abbey, Desert Solitaire, copyright 1968 by Ballantine Books); Oxford University Press (Leopold, A Sand County Alamanac, copyright 1949, 1953, 1966, 1977, 1981); Viking Penguin, Inc. (Thoreau, The Portable Thoreau, copyright 1947, 1975).

"But the desert is the ultimate wilderness," Abbey broke in. "I have considered the restless sea, the towering mountains, the silent desert -- what do they have in common? Grandeur, color, spaciousness, the power of the ancient and elemental, that which lies beyond the ability of man to wholly grasp or utilize, these qualities all three share. In each there is a sense of something ultimate, with mountains exemplifying the brute force of natural processes, the sea concealing the richness, the complexity and fecundity of life beneath a surface of huge monotony, and the desert -- what does the desert say? The desert says nothing. Completely passive, acted upon but never acting, the desert lies there like the bare skeleton of Being, spare, sparse, austere, utterly worthless, inviting not love but contemplation. In its simplicity and order it suggests the classical, except that the desert is a realm beyond the human and in the classicist view only the human is regareded as significant or even recognized as real.

"Despite its clarity and simplicity, however, the desert wears at the same time, paradoxically, a veil of mystery. Motionless and silent, it evokes in us an elusive hint of something unknown. The desert is different. Not so hostile as the snowy peaks, nor so broad and bland as the ocean's surface, it lies open to leisurely exploration, to extended periods of habitation. The desert waits outside, desolate and still and strange, unfamiliar and often grotesque in its forms and colors, inhabited by rare, furtive creatures of incredible hardiness and cunning, sparingly colonized by weird mutants from the plant kingdom, most of them as spiny, thorny, stunted and twisted as they are tenacious. Yes, the desert is the ultimate wilderness" (1968:270-72).

Mr. Thoreau was listening intently. He had seldom ventured beyond walking distance of Concord, but to find wilderness, he did not have to do so. "I have found in myself an instinct toward a primitive and savage wilderness." He spoke, at first pensively. "Coming home through the woods with my string of fish I glimpsed a woodchuck stealing across my path, and felt a strange thrill of savage delight, and was strongly tempted to seize and devour him raw; n that I was hungry then, except for the wilderness he represented.

"Once or twice I found myself ranging the woods, seeking some kind of venison which I might devour, and no morsel could have been too savage for me. The wildest scenes had become unaccountably familiar. Bu I also found in myself an instinct toward a higher, or more spiritual fe, and I love the wild not less than the good"(1964:456-57).

Henry had warmed to his subject, and his listeners had become absorbed by the idea that each of us is conscious of an animal in us, which awakens in proportion as our higher nature slumbers. I cleared my throat to break the spell; I wanted to hear from them on other topics.

"I would appreciate it if you would share with me some of the adventures or beauty you witnessed in nature." This time Abbey led the conversation.

"The flowers are some of the wonders of canyon country. Loveliest of all, however, gay and sweet as a pretty girl, with fragrance like that of orange blossoms, is the cliffrose, also known by the anesthetic as buckbrush or quinine bush. When not in bloom it might not catch your eye, but after the winter and a trace of rain in the spring it comes on suddenly and gloriously like a swan, like a maiden, and the shaggy limbs go out of sight behind dense clusters of flowers creamy white or pale yellow like wild roses, each with its five petals and a golden center. Because of its clouds of flowers the cliffrose is the showiest plant in the canyon country. If Houseman had seen it he'd alter those lines to read, 'Loveliest of shrubs the cliffrose now/ Is hung with bloom along the bough'" (1968:26-27).

When Abbey finished speaking of the wonders of vegetation, Leopold told this interesting story.

"I owned my farm for two years before learning that the sky dance is to be seen over my woods every evening in April and May. The show begins on the first warm evening in April at exactly 6:50 p.m. The curtain goes up one minute later each day until June 1, when the time is 7:50. This sliding scale is dictated by vanity, the dancer demanding a romantic light intensity of exactly 0.05 foot-candles. The stage props, like the opening hour, reflect the temperamental demands of the performer. The stage must be an open amphitheater in the woods or brush and in its center there must be a mossy spot, a streak of sterile sand, a bare outcrop of rock, or a bare roadway. Why the male woodcock should be such a stickler for a bare dance floor puzzled me at first, but now I think it is a matter of legs. The woodcock's legs are short, and his struttings cannot be executed to advantage in dense grass or seeds, nor could his lady see them there.

"Knowing the place and hour, you seat yourself under a bush to the east of the dance floor and wait, watching against the sunset for the woodcock's arrival. He flies in low from some neighboring thicket, alights on the bare moss, and at once begins the overture: a series of queer throaty peents spaced about two seconds apart, and sounding much like the summer call of the nighthawk. Suddenly the peenting ceases and the bird flutters skyward in a series of wide spirals, emitting a musical twitter. Up and up he goes, the spiral steeper and smaller, the twittering louder and louder, until the performer is only a speck in the sky. Then, without warning, he tumbles like a crippled plane, giving voice in a soft liquid warble that a March bluebird might envy. At a few feet from the ground, he levels off and returns to his peenting ground, usually to the spot where the performance began, and there resumes his peenting" (1966:32-33).

I sensed Thoreau was somewhat distraught that he had not witnessed this sight. "Truly," he said, "the woods are full of wonders. There's the unfolding of the lilac's sweet-scented flowers each spring and the laugh of the loon. I have witnessed the war between two races of ants and seen the partridge chicks, perfectly developed and precocious; I have watched the small maples turn scarlet across the pond. The hours spent were not time subtracted from my life, but so much over and above my usual allowance" (1964:various pages).

"I'm sure Mr. Leopold feels the same about the time he spent observing the sky dance. But it sounds to me as if you might get lonesome in your solitary watching. How do you react to such solitude?" I asked.

Leopold hesitated a few moments to arrange his thoughts, and then began. "The words of this answer are taken from the gospel according to the Italian poet Ariosto. I do not know the chapter and verse, but this is what he says: 'How miserable are the idle hours of the ignorant man.' For myself, there is not loneliness but leisure. The man who cannot enjoy his leisure is ignorant, though his degrees exhaust the alphabet, and the man who does enjoy leisure is to some extent educated, though he has not seen the inside of a school"(1966:181).

"In answer to your question," Mr. Thoreau said, "I find it wholesome to be alone the greater part of the time. To be in company, even with the best, is soon wearisome and dissipating. I love to be alone. I never found the companion that was so companionable as solitude. Solitude is not measured by the miles of space that intervene between a man and his fellows. The really diligent student in one of the crowded hives of Cambridge College is as solitary as a dervish in the desert. It would be better if there were but one inhabitant to a square mile, as where I lived. The value of man is not in his skin, that we should touch him"(1964:386-87)

When Abbey heard Thoreau say "desert," he nearly interrupted; finally, he could not keep quiet any longer. He began telling about his first experience with being alone in the desert.

"No travelers, no campers, no wanderers came to that part of the desert that day and for a few moments I felt and realized that I was very much alone. Sunset was approaching so I went outside, sat on the table and watched the sky and the desert dissolve slowly into the mystery under the chemistry of twilight. Dark clouds sailing overhead across the fields of stars. Stars which are usually bold and close, with an icy glitter in their light -- glint of blue, emerald, gold. The night flows in, the mighty stillness embraces and includes me. I am twenty miles or more from the nearest fellow human, but instead of loneliness I feel loveliness. Loveliness and exultation"(1968:13-15).

Silence. We sat there a few moments, the four of us together, yet alone. The fire was still glowing and had kept us warm through the cool October evening. I knew these men were early risers; one or two of them might even be planning an early morning duck-hunting trip. It was not long before we said our good nights. I closed the door behind them, walked into the den and picked up my copy of A Sand County Almanac. As I read, "It is inconceivable to me that an ethical relation to land can exist without love, respect, and admiration for land, and a high regard for its value,"(1966:261), I realized I had just spent an evening with three men who shared this land ethic. They possesss a love, respect, and admiration for the land and its aesthetic value.

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Beyond the Classroom: A "Real World" Environmental Impact Program for High School Students

Robert E. Horvat[1]

Introduction

When President Richard Nixon signed the National Environmental Policy Act (NEPA) of 1969 into law on January 1, 1970, a new era in environmental concern began. While this was not the first environmental legislation at the Federal level, it was landmark legislation nonetheless. For the first time, the Federal government mandated that environmental effects be included in the decision-making process for proposed Federal projects. Environmental concerns were evident in NEPA's stated purpose:

> ...to encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the nation...(NEPA, Sec. 2)

The legislation established the environmental impact statement process, and required each federal agency to include an environmental assessment in recommendations for legislation and/or other major federal actions significantly affecting the quality of the human environment. The basic framework for an EIS under NEPA guidelines is given in Figure 1.

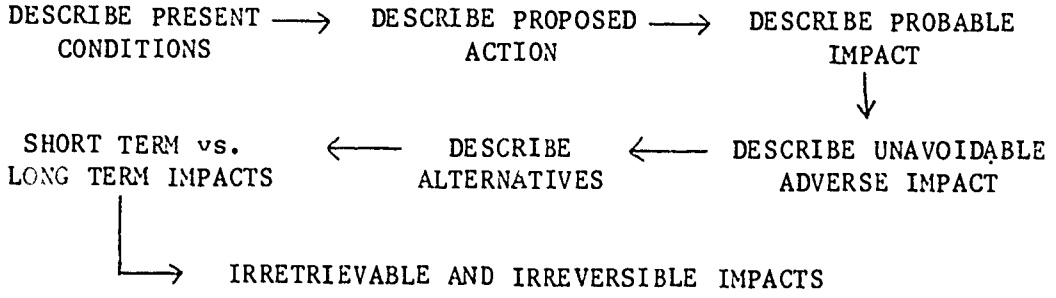

Figure 1. Basic NEPA EIS Framework (Sec. 102(2)(C) of NEPA, 1969)

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Under the direction of the Council on Environmental Quality (also established by NEPA), each Federal agency developed regulations to implement environmental impact statement preparation for major actions. States followed the Federal lead, with a number of "little NEPAs" enacted during the seventies.(1)

Environmental organizations hailed this new legislation, since it encouraged more public input in the decision-making process for major Federal projects. With hindsight, it is obvious that some environmental impact statements were essentially rote processes -- something to be completed before the "job" could start! However, NEPA did provide a valuable new opportunity. It was used many times, by environmental and other citizen groups to force environmental analyses and disclosure of impacts of proposed projects.

From an educational viewpoint, NEPA also provides a valuable model for environmental assessment. Of course, an EIS prepared under NEPA or some of the state laws, is an exhaustive report of highly trained teams of professionals, often working for many months. But the process of "doing" an EIS -- to take an interdisciplinary look at the variety of things that should be included when assessing environmental impacts -- can be a valuable exercise. For this reason we decided to build a science summer enrichment program for high school students around the process of writing and presenting an EIS.

Program Objectives

The 1981 Environmental Assessment Program at State University College, Buffalo had these objectives:

+ to illustrate the complex nature of environmental issues and the need for environmental impact assessment.

+ to present some ecological methodologies and principles necessary to conduct a specific environmental impact assessment.

+ to collect and analyze data which aids in evaluating a specific land-use question, the future development of Times Beach.

+ to write a draft environmental impact statement and present it to a panel of government officials and scientists interested in the land-use decision.

Our overall goal was not a polished EIS, but rather to provide some insight into the complexity of environmental issues and the preparation of an EIS. We wanted to simulate environmental assessment experiences.

Two other faculty members served as co-directors of the Project. My own background in chemistry/science education, teamed with Dr. Thomas Kinsey serving as our biologist/computer resource specialist, and Professor Richard Foster as a geologist, provided basic expertise in environmental

assessment. A variety of guest speakers supplemented our disciplines and provided additional insights. Each speaker is identified in the program content section of this paper, which follows shortly.

Twenty-two high ability high school juniors from Buffalo and surrounding Western New York communities participated. The six week program was for commuters only, thus eliminating need for dorm counselors and extensive planning of "free time" social activities. However, it was important to get this commuter group acquainted and interacting quickly. To aid this process, we scheduled several noon hour sporting events in which everyone could participate.

The Program began on a Sunday afternoon, with participants and their parents gathering for an informational "punch and cookies" session. While the students were getting to know each other around the punch bowl, the parents and Program instructors met in a nearby room. We discussed what the students would be doing, the type of clothing they should generally wear (sturdy for the field work), and a myriad of other details parents are interested in. This informational session with parents is an important element in building a successful project -- and should be a kick-off feature of any program, whether commuter or residential.

Program Content

The environmental assessment program began formal sessions the next morning, using the first of three case studies. Two of the three case studies included during the first week were current Western New York environmental issues -- thus building in relevance and interest. Our purpose in presenting these detailed case studies (one per day) was to have the students begin to identify factors that could/should be part of an environmental assessment.

Love Canal Case Study

Love Canal, a sub-division in Niagara Falls, New York, was our first case study. It was a chemical waste dump in the 1940's and 50's. Later, a new subdivision and elementary school were built there. In the late seventies, off-site migration of a variety of potentially serious chemicals into neighboring homes and the 99th Street Elementary School, ultimately caused both the State of New York, and the Federal government to declare the neighborhood a disaster area. Homeowners had their homes purchased by the government -- but only after much confusion, conflicting research, and emotionally charged confrontations between residents and various local, State and Federal officials.

We presented a historical background to the Love Canal controversy, and used a videotape of Dr. Beverly Paigen, then a cancer researcher at Roswell Park Memorial Institute, who discussed the health effects studies she conducted at Love Canal for the Love Canal Homeowners Association. Mrs. Louella Kenny, an officer of the Homeowners Association, summarized the residents' reactions. She also led a drive-through tour of Love Canal

"Rings 1 and 2" -- many modest, boarded-up homes surrounded by a chain-link fence. The tour provided a somber example of a neighborhood that had died not only from the effects of a chemical dumpsite, but also from fear of that dumpsite.

To balance the pre-environmental presentations of Dr. Paigen and Mrs. Kenny, Mr. Robert Luss, a spokesman for Hooker Chemical Corporation discussed the problems of safe disposal of toxic chemicals in the environment. Hooker was the company who owned the Love Canal property during the time when most dumping occurred. Mr. Luss made Hooker's case: it had properly disposed of the chemical wastes at the Love Canal, according to the accepted practice of the time. The Niagara Falls Board of Education was warned, Hooker contends, about the buried chemicals, but still wanted to build a school to serve the developing subdivision. The Board bought the land for the elementary school from Hooker for one dollar, in 1953. Construction of the subdivision and the school disturbed the clay cap put over the chemicals, Hooker says, and thus triggered the set of events familiar today.

Finally, Ms. Martha Cornwell, of the Environmental Studies Center at SUNY Buffalo, described survey research techniques, and the results of Center-sponsored surveys of various attitudes towards environmental issues, including the Love Canal issue.

Nuclear Fuel Services Case Study

The second case study focused on Nuclear Fuel Services (NFS), a now-closed nuclear fuel reprocessing plant 30 miles south of Buffalo. It was operated by a subsidiary of Getty Oil Corporation from 1966-72, and was the country's only commercially-owned and operated nuclear fuel reprocessing plant. From the years of plant operation, approximately 560,000 gallons of neutralized, high-level radioactive liquid waste are stored in an underground carbon steel tank. The wastes, because of their intense radioactivity, must be isolated from the environment for thousands of years. Yet the tank they are stored in has a useful lifespan of 20-40 years.

The plant site includes a trench area for disposal of low-level radioactive waste, and a storage pool for nuclear power plant spent fuel rods. Nuclear Fuel Services was criticized by the Nuclear Regulatory Commission for their plant operation and use of short-term transient workers in radioactively "hot" areas. Low, but detectable levels of various radioactive isotopes from the plant have been detected in the Cattaraugus Creek watershed which flows into Lake Erie.

During this case study, we reviewed the nuclear fuel cycle, the geology of the West Valley plant site and adjacent areas, the biological effects of nuclear waste, and technological obstacles to safe storage/removal of waste from West Valley. Since an actual tour of NFS was unavailable, Dr. Peter Gold, headmaster of an environmental studies residential college at SUNY Buffalo, provided a slide tour of the West Valley plant site. Ms. Carol

Mongerson, of the West Valley Coalition, gave area residents' views on the the plant, and future disposition of the wastes now stored there. Ms. Mongerson was active in the citizen input phases of the environmental impact statement process, a major component of the government's investigation of plant site cleanup and possible removal of the high level liquid wastes.

Turkey Point Case Study

The third morning of our Program featured Dr. Murray Felscher, former staff scientist at the U.S. Environmental Protection Agency, who presented an illustrated slide-discussion of a problem faced by the Turkey Point Nuclear Power Plant, operated by Florida Power and Light Corporation (FP&L). Poor design of cooling water facilities had produced biologically dangerous releases of hot water into Biscayne Bay, south of Miami. Inappropriate siting of water intakes for the power plant then caused partial recycling of this heated water back into the plant -- thus lowering generating efficiency! (Prior to Dr. Felscher's presentation, students were given selected portions of the actual EIS prepared by FP&L on this problem.)

Our participants suggested some solutions to the problem, based on the EIS information, and Dr. Felscher's presentation. Finally, he revealed the actual solution: a massive series of canals through existing mangrove swamps, which cooled off the existing water and discharged it sufficiently far from the plant's water intakes. The trade-offs involved in this solution vis-a-vis alternatives were then debated (2).

That afternoon we compared the three case studies: the now completed FP&L project with the still "unsolved" problems at the Love Canal and West Valley. What things should have gone into the environmental assessments at these three sites? What was "done right"? What was "done wrong"? We concluded the day by playing a simulation game, "Port Sivad: Decision to Locate a Noxious Facility in a Community" (3) which illustrated the complexity of environmental issues, together with the possibility of vested interest and differing views of the same environmental issue.

Field Work at the College Camp

Thursday and Friday of the first week featured an overnight at the College Camp, in a rural setting about 50 miles from campus. We investigated local ecosystems, and learned some ecological monitoring principles. Students compared aquatic ecosystems above and below a local dam, practiced geological mapping, and performed some biological sampling and chemical analyses. The ovenight also provided students a chance to meet with the instructors informally, and continue building group "espirit de corps."

SEQR as a Model for the EIS

In 1978, New York fully implemented its own version of NEPA, entitled the State Environmental Quality Review Act (SEQR). Like NEPA, it requires that environmental factors be considered along with social and economic

considerations in governmental decision-making. We used SEQR as the model for our environmental assessment, and writing of the draft environmental impact statement (DEIS). New York has provided a number of materials to speed the implementation of SEQR -- these proved useful in our Program.

Both NEPA and SEQR were introduced at the beginning of week two. We discussed the SEQR decision-making process, and the factors to be considered in going through the environmental assessment process in SEQR. (For more information, see The SEQR Handbook, cited in the references.) We supplied each student with a copy of Rosen's Manual of Environmental Impact Evaluation for reference purposes, and identified The Environmental Impact Data Book by Golden et al., as a useful source of important information for EIS preparation. Since our goal was not to produce experts in EIS laws and regulations, only a sketch of the type of information and the overall process required for our environmental assessment, and subsequent DEIS, was provided.

With the process of environmental assessment thus introduced, we began discussing the site for our environmental assessment: Times Beach.

The Times Beach Field Site

Times Beach is located directly south of downtown Buffalo, in an area of the waterfront which is predominately industrial. This 55 acres of land on Lake Erie near the mouth of the Buffalo River (see Figure 2), has changed in use and appearance over the years.

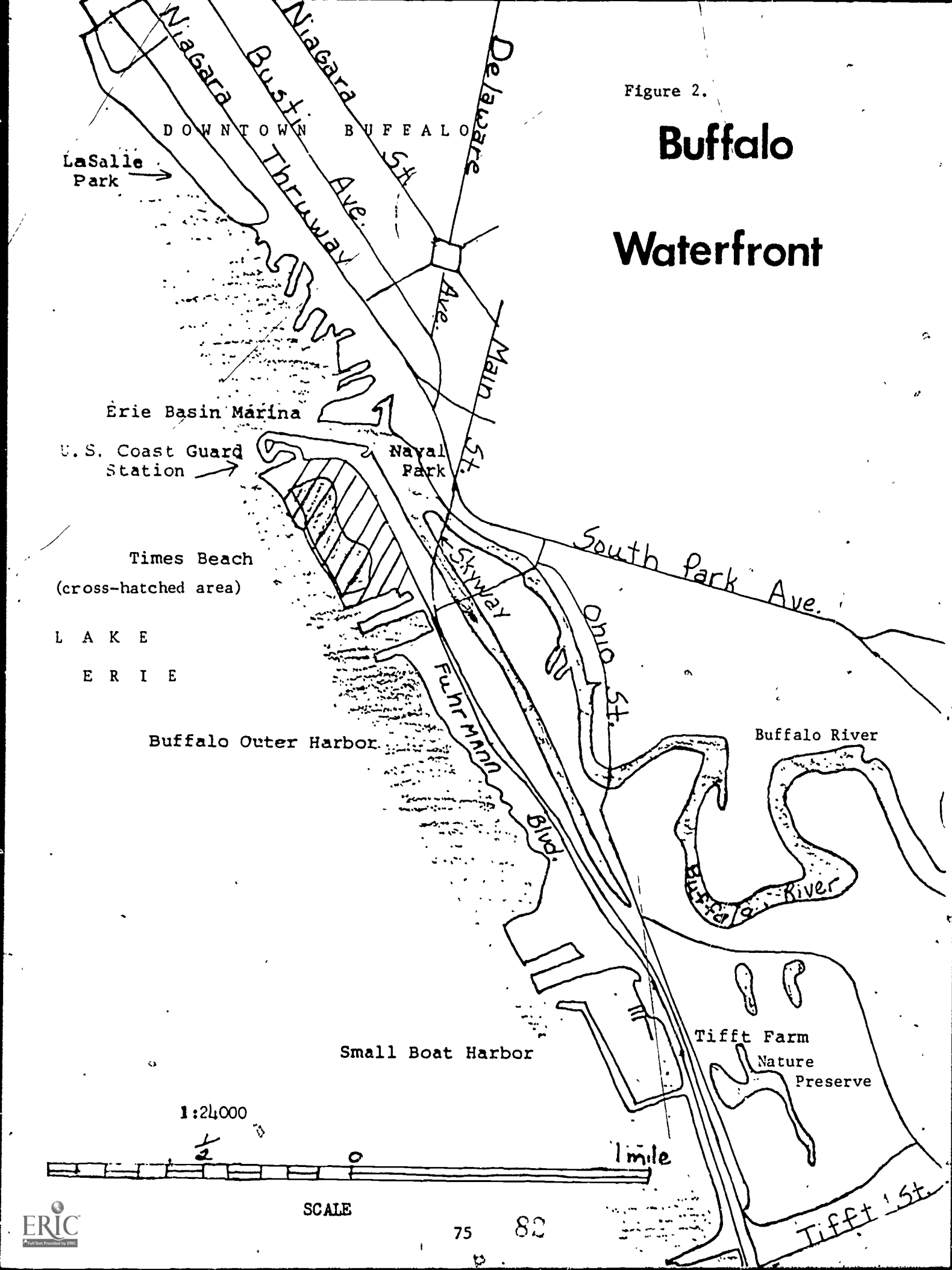
Before World War II, Times Beach was actually a sandy beach, and popular swimming area. But as increasing pollution took its toll on Lake Erie, the Beach gradually evolved into a boat-launching site. In 1952, the Federal government deed the land portion of Times Beach to the City of Buffalo, requiring only that it be used for recreational purposes.

By the late sixties, the Environmental Protection Agency was increasingly concerned with water quality in the Great Lakes. One result was the banning of open lake disposal of polluted harbor dredgings. This was the most common disposal technique used by the Army Corps of Engineers when dredging Buffalo area waterways to maintain navigation channels. Studies done by EPA from 1967-72 showed that Buffalo Harbor dredgings exceeded pollution limits for open lake disposal in oil and grease, Total Kjeldahl Nitrogen, volatile solids, mercury, and chemical oxygen demand. Thus, the Corps had to find a new place to dispose of dredged materials from area waterways.

The location of Times Beach (on the harbor, with its "back" to the Buffalo River) provided a convenient, alternate dumpsite for these polluted dredgings. In 1971, the Corps constructed a dike to enclose the area, essentially boxing the site. Disposal started, and over the next five years, about 555,000 cubic yards were dumped there.

Figure 2.

Buffalo Waterfront



What happened next was ecologically predictable. The water pumped into the site eventually evaporated or filtered through the dikes and the solid material settled to form dry land. Due to its fertility, these dredgings soon supported a marshland attractive to many migratory birds and other wildlife. The 55 acre site developed a variety of habitats, including deep and shallow water in a 20 acre lagoon, silt flats (which had disappeared by summer, 1981), and wooded uplands. Many species of shorebirds, gulls and a variety of small mammals were moving into the area. The site was located in an important flyway for migratory water birds, and its sheltered waters provided an ideal feeding and resting area for them.

The Buffalo Ornithological Society considered Times Beach to be an extraordinary resource, since the birds sited there represented over half of the total number of birds ever seen in Western New York. This was surprising for such a small property, encircled by urban and industrial sites. Because of public pressure, and the availability of other dredge disposal sites, the Corps stopped dredged disposal at Times Beach in 1976.

In 1978, the New York State Department of Environmental Conservation declared Times Beach a wetland under the Environmental Conservation Law. This meant a permit would be needed before any substantial change to the existing wetland was made.

By 1978, a number of development proposals for Times Beach had emerged. The Buffalo Ornithological Society submitted a detailed plan for using Times Beach as a wildlife sanctuary, with maximum preservation of the existing habitat. Meanwhile, the City had suggested two alternatives: a Waterfront Park for active recreation -- thus necessitating completely filling in the wetland, or a combination Active/Passive Recreation Proposal. The "combo" plan would develop half of the wetland into a park, and leave the remainder as a wildlife preserve.

For their DEIS, the students focused on the wildlife preserve option for the "proposed action", largely because it provided the most detail on which to build an EIS. The two City plans were included as "alternative action".

Environmental Coursework

For two weeks, the Program then focused on class and lab activities useful in the upcoming environmental assessment activities at Times Beach. We included intensive instruction in some ecological principles, environmental parameters, data collection methodologies, and analysis techniques. Some of the topics included:

* abiotic and biotic environmental factors at Times Beach, including biogeochemical cycles, ecosystem interactions with temperature, climate, water, soil, etc.; food webs, habitats, community structure, etc.

* geologic factors at Times Beach, including bedrock, erosional factors, depositional factors, beach and sediment quantitative analysis, etc.

* air and water quality assessment, including normal atmospheric components, air pollutants (particulates, sulfur oxides, carbon monoxide); water temperature, transparancy, pollutants, biological indicators, etc.

* socioeconomic factors, including economic impacts of various development options at Times Beach; assessing esthetic effects; acoustic measurements; preparing for and participating in public hearings.

The last topic was presented by Dr. Kit Krickenberger, MITRE Corporation, McLean, Virginia. Dr. Krickenberger has attended numerous public hearings as technical representative of MITRE, a prime contractor for numerous specific and generic EISs prepared by various government agencies. She discussed some straightforward socioeconomic projections that could be included in an EIS. She also dispelled apprehension about testifying at public hearings!

Field Work at Times Beach

After an initial visit to Times Beach, and a brief presentation of the existing data bases for the Times Beach area, the students chose a primary interest group: biological, chemical or geological. (In order to even out groups, some persons got their second choice. Because of the work load, we put more persons in the biology group.) The groups then tried to identify the major issues at Times Beach, in terms of the Environmental Assessment form required under SEQR. Part I of the form focused on Project Information, including information about the ecosystem. Part II requires the reviewer to evaluate Project Impacts and Their Magnitude, while Part III is an Evaluation of the Importance of Impacts. The two City of Buffalo proposals (Waterfront Park, and the "combo" Park/Wildlife Preserve) would essentially destroy all or part of the current wetland. Thus, a DEIS for the development options at Times Beach could provide valuable information to aid the decision-making process.

The three groups then began the data collection process at Times Beach, focusing on information useful in the various chapters of the DEIS.

The geology group mapped the Times Beach site, characterized the site from a geological perspective. The surface materials were described and chemical soil analyses for pH, humus, nitrate, pottasium, and phosphorus were conducted. Soil loss at Times Beach was determined using the universal soil loss equation. This group provided a series of support services to the other groups, including the establishment of precise locations for sampling sites, and identifying those sites on appropriate maps.

The chemistry group conducted a major water sampling program in the Times Beach lagoon, using six sites in various areas of the water body plus a comparison site in the deep water channel, adjacent to the dike. 21

parameters were measured, including pH, dissolved oxygen, turbidity, phenol, chemical oxygen demand, oil and grease, nitrates, and total hardness. Air quality sampling for sulfur dioxide, carbon monoxide and total oxidants, was conducted for 10-30 minute periods on a number of days. Sound levels were experimentially determined at five sites.

The biology group described the biological communities at Times Beach. Plant transects were done at seven locations, and sampling sites in the lagoon yielded information on planktonic life. Insects were collected at four locations and identified. Fish life was sampled one day, using a seine net along the shores of the dike. An early morning bird census was conducted by the group of mostly inexperienced bird watchers. Informal observations of other animal life at Times Beach were also recorded.

All students were also part of a socioeconomic group, for two reasons: almost all expressed interest in this area, and all would be needed for the survey data collection. The major work of this group was to draft an eleven item survey, and use it to collect data in various areas of downtown Buffalo, near Times Beach. The survey was designed to sample three areas: respondent's knowledge of present and past uses of Times Beach, their own needs for recreational areas and satisfaction with Buffalo's recreational areas, plus their ranking of the development options for Times Beach. In addition to the survey, which would be termed "political aspects" in a NEPA-based DEIS, the development options were also evaluated in terms of their population/growth-inducing aspects, demand on services, land use, noise aesthetics, and their impacts on archaeological and historical resources.

Writing the Draft Environmental Impact Statement

The students began drafting the various chapters in the DEIS with about eight days remaining in the program. We reassiged all students into one of two groups: the larger group would have prime responsibility for drafting (and re-drafting!) the various sections of the DEIS. A smaller group would help with that, but would focus on preparing for the hearing to be held on the last day of the Program. This group assigned topics to be presented, conducted several dress rehearsals, and prepared diagrams, slides and overhead transparancies for the verbal presentations. All students partipated both in writing the DEIS, and in presenting material at the hearing, however.

The draft EIS, which ultimately totaled 195 typed pages, contained the following major chapters and topics:

Description of the Proposed Action. A brief history of Times Beach, and presentation of the Buffalo Ornithological Society's plan for a wildlife sanctuary.

Environmental Setting. The site was characterized, in terms of its geological, chemical and biological setting. Previous studies were cited, and used for comparisons, when warranted.

Significant Environmental Impacts. Both primary (direct results of the proposed action) and secondary impacts (indirect or induced) for the sanctuary proposal, plus adverse environmental impacts.

Irreversible and Irretrievable Commitments of Resources. Financial committments, construction materials, and man-hours committed are included here. Trade-offs between short term gains and long-term losses are also examined.

Socioeconomic Considerations. Included here were a variety of "growth-inducing aspects", including population effects/demand on services, aesthetics, sound levels, and political impacts (the survey).

Effects on the Use and Conservation of Energy Resources. Impacts on energy consumption are briefly addressed.

Mitigation Measures to Minimize Environmental Impact. Steps taken to reduce or minimize negative environmental effects, or to produce beneficial impacts were discussed.

Alternative Proposals for Times Beach. The other two development proposals for Times Beach (Waterfront Park, "combo" plan) were evaluated here in a general way. The primary impacts of each, along with socioeconomic impacts were included. Two "no-action" alternatives were also evaluated: one with no maintenance (and subsequent build-up of trash at the site), the second with minimal maintenance. The chapter concluded with a table comparing impacts for the three alternative actions, and two "no-action" options.

Appendices. Various appendices were included, including one which spelled out procedures for Times Beach mapping, sound measurement, chemical tests, plankton sampling, plant transect methods, etc. Other appendices provided historical data on birds sited at Times Beach, characteristic plants of the area circa 1976, and a 1975 vegetation pattern study at Times Beach. A copy of the public opinion survey was included, as well as the State Environmental Assessment Forms for the wildlife sanctuary proposal.

The Hearing

A panel of six persons conducted the mock hearing on the Times Beach DEIS. The hearing was an attempt to model the process which occurs when comments are solicited on a draft environmental impact statement. Hearings are sometimes conducted to obtain public comment, if the issue warrants. Each person was interested in, or had some responsibility for the Times Beach decision. The six panelists were:

Dr. Robert Andrle, Buffalo Museum of Science (member of Buffalo Ornithological Society)
Mr. Harold Dodge, Chairman, Erie County Development Coordination Board
Mrs. Gail Johnstone, Director of Planning, City of Buffalo
Dr. Pulak Ray, Acting Director, Great Lakes Laboratory
Mrs. Joan Schmidt, Erie County Environmental Management Council
Mr. Anthony Voell, Deputy Commissioner, Erie County Department of Environment and Planning

Each official had some time to scan the (rough) draft EIS, before the hearing began on the morning of the last day of the Program. The hearing consisted of presentations of each of the major elements of the DEIS by students, followed by questions from the panel. While a number of technical details were questioned, the students generally fielded questions very well. Overall, the panel members were highly impressed with the job done by the Program participants in such a short time period.

Epilogue

When the DEIS was typed, each student received a copy. Copies also went to all the hearing panelists. Buffalo Mayor James Griffen invited the students and Program instructors to his office one afternoon, to formally thank us for providing useful information on Times Beach. Each student received a letter of thanks from the Mayor.

Times Beach remains in limbo today. A decision has been delayed, because of concern for the nature of pollutants in the dredged materials dumped there. Recent studies by the Buffalo office of the Army Corps of Engineers did indicate sediment samples from Times Beach contain low but detectable amounts of aniline compounds, benzo(a)pyrene, and polychlorinated biphenyls. Other organic pollutants including the chlorinated hydrocarbon pesticides were not detected. It did not appear the existing pollutants bioaccumulated in plants growing in the area.

The silt mudflats, present in the mid-70's at Times Beach, have undergone rapid ecological succession, to become a dense cattail marsh bordering the lagoon area. In fact, the value of Times Beach as a bird nesting area appears to have diminshed somewhat, because the mudflat habitat no longer exists. (The wildlife sanctuary proposal described in the DEIS, was modified to reestablish this mudflat, in order to attract a larger variety of shorebirds, gulls, and terns.)

All the environmental monitoring done during the Program, indicated that Times Beach was a healthy, functioning ecosystem. Oil and grease from the bottom sediments in the lagoon did greatly exceed EPA standards, but it did not appear to have major serious impact. For example, biological sampling clearly indicated a good population of aquatic plants in the lagoon.

The Times Beach survey, conducted in downtown Buffalo one day over the noon hour, had 235 respondents. Most persons did not know specific information

about Times Beach, but once informed felt it was an important local land use issue. The most popular development option was the "combo" plan of half Park, half wildlife sanctuary.

Evaluation and Recommendations

1. Only informal evaluation of the Program was attempted. Chats with some of the students yielded several suggestions for modifications. However, all participants expressed enthusiasm for their experiences in the Program. Most are now in college, studying a wide variety of science fields.

2. Let the media know about your program. Programs with local studies are popular with writers and editors. We garnered several newspaper articles, plus good TV coverage of the field work at Times Beach.

3. Staff for a program involving environmental impact should include a social scientist, to aid in socioeconomic evaluations. We could have used an in-house expert.

4. More time should be alloted to writing the DEIS. The short time period (7 days) made this process a "real killer" for all concerned. Extra time could be provided by trimming the case studies.

5. More time for monitoring, especially in the biological area was needed. Perhaps more field time, and slightly less environmental instruction in the classroon could help here.

6. A redivision of student groups might be desirable. The geology group did not have the workload that the chemistry and biology groups had.

7. Instructors directed the writing process for this DEIS. In the future, use a few of the best students to get the job done. The instructors should still carefully monitor the process, but not assume direct control.

8. The topic/site for the EIS must be carefully chosen. Ideally, it should be a relatively straight-forward project, on a site amenable to standard environmental monitoring techniques. The instructors should identify previous studies of the general area, and existing ecological and other background information. Detailed information and cost estimates for the proposed project are particularly important, since these form the "backbone" of the EIS, and comparisons between alternatives.

9. EIS preparation is a successful teaching tool for college students too. We now include a course which focuses on preparing a DEIS for a proposed local project in our interdisciplinary Environmental Sciences Minor at Buffalo State College.

10. Most federal grant programs for this type of science enrichment project have been eliminated. If such programs are to continue, it will take effort and creativity on the part of program instructors -- and the assumption of significant costs by program participants. However, colleges may well consider underwriting such programs, in an attempt to attract high quality students to campus, and perhaps later enrollment.

Footnotes

(1) Currently, 22 states have environmental review laws or executive orders. All are modeled after NEPA, but vary widely in their effectiveness. For example, Indiana in practice limits FIS work to major transportation projects, such as highways built with Federal funds. Texas, with an executive order-type environmental review, also appears to have relatively little state-initiated environmental impact statement activity. In contrast, New York and Washington State have laws which mandate formal environmental review processes for many state, local government, and private projects which require government review.

(2) Dr. Murray Felscher conducted a number of NSF-funded Chautauqua Short Courses in the mid-70's, which used the Turkey Point plant problem as a springboard to discuss and detail environmental impact decision-making. I participated in one of these, and found the technique fascinating. Dr. Felscher is now an environmental consultant, and is available for presentation: Dr. Murray Felscher, President; Association of Technical Consultants, P.O. Box 20, Germantown, MD 20767, or call: 202-393-3640.

(3) The author of the Port Sivad simulation game is Dr. John F. Jakubs, Department of Geography, The Ohio State University, Columbus, Ohio 43210.

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A Resources Education Program for Latin America

Gerald A. Lieberman[1]

The Global 2000 Report to the President, prepared by the Council on Environmental Quality, states that: "Deforestation is projected to continue until about 2020 ... Most of the loss will occur in tropical forests of the developing world..."; and, "By 2020, virtually all of the physically accessible forest in the LDC's (Lesser Developed Countries) is expected to have been cut..." (Barney, 1980:26) "Between half a million and 2 million species -- 15 to 20 percent of all species on earth -- could be extinguished by 2000 ... One-half to two-thirds of the extinctions projected to occur by 2000 will result from clearing and degradation of tropical rainforests." (Barney, 1980:37)

Public and private organizations have been working to develop environmental education programs in the United States for the past two to three decades. Unfortunately, to date few programs have been disseminated to the developing countries where they are vitally needed. What is needed is an integrated system of basic resource management education. Such a system must provide an understanding of natural resources, techniques for managing those resources, and the knowledge and experiences necessary to produce rational decisions about the growth of society.

As a result of the findings of studies such as the Global 2000 report, RARE, Inc., a non-profit organization devoted to the protection of endangered plants and animals, has focused its efforts on stopping the destruction of tropical rainforests. RARE, a publicly supported organization which is starting its tenth year, has responsed to requests for assistance in the establishment of conservation education programs by developing a new program, formally designated the "Resource Management Education Program" (RMEP). This project seeks to teach the children of Latin America how and why to care for the plants, animals, and other natural life around them.

Program Description

The RMEP was developed by RARE's staff of environmental educators and several interns with review and technical assistance from faculty at Pennsylvania State University and Rutgers University. The program was designed for use in primary schools throughout Latin America and it represents a coordinated educational progression from basic awareness of resources -- through the development of concepts, skills, values and attitudes -- to problem solving experiences and decision-making abilities. All of the studies are designed to help young citizens learn how to make responsible decisions about their resources.

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The materials for the RMEP were based on the teaching objectives of Costa Rica's Ministry of Education. Since the education systems in use by Costa Rica are some of the most advanced in Latin America, this curriculum provides a sound basis upon which to build a program that can be disseminated to other Latin American countries.

Goals

In general terms, this program seeks:

to develop an awareness of natural resources;

to provide the basic experiences and knowledge to develop the skills needed to identify and understand present and future resource management problems;

to tender the opportunities and encouragement which will allow students to become actively involved in the learning process; and, which will allow them to participate in basic resource management action and enhance their environment; and,

to cultivate a land ethic and resource conscience which will ensure the wise, long-term management and use of the natural resources upon which we all depend for survival.

Program Phases

The in-country development of the RMEP is conducted in six major phases. Some of these phases are related to the pedagogical development of the program while others must be concerned with the long-term political and sociological aspects of initiating and maintaining a program in a foreign country.

Phase I --- Develop in-country contacts

The temporary nature of RARE's involvement in the establishment and dissemination of the RMEP in each country necessitates the development of a strong local constituency. Establishing a network of contacts with local conservation organizations, university faculties, and Ministries of Education is therefore of critical importance to the long-term success of the RMEP.

Phase II --- Pre-pilot review and workshop

The pre-pilot test review and workshop serve two basic purposes. First, they are a means for adapting the RMEP materials to the specific needs of the country. Changes are recommended by a team of local professionals, with respect to biological conditions and special idiomatic needs of the target country. The second, and perhaps most important aspect of this Phase, is that it provides for the active participation of the professionals within each country. This is critical to the continuing success of any such program.

Phase III --- Completion of pilot materials

Subsequent to the review and workshop conducted during Phase II the RMEP materials are revised by RARE staff with assistance from the local team. The package which is to be tested during Phase IV of the program is then prepared and produced. Once these modifications have been made, the materials are available for testing; no further major changes are made until Phase V.

Phase IV --- In-country experimentation with materials

One of the main objectives of the in-country pilot project experiment with the RMEP materials is to demonstrate the educational approach represented by this program. Additionally, this test phase is used to ascertain the existence of any difficulties which might be discovered by the teachers.

The pilot program is being conducted with the cooperation and participation of the "powers that be" in the government, the Ministry of Education in particular, teachers and local conservation organizations. Representatives of these agencies and organizations (the local team of professionals) have the leading role in the teacher training, implementation, and evaluation of the results. The schools participating in the test are chosen to represent a cross-section of the cultural and socio-economic structure within the country.

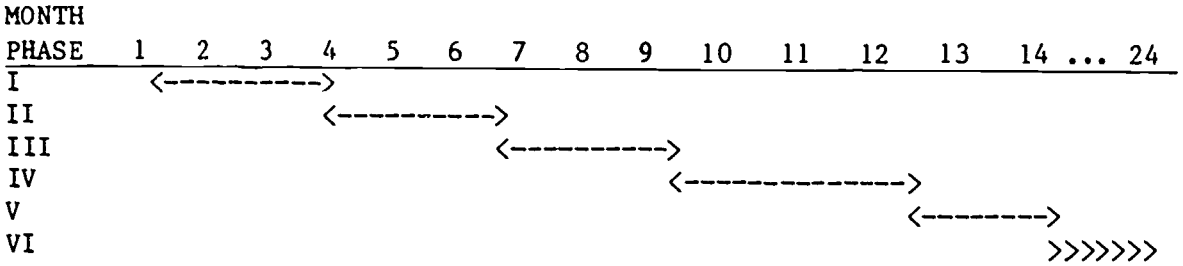
Phase V --- Final revisions of materials

"Final" revisions to the RMEP materials, based on the results of the in-country pilot programs, are completed as a joint effort of the local team and RARE staff. These modifications are completed during a review and workshop subsequent to the completion of the Phase IV in-country testing.

Phase VI --- Program continuation

The number of copies available for use in each target country is dependent upon funding. Continued supervision and review of the program becomes the responsibility of the Ministry of Education working in conjunction with the local teams of professionals. The in-country constituency for the program must maintain the government and Ministry's interest in the long-term success of the RMEP and the training of further groups of teachers.

GENERALIZED TIMETABLE



The schedule for the implementation of the RMEP in various contries follows one basic pattern. Differences in the calendar year timing of the phases is dependent on the program schedules which are in use by the target country.

Current Status and Future Developments

In 1982, with the cooperation of the Ministry of Education, a pilot program was implemented in 11 Costa Rican schools. The participating teachers and supervisors have received special training, from the in-country team and RARE staff, to enable them to provide comments from their "hands-on" experiences. (The materials were designed so that during normal operation of the Program there will be little need for "pre-training" of teachers.) Subsequent to the pilot program the Costa Rican Ministry of Education intends to make the RMEP mandatory in all schools.

The success of the RMEP pilot program in Costa Rica has stimulated interest from other countries concerned about the present and future status of their natural resources. RARE is the first stages of developing similar programs in Colombia, Ecuador, Chile, and Panama.

Resource education efforts at all levels are vitally important in the world's lesser developed countries. Cooperative efforts with educational institutions from the developed countries provide the most effective means through which to expand these efforts where they are most needed.

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The Environmental Educator and the Handicapped Visitor

Nancy Marie Payne[1]

Each of us has a handicap; a physical, psychological or mental defect which sets us apart from the accepted norm. Some people have an inability to get to appointments on time; some people stutter; some break out in hives in stressful situations. For others the handicap may be more encompassing: the inability to see, or hear; the inability to read; a lack of muscle control; or even a limited reasoning capacity. All of us have learned to co-exist with our handicaps, learned ways to compensate for them or ways to overcome it by working around them. With most of us, our handicap does not take much time out of our daily lives. We are able to pursue and satisfy our need to interact with the environment through hiking, canoeing, birding or outdoor photography. Persons with debilitating handicaps have spent a large part of their lives learning to function with them. Their time in the natural environment is usually minimal, yet their need for environmental pursuits high.

Although the environmental education needs of the handicapped person are stressed here, the nature of their handicaps is not. The fact that a person with a debilitating handicap is at an environmental center usually means that they can function independently enough to care for themselves. It would be courteous though, before a program or walk, to ask if anyone has a special need or if there is some special way you can interpret for everyone. It has been found that, for the most part, persons with handicaps do not want preferential treatment. Most do not want specialty trails (braille trains get little use by the blind community), or specially marked areas (picnic areas for the wheelchair-bound would be unacceptable to many). Handicapped persons in general want to be treated like everyone else. They want to be integrated with all segments of the population. In general, if we plan our trails and our presentations to involve all the senses of a person without a debilitating handicap, then the walk or presentation will be involving to the handicapped person as well.

This, then, puts the responsibility of handicapped services on the trail designer and the environmental educator. Much has been written about designing trails with all persons is mind (see bibliography) and it is not my intent to dwell on that subject. Suffice it to say that multiple-use trails with sensory interpretations appeal to a large number of persons, not only those with handicaps.

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With more and more people taking an interest in the environment, it is becoming increasingly more common to find handicapped persons at environmental education programs and walks. We have to take a hard, cold look at our presentations and our delivery. No longer does the traditional "look at the bird while I expound" approach work. Maybe it never did. The key to a successful presentation for any audience is a multi-sensory, hands-on approach. To give people a chance to touch, feel, smell and manipulate is to invite them to interact with their environment rather than be a passive receiver. With a little forethought, any walk or program can be multi-sensory. Collect feathers to take on your bird walk. Use your fingers to simulate beak shapes and invite your audience to do the same. Before any walk, preview your site and know where nests or low woodpecker holes are for people to touch and smell. A tape recording of bird calls is not heavy to carry and insures that everyone is listening to the same bird call. When talking about a bird, compare its size to something the audience is familiar with, preferably something near at hand. For example, "This woodpecker would extend from the tip of my fingers to my elbow." Each of the tips mentioned would not only make the walk interesting to a blind, mentally handicapped or deaf participant, but would spark the interest of any visitor.

If the program is an indoor presentation, all of the above-mentioned aids would enhance it. Even slides can be used with visually impaired persons in the audience if a little consideration is used. Do not be apologetic for the slides, because that calls attention to the person's disability. That situation should be avoided. Do a lot of describing during the presentation. If possible, use mounted specimens or study skins in conjunction with slides.

Environmental educators go through a lot of natural history training. Often skills like rapport and effective communication are learned on the job, or not at all. Unless educators have frequent dealings with persons with special needs, they tend to feel uncomfortable with handicapped persons in the audience. The best way to deal with feelings of inadequacy is to learn about various handicaps and to associate with handicapped persons. Trainings in communications could include speakers from handicapped organizations such as associations for the blind, cerebral palsy centers, Eleanor Roosevelt developmental centers, etc. Many of these organizations have clients whose job is to establish rapport with outside agencies. They will be more than willing to help staff members learn what to do and what not to do for handicapped visitors. Nothing can substitute for interpersonal contact, though. Many organizations for the handicapped conduct open houses and community days where the general public is invited. Opportunities like this are invaluable for breaking down prejudices that we all have regarding the handicapped person.

Often environmental educators tend to be nature identifiers rather than interpreters. All of our visitors need challenges, but especially the handicapped individual whose exposure to nature may be minimal. Instead of telling people what causes such things as ball galls or spittle bug spittle, let them probe the object themselves. Suggest carry-over activities such as planting for wildlife, or building bird houses or

feeders, so that the visitors can begin to be aware of the wildlife around their homes. All our visitors need to see their place in the natural scheme of things. Questions that cause visitors to think beyond the immediate and visual can serve this end. "What animals would be affected if pesticides killed off all of the ground beetles?" "How does a dry spring affect amphibians and the rest of the food chain?"

Having handicapped persons at our nature centers and in our parks is a benefit for all our visitors. Their presence challenges the environmental educator to be more attentive to the audience's abilities and more creative in their programming. When educators present a program with their audience in mind and cater to the visitors' abilities, everyone benefits, because everyone has special needs.

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From Columbus Abroad: The Ohio State University's International Environmental Education Effort

Robert E. Roth[1]

The Division of Environmental Education has been involved with the development of environmental education programs through undergraduate and graduate resident instruction, reasearch, and public service since its creation with the School of Natural Resources in 1968. Through participation in the 1972 U.N. Stockholm Conference on the Human Environment to the creation of the National Environmental Education Clearinghouse for the Educational Resources Information Center (ERIC) of the U.S. Office of Education in 1970, the Division has provided leadership to the field. Over 10,000 research and curriculum documents in environmental education have been reviewed and processed through the ERIC Clearinghouse for Science, Mathematics and Environmental Education (ERIC/SMEAC). To date, 85 publications have been produced for volume distribution to researchers and practitioners in the field in the U.S. and abroad. The resulting data base provides the most complete access to environmental education literature that exists anywhere.

The Division is currently involved in a large-scale international environmental education project with the Caribbean countries of Barbados and the Dominican Republic.

The purposes of this project are to: (1) establish cooperative working agreements with the Caribbean Conservation Association in Barbados and the Ministries of Agriculture and Education in the Dominican Republic; (2) develop a targeted environmental education manual appropriate to each country; and (3) plan a conservation/environmental education workshop model for the training of selected agency and educational personnel.

Students and faculty benefit by this program as it strengthens international components in two existing OSU courses and aids in the development of a new environmental education course emphasizing international environmental education program models.

This project, which began in early 1981, has resulted in travel and intercultural contact for representatives from the three countries. Last year, OSU officials traveled to the Dominican Republic where meetings were held with key officials and field trips were taken throughout the country to gain a better understanding of existing programs and problems in natural resource conservation and environmental education. In addition, three complete sets of ERIC/SMEAC environmental education materials were provided to key personnel in the Ministry of Agriculture and the AID Mission in Santo Domingo. OSU representatives also visited Barbados last year to accomplish the same goals.

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The second phase of the program began in September of 1981 and concentrated on three major areas of activities. The first area was one in which selected representatives involved with environmental education in the respective countries were brought to OSU to discuss needs and to provide guidance in relation to the development of the draft manual of environmental education activities, the prototype workshop model, and needs in relation to program development. The second area involved gaining input concerning modification of the proposed environmental education manual. The third consisted of the development of an appropriate workshop model that will achieve objectives specified by the host countries.

Faculty of the Division of Environmental Education have been involved through the Title XII U.S. AID Program with environmental education development in the Dominican Republic for two years and through correspondence with the Caribbean Conservation Association headquartered in Barbados since 1972. The present Title XII project has led to the establishment of cooperative working agreements with the Ministry of Agriculture, University Pedro Henriquez Urena in the Domican Republic and the Caribberan Conservation Association in Barbados. Other accomplishments include the development of targeted environmental education activity manuals for the Dominican Republic and Barbados and an environmental education workshop model. Work is underway with the Universidad Nacional Pedro Henriquez Urena to assist in the conducting of a National Environmental Education Seminar to be held in the Dominican Republic during November 1982, that will identify the current status of environmental education in the country and explore needs and next steps required. Key environmental education officers from the Dominican Republic and Barbados have visited Ohio State to participate in needs assessment activities and the development of the respective environmental education activity manuals. Faculty of the Division of Environmental Education are participating as a group in Spanish language training and reading and speaking expertise is being further developed.

OSU's future plans for this international project include: (1) develop and teach four-day environmental workshops for agency and educational personnel with the Universidad Nacional de Pedro Henrico Urena and Barbados Community College; (2) conduct a formal cognitive and affective assessment of conservation and environmental needs in the Dominican Republic and Barbados as perceived by selected clientele employed in education, government, agency, and private enterprise positions; and (3) develop a longitudinal environmental education evaluation procedure to measure shifts in the perception of issues and related knowledge and attitudes held by citizens in both countries.

The States and Energy Siting: Cooperation in the Ohio Valley— A Case History in Transitional Times

Thea Teich Townsend[1]

Introduction

In mid 1982, the Ohio River Valley Water Sanitation Commission (ORSANCO) concluded a study which investigated institutional mechanisms of dealing with the interstate issues that arise during energy development. The Commission, formed in 1948 by a Compact signed by the governors of eight states -- Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia -- is an interstate regulatory agency providing water pollution control in the Ohio River Valley. As such, it also provides a regional approach to environmental issues that enables its member states to work together cooperatively to solve them.

The regional scope of environmental problems in the Ohio Valley is understood when one realizes that the Ohio River directly touches six states; its tributaries stretch into seven more. The river is 981 miles long, drains an area of more than 200,000 miles, and today provides the water supply for more than three million people.

The interstate problems arising from water pollution are fairly straight-forward when compared with those connected to energy facilities development. These latter issues are more complex and generate questions on many fronts: environmental, economic, social, and political. The original concerns and reasons for initiating the study were primarily environmental, and it was in this arena that the Commission focused its activities. But as the study progressed, the Commission found that the other areas of concern were highly interconnected; indeed, state officals participating in the study were as likely to cite economic and social issues as primary in energy development decision-making. As time went on, the first of these became more predominant.

Organized as a case history, this paper will review the study, its origins and outcomes with particular attention to its communications aspects. In analyzing the study's development, it will also attempt to incorporate the impacts of outside events and attitudinal changes among participants due to these events.

The study, formally entitled "Institutional Mechanisms and the Impacts of Siting Major Energy Facilities Along the Ohio River," was sponsored by the Commission and was conducted from January 15, 1981 to May 31, 1982. The

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study was performed under a subcontract by the Council of State Governments, a nonpartisan research and support organization formed by and for all state governments and located in Lexington, Kentucky. Financial support for the study was provided by a grant from the John A. Hartford Foundation of New York City.

How This Study Came About

There are good reasons for calling the 1970's "The Energy Decade" instead of the "Environmental Decade" as coined in its early years. Frequently, during the 10-year period, energy-related crises loomed; oil embargoes, Alaska pipeline showdowns, Iranian revolutions, New York blackouts. By the decade's latter years, Americans were staring at dollar-plus charges per gallon on gasoline and exclaiming about their "right" to drive; the "all-electric" home had become a monthly bill-paying nightmare; and a power plant near the capital of Pennsylvania -- Three Mile Island -- had become a household word and a public relations albatross to the nuclear energy industry.

The American citizen had seen two of his most cherished values badly mauled, if not destroyed during this period. One: that the U.S. was essentially self-sufficient in natural resources and was therefore buffered against the various erratic events in the world that threatened the orderly movement of these necessities. Two: that advanced and developing technologies could solve all foreseen and unforeseen problems with little or no impact on the everyday lives of everyday people, except perhaps, to make them easier.

In just a few years, Americans realized that they were part of a world community, competing in international markets for limited natural resource supplies. They also discovered that their "technical fixes" were not always permanent or perfect.

As with most events that bring us up short -- Sputnik being the best example -- we reacted fast and furiously. "Energy Independence' became the catch phrase of the mid-to-late seventies. What Americans had in abundance in the United States was coal and the navigable waterways and roads upon which to move it. True, coal-burning had its problems, but many of these seemed easily surmountable, particularly when the incentives were great.

One of the areas of this country pinpointed as prime for energy development was the Ohio Valley. Close to major cities and coal fields, criss-crossed by navigable waterways, railroad lines and highways, and including in its population a trained workforce, the Valley seemed ideal for a proliferation of electrical generating and synfuels plants. Coal slurry pipelines to carry pulverized coal from Illinois and West Virginia to southern cities were also proposed. The impact of all of this on Ohio Valley water and air quality and water quantity was relatively forgotten, at least for the moment.

But not for long. In 1978, certain member of the Ohio River Valley Water Sanitation Commission became concerned about the proposed energy development along the banks of the Ohio and its tributaries. Approaching the issue from a variety of backgrounds and experiences -- technical, political, and social -- commissioners believed the proposed energy facilities construction needed a thorough exmaination to assure orderly development and protection of the environment. What gave credence and a chance for success to the Commission's efforts was the diversity of viewpoint which enabled the group to foresee some of the obstacles in the way of dealing with intensive energy development along the interstate stream. Even then, not all the stumbling blocks were predicted.

A committee of the Commission proceeded to develop background papers related to state energy development regulations. A survey of energy officals in the eight commission member states resulted in near unanimity regarding the need for a method of dealing regionally with energy development issues. Meanwhile, the Commission staff was looking for private funds to support a study to identify and delineate such a method. Proposals sent to the U.S. Department of Energy and various foundations carried the title "Institutional Mechanisms and the Siting of Major Energy Facilities Along the Ohio River". The shift of this title to that of the study's final report, "The States and Energy Siting: Cooperation in the Ohio Valley," is a microcosm of the changes in perspective of the study team and its steering committee. This will be examined later.

In January, 1981, a grant for the study was awarded to the Commission by the John A Hartford Foundation of New York City. A subcontract was arranged with the Council of State Governments (CSG). Staff for the project were CSG's Program Manager for Environmental Resources and Development and a project researcher. The project researcher formerly served with one of the Commission member states' natural resource agency. As such, he had been involved in several confrontation sitations with the state's electrical utilities. This unfortunately led to some time-consuming communication problems later. The study plan also called for the Commission to handle all general public communications.

Phase I

The first phase of the study was a series of face-to-face interviews by project staff with key individuals in government, energy industries, citizens' organizations, and universities in the six states along the Ohio River mainstem. These individuals were slected from suggestions made by Commissioners and members of commission advisory committees. Although far from statistically organized, the choice of interviewees provided the study staff with a broad range of viewpoints.

Perhaps too broad. Selected for their influence upon state government attitudes and activities regarding energy development, many representatives of state government could not, however, provide thorough answers to questions regarding the nature and scope of interstate, regional issues in this area. For many of the officials, energy development was only one of

several areas of responsibility. States' attorneys general, for instance, would become involved with interstate issues concerning energy development, but could shed little light on the kinds of interstate issues they could forsee. Indeed, some state officials considered the resolution of interstate issues primarily the responsibility of the courts.

In general. Phase I of the study revealed a diversity of viewpoints regarding what constituted an interstate energy development issue and how to address it. Individual state sovereignty and competition among states for the economic expansion that accompanied energy development were cited several times as obstacles to the development of any method to solve interstate energy problems regionally. Furthermore, despite the study's emphasis on the siting of future energy facilties, operating problems and concerns about existing facilties were often noted by interviewees, increasing the diversity of viewpoint. Concerns about nuclear power were underscored.

Energy industry responses seemed to depend upon the interviewee's degree of policy-making responsibility. The study's early emphasis on "energy siting" and use of this terminology (as opposed to the broader term "energy development") also contributed to the diversity of response. According to several energy industry representatives interviewed, there were no "interstate siting problems." Existing energy facilities did not fall into the study's purview because they had been "sited" many years before. The potential interstate environmental issues of air and water pollution would be eliminated in future energy facilties because regulations mandated pollution control equipment and compliance with standards. Thus, there would be no interstate "siting" problems with future plants.

This difference in perspective was one of the major reasons behind the lack of consensus regarding the identification of interstate siting issues and mechanisms to deal with them. Another obstacle that surfaced rapidly was the opposition of many levels of government to the formation of new organizations with potential long-term benefits but little short-term return. Officials and legislators agreed, however, that without a formalization of the mechanism -- its purpose, procedures and responsibilities -- it would probably be ineffective. They also strongly opposed, as did the energy industry, any new layer of regulatory authority to further complicate the energy development process. Any mechanism established would have to be relatively informal and deal with facilitating the process through communication and information exchange. That was about as far as anyone was willing to go at that point.

Reporting back to the Commission Project Steering Committee In May, 1981, Council of State Governments (CSG) staff noted that while there existed this diversity of response which prevented them from making any clear recommendation about the next phase of the project, they could point to several areas of agreement:

> There is a need for economic development and sound managment of natural resources in the Ohio Valley ....

These interests should serve as the starting point for any mechanism implemented.

There is a fear of federal intervention if states fail to deal effectively with interstate issues and disagreements .... Therefore, the states themselves must develop a way of dealing with potential issues of multi-state concern.

There is a need for a forum to communicate and discuss shared environmental and development concerns ... This is also viewed as a means for decision-makers to make trade-offs without resorting to litigation.

Phase II: Regroup and Retrench

Two more items resulted from the Phase I research:

1. Information on the purpose and scope of the study had to be distributed widely to assist project staff.

2. Clarification had to be made as to just what shape the final mechanism for dealing with interstate energy development issues or method might take. There was evidence of confusion on this point. Interviewees seemed to automatically assume that "mechanism" implied "organization." similar in some ways to the Commission. This misinterpretation led to much of the reaction against new organizations because of the costs involved in maintaining them effectively. Project staff had to stress repeatedly the fact that the mechanism could be either as informal as an interstate agreement to exchange information or as binding as a legal compact.

With the submission of CSG's Phase I report, the Commission initiated publication of In Progress, an occasional newsletter on the project. The newsletter did much to clarify the purpose and background of the project and put to rest fears that additional regulations regarding energy siting were under consideration. It also helped clarify the Commission's position on the study.

Concurrently, it was necessary to re-evaluate the data from Phase I and revise plans for Phase II. It had been hoped that Phase I interviews would identify two to four mechanisms or methods of dealing with interstate energy development issues. Unfortunately, this consensus was not forthcoming. Some basic agreement as to functions and characteristics had been delineated, but no actual method had been specified. Thus, as far as this requirement went, Phase II was at ground zero.

It was quickly determined to confine Phase II discussions strictly to energy, natural resources, and environmental protection personnel within state agencies and legislative staffs. In additon, legislators from the states bordering or surrounding the Ohio River mainstem who had expressed

particular interest in energy-related matters would be asked to participate. A series of "workshops" was arranged for each state capital. Participation was by invitation only. The workshops were organized to present the background of the study and the analysis accomplished to date, and to initiate discussions that would lead to the identification of specific mechanisms.

Results again were mixed, and the final seven CSG recommendations ranged from the sponsorship of a symposium on Ohio Valley Environment, Energy, and Economics to the establishment of a mediation center. It had proven impossible to home in on one or two specific mechanisms and refine them until one met all the requirements for addressing multi-state energy development issues. The CSG recommendations are enumerated below:

1. Hold a Regional Symposium to encourage greater public awareness of the siginificance of energy development to the ohio Valley.

2. Establish a Central Communications Channel, serving as a multi-state information clearinghouse for policy concerns and technical issues.

3. Use the National Environmental Policy Act (NEPA) process as an effective procedureal vehicle for solving energy facility specific/multi-state problems.

4. Establish an Environmental Mediation Center to facilitate communication and negotiation among industry, public, and governmental disputants in selected energy and other environmental conflicts.

5. Use a Multi-state Forum to encourage identfication and continuing discussion of shared regional issues in the Valley that call for cooperative action.

6. Set up a Regional Association of State Air Quality Officials to identify and assess shared and long-term air quality concerns.

7. Improve each state's ability to anticipate and address regional issues through development of state policies and goals for energy and natural resources development.

What was even more surprising was that in the final analysis there was some agreement that the mechanism(s) implemented should have an established structure. A more formal arrangement was called for in the second phase of the study, as opposed to the highly informal methods approved during Phase I. Furthermore, this more structured mechanism should be attached to an already existing regionally-oriented organization such as ORSANCO. This reponse was a complete turnaround from Phase I, when regional organizations were almost universally rejected. The change might be partially due to the changes in orientation of the participants. But this cannot account for the entire turnaround, since the attitudes of legislatures, major

industries, and executive government offices have influence on regulatory agencies and their personnel.

During the conduct of this study, outside events led to major upsets in all sorts of projections, forecasts, and plans of states and municipalities, industries and businesses, and private and non-profit institutions. To cut government spending on the federal level and therby attempt to slow inflation and interest rates, grants and government-supported loan programs were drastically reduced starting in late 1980. By the time this energy development study was underway in early 1981, state officials who, only a short time before, were fairly secure and optimistic about future program expansion, were now trying to find ways of holding the line or working with decreased resources. However, no one knew precisely how things would eventually turn out, or how long and extensive the recession would be. Thus, not only were state officials and industry personnel dealing with diminshed resources, they were dealing with uncertainty as well. And uncertainty breeds anxiety. This probably was a major reasons for the diversity of viewpoint or lack of consensus resulting from Phase I. Uncertainty about what could be expected in the near future could have led to the unwillingness of the people interviewed in Phase I to commit themselves to a particular course of action. This was probably one of the major factors in the difficulties encountered by CSG staff in identifying specific mechanisms in Phase I.

By the time Phase II was underway in late fall of 1981, many of the uncertainties had resolved themselves. The situations at the state government levels were not particularly optimistic, but at least most people knew what to expect. Many state agencies were not rehiring positions vacated through attrition; some were forced to lay off some workers or not hire seasonal employees. Budget cuts eliminated plans for program expansion in many cases, but basic services were maintained. The states looked for ways to streamline their operations through coordination and cooperation. They turned to ORSANCO to meet some of these needs.

When confronted again with the question of mechanisms for dealing with interstate energy development issues during Phase II, workshop participants from state pollution control agencies knew that new projects without external support or funding faced stiff competition with existing programs. It was also obvious that the same funding shortages would essentially stifle informal arrangements to address these issues. Maintaining the basic services had become the greatest priority among the states.

To address interstate energy development issues, a mechanism would have to attract the participation of state governments, the energy industry, and concerned citizens. To do this, the mechanism would need structure, support, and legitimization. Under the conditions current in the spring of 1982, the only way to accomplish all of this was to connect the mechanism to an already existing organization that provided the regional approach inherent and necessary in all the proposed methods. The ready answer to this was the Commission.

Epilogue

In response, the Commission has moved to organize an Energy Roundtable, which will incorporate two of the Council of State Governments' recommendations: establish a communciations channel to serve as a multi-state clearinghouse for information exchange on policy concerns and technical issues; and use a multi-state forum to encourage identification and continuing discussion of shared regional issues in the Valley that call for cooperative action. The Roundtable is aimed at providing the communications link between states and the energy industry so vital to assuring early and open discussion on potential issues of interstate concern in energy development. As of this writing, the Roundtable is still in its earliest stages of development, but there has been interest and hope expressed for its success in the Ohio Valley.

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The States and Energy Siting: Cooperation in the Ohio Valley, Vol. I: Main Report and Vol. II: Appendices, Council of State Governments, May, 1982.

Note on Availability:

The States and Energy Siting: Cooperation in the Ohio Valley

Vol. I: Main Report
Vol. II: Appendices are available for $8 each from:

The Council of State Governments
Iron Works Pike
P.O. Box 11910
Lexington, KY 40578

Other publications developed during the study are available in limited supplies free of charge from:

The Ohio River Valley Water Sanitation Commission
414 Walnut Street
Cincinnati, OH 45202

(with the exception of the Background Paper prepared for the Ohio Valley State Workshops, which was printed in extremely limited numbers and intended for use only in those workshops. Much of the material in the background paper was taken from or reproduced in other publications.)

Learning To Teach: Teaching to Learn — Environmental Education and Leadership Training for Teenagers

David A. Wilson[1]

The Missouri Botanical Garden has just completed the second summer of an environmental education and leadership training program for high school students in the St. Louis area. The theme of the program is Learning by Doing. As the Director of the program, I have the unique opportunity to work with motivated and talented students who are involved in the program because they want to be there. Sixty students divided into two sessions spent three weeks in the summer learning about the urban environment and the natural world, and learning also environmental concepts and activities they can teach to grade school children during the school year. The three week program is the first part of a year long course which they can take for credit from their high schools. During the school year the students go once a week to grade schools where they teach third, fourth, or fifth grade children about the environment.

Students enroll in ECO-ACT because they are interested in the environment, or in leadership development, or in learning how to teach and in teaching grade school children.

Environmental and Leadership Education

Leadership style can take many forms. The essential aspect of leadership training for individuals, regardless of personal leadership styles, is that they must learn to step through three stages.

First, a leader must develop an ability to think critically, to evaluate a situation, to listen effectively, and to perceive choices which exist. Second, a leader must be able to weigh the options for possible action. At this stage, one must develop an ability to perceive decisions available based on what is feasible and not just what the leader thinks is "right". Many a successful leader has lost a constituency by selecting and sticking dogmatically to a plan of action which few others are prepared to follow. This leads to the third stage, which is acting on one's decisions. The successful leader is able to act on the best plan available within the realm of the possible.

If this sequence for leadership training sounds much like the steps involved in environmental education, it is because it is very similar. To study the environment means very little if one cannot use that understanding to act effectively on it. The process is indeed very similar: developing awareness of the issues, identifying problems, looking for potential solutions, choosing a solution and acting on it, and evaluating results of one's action.

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The difference between the two educational components is that leadership training focuses on the individual acting with other individuals, while environmental education focuses on the individual acting in relationship to the world around her/him. The dual focus of the environmental leadership program clarifies what needs to be in a program that attempts to do either. The teaching component is a relatively safe mechanism through which the student can apply the theory of both environmental education and leadership training, thereby internalizing the understanding and the process.

The core of the teaching component of ECO-ACT is the central focus of this paper. In preparing to teach, the students learn ecological concepts and develop basic leadership skills. In the process of teaching, the students learn about themselves and about the world around them.

Knowing that they will be expected to teach grade school children has a profound effect on the way the high school students act during the summer session with their peers. When the thirty students from fifteen high schools arrive on the first morning, they are introduced to a variety of initiative games which introduce them to each other and to the program leaders. Looking back at this first morning experience at the end of the three week session, one student commented, "I sure thought it was weird that we were supposed to lie on the grass while playing Skin the Snake, but then I figured we were doing activities which we could do with the third graders this fall."

Time and time again, the sophisticated high school student who might normally balk at activities he or she would term silly or juvenile would join in willingly because "It is something to do with the little kids".

Likewise, the students are much more attentive to the simple learning activities which introduce them to environmental concepts, because they know that they will be expected to teach these at a later date. During the first year of the program, I was constantly amazed by how the students were able to reach back into their experiences from the summer to find activities to do with the grade school children. During the third week of the summer program several sessions are devoted to specific lessons to conduct with the grade schoolers. The students use these activities, but they also cull many more activities and additions to these clearly defined lessons from the experiences that they had learning about themselves and the environment. Many of them will play the introductory " New Games" with their own students during their first and second visits to the elementary schools. In preparing to teach, the students are ready to take seriously their environmental education.

Basic environmental concepts are simple to understand on one level -- e.g., the green plant is the source of all food and all the oxygen we breathe; the sun is the source of all energy on earth; two parts of an eco-system are the biotic and abiotic; and the three essential features include an outside source energy (the sun), the cycling of nutrients, and specific relations between plants and animals.

On another level, we as a society are woefully ignorant of the implications of these ecological concepts for the way in which we actually live. Witness the New Hampshire town which decided to pass an ordinace to ban street trees because the leaves are such a mess to clean up. In many schools, the fundamental concepts about how life exists on earth are virtually neglected throughout the sciences. And even where the information is given, the fact that the green plant is the only living thing capable of transforming the sun's energy into another usable form, is just one of many facts soon forgotten. The big picture is often lost, because we are so eager to focus on little details. In preparing to teach the younger children, the high school students are ready to go over these concepts, and as a result they begin to know them.

One of the early activities we suggest the high school students conduct with the school children is a school yard ecology investigation. This begins with the students taking paper bags out to the school yard and collecting things that they find are interesting. When the high school students did this activity, one overweight student returned with only an empty potato chip bag in her paper bag. When each explained why each had picked up what they did, she said, "This reminded me I had not had breakfast." (!) At moments like that, I begin to wonder whether the high school students will succeed in their roles as teachers. And yet, since it is the process we are most concerned about, since the younger children who search the school yard will have their own reasons for picking up whatever they select, and since the process of exploring the school yard helps open their eyes to the everyday world they inhabit, our student with the potato chip bag will probably succeed, as she becomes more aware herself in her environment. Moreover, we stress to the high school students that just as we provide them the opportunity to explain why they selected what they did, so too they can encourage the grade schoolers to do the same. By the end of our three week program, most of the high school students understand that our constant sharing of opinions and ideas in our circles is a central part of leadership training -- learning how to speak and listen in public. Some of them are therefore eager to give the grade school children a chance to develop their skills in similar fashion.

Teaching as Empowerment

In many respects, leadership training should be an aspect of "basic skills" development. Learning to speak in public, learning to listen, learning to evaluate and think critically, are leadership skills which can be developed only by doing. Too often in the schools, the students have become such passive subjects that their leadership skills are never built. Even among the students in the ECO-ACT program, I have found a tendency for students to arrive without a pencil or their journal (or other paper for writing). Similarly, they tend to leave the important handouts on the table behind them as they leave at the end of the day's session.

Many teachers have remarked on the attitude, "I'm here; so entertain me," which is so prevalent in the schools. This attitude I trace to the sense of powerlessness most students feel in relation to their own learning and to the world around them. This sense is reinforced by the practice of TV watching. Even these ECO-ACT students who are selected as potential leaders, often appear mystified by the world around them. The idea that one can take responsibility for one's own learning, let alone take responsibility for changing the community is remote.

In the three week summer program, we walk the students through the stages of environmental education: from developing an awareness of issues, to investigating the problems, to looking for solutions, to selecting a solution and acting upon it to have some impact on the community. When given the opportunity to come up with a project of their own choosing the students are slow to respond. Initially only a few find projects; most are willing to go where we send them and do what we suggest. In some ways, the teaching assignment is similar. The students go where sent and teach the lessons we have suggested they teach. But the significant difference is that when they go to teach, they must be prepared; they are in charge.

The experience of teaching gives the students a sense of power and authority. They are responsible for the learning of their own students. They must go to class prepared for that one hour during the week. Even for the most scholastically successful students the experience of having to prepare a class and teach is usually unexpectedly difficult. For the students who were in the middle of their classes academically, the process of getting into the role of teacher has had a significantly positive impact on their self-confidence and often on their grades. One student remarked how he now had the respect of his school administrators because he was able to talk with them about his experiences as a teacher. Another explained how she could understand so much better the high school teacher's role in her classes since she had been in that role in the grade school.

In sum, the students as teachers have to make use of leadership skills they may not previously have used. They must go through the process of perceiving the choices (thinking critically about what they will teach and why); then they must make their decisions about what to teach and how to teach it (weighing the options for the possible); and then they must follow through on their decisions, by teaching and leading their students through a pre-arranged lesson. In the process of planning and teaching, the student learns what he or she already knows and uses that information to carry out the lesson.

Why should the act of teaching be such a good vehicle for building leadership skills? We all learn by doing. When the student takes on the role of the teacher she/he finally has an opportunity to act on information acquired in school and in his/her daily life. In our information rich society, students learn more and more facts, but they have very little opportunity to use anything that they have learned in school when they get into the outside world. The teaching activity is still a school activity, but the students can put the years of experience to work in a setting which they help to create.

In the short run, the students will be more prepared to take charge of their own lives, because they have had the experience of doing just that. In the long run, these students will be ready to step into leadership roles because they have already begun to take charge of their own and someone else's learning.

RESEARCH AND EVALUATION—
REFEREED PAPERS

Environmental History: Unsung Heroes of the Environmental Movement

Harold L. Ickes, The New Deal, and American Conservation

Clayton R. Koppes[1]

Abstract: *Secretary of the Interior Harold L. Ickes and the New Deal made one of the most important contributions to American environmental history. This article describes Ickes's personality and assesses the role of his Interior Department in regard to three key concepts of environmental policy -- efficiency, equity, and esthetics/ecology.*

As any observer of James Watt knows, the Secretary of the Interior has perhaps the most critical position in the country in environmental policies. And as the case of Mr. Watt suggests in a perhaps heightened form, environmentalists have often been at loggerheads with secretaries of the interior. An important exception to this pattern, however, is Harold Ickes, Secretary of the Interior from 1933 to 1946. Ickes's thirteen years as secretary marks the second-longest tenure of any cabinet member in history. More important for our study, he left one of the most illustrious records of any interior secretary. My purpose today is to present a character sketch of Harold Ickes and discuss conservation policies during a crucial period of American environmental history.

Harold LeClair Ickes's life embodied the upward mobility sung by Horatio Alger. He was born in 1874 to a stern father who operated a notions store but rejected him and to a mother who loved him but died when he was sixteen. For all practical purposes without family, he set out for the new University of Chicago in 1893. This was the raw, bustling, dynamic Chicago of which Rudyard Kipling wrote: "Having seen it once, I earnestly desire never to see it again" (Glaab and Brown, p. 111). It was the Chicago that Carl Sandburg called "stormy, husky, brawling, City of the Big Shoulders." And it was the Chicago of Upton Sinclair's Jungle, the famous socialist novel written to expose the brutal conditions of the working class, but which instead so alarmed bourgeois reformers about the contents of their frankfurters that it resulted in the passage of the Pure Food and Drug Act of 1906.

As an idealistic, moralistic, ambitious young journalist and later lawyer, Ickes plunged into Chicago's maelstrom of reform politics. He quickly developed a pugnacious reputation that led his biographer Linda Lear to term him "the aggressive progressive" (Lear). Influenced by Jane Addams, among others, he campaigned against machine politics, for minority rights, and against the private utility trusts epitomized by Samuel Insull. Most of the causes he supported failed, but they sharpened his ideas about public and private virtue. He recorded a notable success in a personal cause: In 1911 he married the divorcee Anna Wilmarth Thompson, perhaps the city's most eligible heiress.

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When Franklin D. Roosevelt and the New Deal swept to power in 1932, Ickes's three decades of unrequited labor on behalf of reform politics held him in good stead. Roosevelt decided he "liked the cut of his jib," and to everyone's astonishment, appointed the still obscure Ickes Secretary of the Interior. The appointment was in part political: FDR owed favors to the insurgent progressive Republicans from the West who had broken with their party to support him, and Ickes, with his ties to that group, satisfied this requirement (Lear, pp. 363-83).

Ickes quickly developed into a formidable administrator. He was acutely aware of the department's image, nourished by Teapot Dome and other scandals, as a warren of corruption and special privilege. He was willing to use virtually any means to keep his department clean. In the process he won two nicknames that he cherished: "Honest Harold" and "the old curmudgeon." To his dedication and vision he added what Warner Gardner, one of his solicitors, termed "generally wholesome talents for terror." Ickes was one of the few secretaries who managed "to overcome the jello-like consistency of the bureaucracy and make it do what the Secretary wanted," said Gardner. "No other example comes immediately to hand where an established department was remade so that it amounted to an instrument controlled by the Secretary" (Gardner, p. 11).

Ickes used a panoply of techniques for policing the department. At times he tapped telephones, rifled desks, and spied on his bureaucrats. Other tactics were more savory. Early on Ickes became suspicious that some of his staff were initialing their approval of some public works recommendations -- they could mount to 150 pages apiece -- without reading them. He had a secretary type out a large segment of Alice in Wonderland, enclosed it in appropriate covers, and tossed it into the bureaucratic chain. Before long the fantasy was back on his desk with the initials of ten approving officials. "If any of those ten had a real contribution to offer the Interior Department, I'm sure he was forgiven," Gardner said. "If he didn't, he may have been out hunting for another job. That sort of conduct repeated often enough brings even quite large departments into a sudden stage of intimidation" (Gardner, pp. 11-12).

On occasion Ickes bucked even the president. Over Ickes's objections Roosevelt appointed Charles West, an Ohio politician, as undersecretary. West made the mistake of leaving his three-room office suite for a speaking tour. "He returned to find all furniture, all drapes, all rugs, removed, except for one desk and one straightbacked chair sitting in the middle of the largest room. Mr. Ickes' view ... was that certainly the President did control Mr. West's appointment, but that he, Harold Ickes, was in charge of the furniture in the Interior Department. Mr. West left very shortly after his return" (Gardner, pp. 12-13).

Such tactics earned Ickes a regiment of enemies. Ernest Gruening, who served as director of territories until Ickes got tired of him and made him governor of Alaska to get him out of Washington, called Ickes's department a "concentration camp" (Gruening). Horace Albright, director of the park service 1929-33 and a long-time conservationist politico, said that all of

"Honest Harold's" friends could have ridden to his funeral in the backseat of a taxicab (Albright, p. 568). Clinton P. Anderson, secretary of agriculture from 1945-48, called Ickes "a self-appointed Jesus Christ with a conviction that he was the only honest man in the country .... We all ... hated Ickes cordially" (Anderson with Viorst, pp. 76-77).

Ickes welcomed hatred from the right quarters. He returned Anderson's low opinion, with interest. Like Warner Gardner, many of his subordinates respected, and even revered, the old Bull Mooser. Dillon S. Myer, head of the War Relocation Authority, felt he gave "the kind of support ... a boss should give" (Myer, p. 342). John Collier, commissioner of Indian affairs from 1933 through 1945, believed that there were "very few equally great" men in American society (Collier, p. 293). From March 20, 1933, to February 15, 1946, there was no doubt who was secretary of the interior or where he stood. And when he resigned -- or was fired -- in a celebrated row with President Truman, many liberals lamented that the event marked a distinct turn for the worse in American liberalism.

Ickes brought to his job some well formed ideas about environmental policy. There were three key ideas in the American conservation movement before the 1960s -- efficiency, equity, and esthetics/ecology (Koppes, 1983a and 1983b). Ickes endorsed all three, but gave them a distinctive balance.

First, efficiency. Historian Samuel P. Hays has written that a major belief on the part of Theodore Roosevelt, Gifford Pinchot, and other progressive- era conservationists was "the gospel of efficiency." Its crux "lay in a rational and scientific method of making basic technological decisions through a single, central authority" (Hays, pp. 262, 271). This branch of conservation had a strong development orientation. It was not much concerned with wilderness preservation, and it was not necessarily antimonopoly.

Second, equity. One of the central questions about conservation policy is: who benefits? The ownership and use of natural resources inevitably raises Harold Lasswell's classic question about politics: "who gets what, when, where, and how." The equity branch of the conservation movement has stressed federal control and/or regulation of natural resources to make possible a wider distribution of the benefits.

Third, esthetics/ecology. These ideas undergirded preservation of natural areas intact. In the early part of the century preservationists' concerns were primarily with what has been termed "monumentalism" -- the preservation of spectacular natural phenomena or particularly scenic attractions (Runte). By the 1930s that idea was merging into an ecological approach which emphasized preservation of areas as ecological units. Everglades National Park epitomizes the change. It lacks the towering peaks and vertiginous canyons typical of most older parks; it is instead a "river of grass" in which changes in elevation are all but imperceptible. The park attempts to preserve a particular ecosystem -- a swamp, a type of habitat once considered suitable only for drainage.

Ickes was a strong believer in all three tenets of conservation, but he brought added emphasis to the equity and esthetic/ecological considerations. Early in his term he outlined his environmental vision in a suggestive metaphor drawn from nature: "A forest is a community of trees, as a city is a community of human beings," he said. There is a struggle for existence in a forest, he acknowledged. "But, on the other hand, a forest is a cooperative community in which each tree helps its neighbor and contributes its part to the common protection of the young." What occurred as a matter of course in nature required conscious intervention in society. "We now undertake to achieve a grand vision for the whole country, saying that this land shall be cropped, this shall be range, this shall be forest, this shall be worked for minerals," Ickes said. "In this way, and no other, can we properly conserve -- that is to say, use wisely -- our natural resources and provide for a more equable distribution of their bounties" (James, pp. 55,10).

Ickes was not a solitary warrior, of course. He benefited enormously from the political climate of the 1930s, with its support for social reform of many kinds and its skepticism of capitalism. The depressed economy helped also in that it was easier to acquire lands for parks or regulate the use of natural resources when land prices were low and demand slack. The secretary could count on impressive support within the executive branch. President Roosevelt, who listed his occupation in Who's Who as "tree grower," was an avid conservationist. He ordered a special photographic survey of the Olympic peninsula in Washington so that he could personally demarcate the boundary of the new national park there. Members of Ickes's staff and the federal bureaucracy lent important support. One of the most notable figures was Robert Marshall, the strenuous hiker and youthful founder of the Wilderness Society, who served in various federal conservation positions in the 1930s (Fox, chap. 6).

The efficiency philosophy remained strong in the realm of public power as Ickes used the Bureau of Reclamation for a vast expansion of not only irrigation but public power. In 1933 the installed capacity of the bureau's generating plants stood at 30,000 kilowatts -- about the size of a town light plant. By 1946 that capacity registered 2,178,197 kilowatts. The Bureau of Reclamation claimed to be the largest single power agency in the world at the time. Moreover, these statistics only scratched the surface. Some of the bureau's greatest projects, such as the mammoth Central Valley Project in California, were authorized under the New Deal but were just getting started. Public power was fostered, too, by other New Deal agencies such as Tennessee Valley Authority and the Rural Electrification Administration. In 1937, as these bureaus began gaining momentum, federal turbines generated 1.6 percent of the nation's electricity; by 1944 they recorded 12.7 percent (Secretary of the Interior, 1933, 1946).

But more significant than reclamation's acres of pipe and yards of concrete was the new prominence the New Deal gave equity issues. Ickes tried repeatedly to unsnarl the Hetch Hetchy tangle. The destruction of the valley dismayed him, but he hoped at least to shut off the windfall profit for PG&E, which he termed "that piratical private utility." "Honest

Harold" ruled that the contract with PG&E violated the Raker Act, the original statute that allowed the dam to be built, and he ordered the City of San Francisco to develop a plan to replace PG&E with a municipal system. The city finally did so, only to have its voters twice reject the bond issue that was necessary for its implementation. Then the secretary won a suit which enabled him to ban the sale of power to PG&E. But San Franciscans again refused to pass a bond issue to set up a public system as an alternative. In 1942 Ickes finally bowed to political intransigence and wartime exigency and approved a contract with PG&E. Although the secretary met defeat, his determination in the face of opposition in a politically important state was remarkable (Kahrl, p. 37).

Equity issues in California stirred further political turmoil when Ickes and some of his advisers resurrected the all but forgotten 160-acre law. The Bureau of Reclamation's efficiency-minded engineers wanted no part of the acreage limitation. It had been "a dead letter for years," they said, and they warned the secretary that it was better to "let sleeping dogs lie." The focus of controversy became the Central Valley project. The valley had probably the most skewed land holding pattern in the country. Two percent of the landowners held nearly one-third of the land. If public water were turned on this checkerboard, without limitation, giant land companies and big farmers would benefit disproportionately -- in direct contradiction to the purposes of the reclamation act. Application of the 160-acre limit offered "the best opportunity now available for correcting the land pattern in California," pointed out Arthur Goldschmidt, a liberal economist on Ickes's staff. Large landowners in the Central Valley counterattacked by pushing an exemption through the House of Representatives in 1944, but the department, aided by liberal senators, reinstated the 160-acre limit in the upper chamber (Koppes, 1978).

Reclamation's redistributive purposes advanced in the Columbia Basin Project in 1943 when the department secured legislation enabling it to buy land about to be irrigated and then divide it among small farmers. Congress also gave the secretary the authority to string some transmission lines from reclamation bureau power houses and build related facilities in 1944 (Koppes, 1978). The bureau could scarcely realize Ickes's equity purposes if it generated the power but then had to turn it over to private firms for distribution. Vital though such legislation was, however, it merely established the conditions for equity. Equally important would be implementation of these acts -- something that would fall to Ickes's successors in a changed political and economic climate.

Throughout these struggles an overriding issue was comprehensive planning. Because of the presumed similarity to socialist states, planning aroused as much controversy as almost any other New Deal measure. Planning went hand-in-hand with valley authorities -- agencies which would do comprehensive planning for an entire river basin, much like Roosevelt's original ideas for TVA. A consistent theme of Interior Department planning was equitable division of the benefits of federal projects. In the Central Valley of California, for example, departmental planners saw the reclamation projects as areas to establish prosperous, roughly egalitarian

communities. Jurisdictional quarrels over where valley authorities would be housed produced some of the bitterest internecine squabbling in the New Deal. Ickes wanted them for the Interior Department; TVA partisans thought they should be independent. Fearing an erosion of their prerogatives, Congress, and state and local governments usually wanted no part of valley authorities in any form. During the conservative resurgence in the late 1930s, Congress turned down plans to create seven "little TVAs" (Leuchtenburg, 1952). Ickes's dream of a Missouri Valley Authority in his department foundered when the reclamation bureau chief cut a controversial deal with the head of the army corps of engineers to divide the valley between the two feuding agencies. Congress too spurned a Missouri Valley Authority, with Vice President Harry S. Truman casting a tie-breaking vote against the measure (Hart, chap. 7). Planning and valley authorities represented a major attempt to introduce nonmarket considerations into the existing capitalist political framework, but their possibilities, like that of the original TVA, went largely unrealized.

Efficiency and equity considerations were intertwined on public domain issues. The efficiency emphasis was clearly evident in the Taylor Grazing Act of 1934, a measure which brought federal regulation to the remaining public lands. Worn thin by the depression, the Western ranchers, who were the major users of the range, now warily accepted federal regulation. To make it more palatable, Ickes promised that fees would be low and would cover nothing more than the cost of administration; he also appointed a Harvard-educated Colorado rancher, Farrington Carpenter, as grazing director. Under Carpenter's solicitous administration, federal regulation appears to have had two chief results: It rid the range of the itinerant sheepdrivers, whom ranchers considered a menace, and it favored large stockmen in the distribution of grazing permits. Federal regulation thus brought order and stability to the range, but smaller operators tended to lose out in the process (Peffer, chaps. 12-13; Richardson, 1973, p. 6; and Foss, chap. 4). In the 1930s, therefore, federal regulation of the public domain produced results similar to those of the efficiency school of the progressive era: Central, expert control brought greater order and stability to the range, but by ending the competitive situation in which smaller operators maintained a toehold.

The inequity of the administration troubled Ickes. Moreover, although the condition of the range had stabilized, it sorely needed rehabilitation. Ickes hoped to accomplish both. Repeatedly tempted to fire Carpenter, he drew back for fear of political reprisals. Then the war intervened. Finally, in 1944 he appointed Clarence Forsling, a dynamic administrator from the Forest Service, to revitalize the Grazing Service. Forsling proposed a range rehabilitation program that would sharply reduce usage and convert the grazing administration into a comprehensive land management agency. He also proposed to raise stockmen's artificially low fees and to redistribute permits in favor of smaller operators (Forsling). In his attempt to improve the equity situation of the public domain, Forsling had thrown a fistful of matches into the political tinder. But dealing with the political prairie fire would fall to Ickes's successor (Peffer, pp. 260-263).

A similar conflict of efficiency and equity arose over regulation of the salmon fishery in the territory of Alaska. The Interior Department inherited the Bureau of Fisheries from the Department of Commerce in 1939 as a sort of consolation prize for losing the real catch: the Forest Service. Little could be done during the war. But at war's end Ickes decided to bring greater equity to the situation. The problem was that the salmon fishery, worth $100 million annually, was dominated by six stateside food-processing firms. They had acquired most of the permits for fish traps, huge networks that were placed in streams to snag the salmon as they rushed upstream to spawn. This oligopoly created two problems for New Deal conservationists; the deadly efficient traps seriously reduced the size of the resource, and their concentration in a few firm hands seriously hurt smaller fishermen, particularly Alaska natives. Adopting the attitude of a strict efficiency conservationist, Ira Gabrielsen, director of the fisheries bureau, insisted that his only rightful concern was preservation of the resource; the distribution of fish trap permits did not concern him. Ickes vowed, however, to "smash the salmon monopoly" -- the progressive-era rhetoric lingered -- and scheduled hearings for February 1946 as the first step in a redistribution in favor of small operators. But like the grazing imbroglio, the issue of equity in the Alaska fishery was raised by New Dealers only to be settled on very different terms by their successors (Cooley, pp. 31-35, 47-68).

In sum, Ickes's department remained committed to the efficiency ideal of conservation, but it brought greater prominence to equity issues than had previous administrations. Not all of these attempts to bring greater equity to natural resources use were successful -- some were raised belatedly -- but they represented a significant enhancement of this politically sensitive aspect of the conservation movement.

The esthetic/ecological movement regained a prominence it had not had since Theodore Roosevelt, and the shift from monumentalism to an ecological approach became perceptible. Ickes succeeded in dramatically expanding the amount of protected natural area. The national park and monument system grew from 14,739,405 acres in 1933 to 20,346,249 acres in 1946. Several major national parks were established. Four of them -- Olympic, Kings Canyon, Big Bend, and Everglades -- were predominately wilderness parks with limited tourist access and reflected the new ecological doctrine. The number of national monuments grew from 33 to 86, and a host of wildlife refuges were added (Secretary of the Interior, 1933, 1946; Swain, p. 330).

He also tried to minimize the impact of developments, particularly roads, to make them accessible. He did not believe that roads should be build indiscriminately to open up areas for younger people who were too lazy to walk or even for older people like himself who could not walk in. As he told a convention of state park officials, a skyline drive may sound "poetical" but it may be "an atrocity" (Ickes).

Like Everglades, Olympic park reflected the emerging ecological sensitivity. The area included some "monumental" features, such as

Hurricane Ridge, though not on the scale of parks such as Grand Canyon or Yosemite. The most important element in setting the park boundaries, however, was not topography or scenery but the sense of the area as a biotic unit. This process produced a much larger park than either the Forest Service, which controlled most of the land, or the local lumber industry wanted, but it gave protection to a unique rain forest and magnificent expanses of forests (Ise, pp. 382-92).

The depression of the 1930s with its decline in land prices made it easier for the federal government to acquire and preserve land free from economic activity. Nonetheless, as Olympic park suggested, preservation was controversial. Ickes tried to turn most of the southeastern triangle of Utah into a huge national park. The park would have preserved not only such spectacular areas as Arches and Canyonlands national parks, which later became part of the park system, but would also have saved Glen and Marble Canyons of the Colorado River. Congress would have none of it, however (Richardson, 1965).

When economic activity revived, and the conservative coalition augmented its forces after 1940, preservation was thrown onto the defensive. Two critical challenges surfaced. Grazing interests wanted to run stock in the national parks, as they had done in World War I. But Ickes refused, remembering that this minimal gain in meat and wool production had been purchased at the cost of environmental damage that took decades to repair. The lumber and aircraft industries used the war emergency as an excuse to try to cut the superb stands of Sitka spruce in Olympic park. But with Ickes standing firm against any commercial logging in the preserve, substitute sources were located. The park system even gained an important addition when Roosevelt signed an executive order making the Jackson Hole country in Wyoming a national monument. Congress, led by infuriated westerners, overturned his order, but the president pocket-vetoed the measure. Then the legislature refused to appropriate any funds for administration of the monument. Through FDR's and Ickes's tenacity, however, the area was preserved until its status could be resolved later. Preservation thus was a major facet of New Deal conservation, and it marked the first time that the new ecological doctrine was being written into policy (Richardson, 1973, pp. 11-13, Righter).

By 1945 the New Deal had compiled as significant an environmental record as any period, except possibly the first Roosevelt. It promoted efficiency, but gave more emphasis to central planning than the progressive era. And it brought new prominence to the equity and ecological issues.

All these victories were tenuous, however, and many of them were diluted, and even reversed from 1945 through 1960. The reasons for these changes lie beyond the scope of this paper. But they have to do in large measure with the changed economic climate. The new theme was economic growth in an ever-expanding capitalist economy; natural resources came to be looked upon as primarily a contribution to production. The left-of-center politics that gave the New Deal a distinctive leaven subsided as most Truman- and Eisenhower-era liberals wound up embracing a centrist political philosophy that was often hard to distinguish from conservatism (Koppes, 1983a).

Some changes may be briefly mentioned. The efficiency conservationists were in the saddle as the Interior Department emphasized making resources productive. The Bureau of Reclamation launched an ambitious dam-building program, particularly in the Colorado and Snake river basins. But the equity provisions died. Comprehensive planning and valley authorities were jettisoned; administrative subversion left the 160-acre a paper tiger. The department negotiated new, controversial contracts with none other than PG&E, "that piratical public utility." Moreover, the Truman administration raised the most critical threat to the esthetic/ecological side of the environment since Hetch Hetchy when it tried to build a dam in the heart of the spectacular canyons of Dinosaur National Monument. The Truman administration also tried to reduce the size of FDR's prize, Olympic National Park, but was fended off by preservationist opposition that included Eleanor Roosevelt and Harold L. Ickes. In 1951 the Bureau of Reclamation also tried to build a huge high dam in Hells Canyon of the Snake, but was stymied in a struggle between public and private power advocates. Commissioner of Reclamation Michael Straus, once an Ickes loyalist but now the embodiment of the new wave in the department, appealed to his old boss for support of his dam in Hells Canyon. But the "old curmudgeon," as was so often the case, set the issue straight: Hells Canyon should not be marred by any dam, private or public (Koppes, 1983a).

Ickes watched these trends with mounting dismay. He spoke out against them frequently, first in a syndicated newspaper column and then in a weekly page in the New Republic. He disliked Truman -- he confided privately that he considered the man from Independence as qualified to be president as "Adam's off ox" -- but he campaigned for him nonetheless in 1948 because he feared Dewey and the GOP more (Hamby, 1973, p. 258). But by the time of his death in 1952 Ickes had lost most of his influence. He was a voice crying, if not in the wilderness, then for the wilderness. Not until the 1960s and 70s would the environmental visions of New Dealers like Harold Ickes again be congenial in Washington.

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The Artists of Rural America: Recovery in the 1930's by Curry, Wood, and Benton of America's "Middle Landscape"

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Abstract: *John Steuart Curry, Grant Wood, and Thomas Hart Benton, all native midwesterners, depicted in their popular public painting, often government-subsidized, the continuing influence of the image of the yeoman farmer and his agricultural landscape upon basic American values. Such interest in rural roots was particularly strong during the industrial collapse of the 1930's.*

For most rural Americans, a "pretty" or "beautiful" landscape has always been directly connected to economic prosperity. One of John Steuart Curry's most famous paintings is Our Good Earth (1940-41), simply showing a farmer and his children knee deep in a flat wheat field (Czestochowski, 1981: 110). It is not aesthetically sophisticated, but it is easy to read prosperity on the land in the painting. Agricultural abundance is also the primary theme in Thomas Hart Benton's highly-stylized Wheat (1967) (Baigell, 1975: pl. 218), and Grant Wood's Young Corn (1931) (Czestochowski, 1981: 32), both of which are closeups of the edge of a field, with nothing else in sight than the ripe plants.

There is little art for art's sake in rural America. Any academic theorizing about the farmer's landscape aesthetic would get laughed right out of the country and back into the ivory tower. Grant Wood was simply amused by formal interpretations of his famous 1930 painting, American Gothic: "I do get a big kick out of some of those eastern art critics ... I had my sister in there and my dentist -- both looking kind of stern to go with the building .... I did think of using a two-tined fork like the one used to pitch straw, but I thought that was too old-fashioned so I used a three-tined one.... You know what one New York reviewer said? 'Such marvelous symbolism: the Holy Trinity.'" (Cahalan)

An early environmental aesthetic does not emerge from these rural landscapes, nor was the American farmer an early ecologist, but the farmer and the artists who sought to depict him made important contributions to a growing modern respect and love for the land.

What looked best to the American farmer were the amber waves of grain and the fruited plain. So did the freshly plowed fields in the spring or September's silos full of harvested corn, sorghum, or soybeans. His interest was in the economics of visual experience, not its aesthetic or

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environmental message. The notion of any strongly-felt aesthetic does not hold up when one remembers the old cars in the corner of a back field, the broken down washing machine and refrigerator rolled down a neighboring ravine, and the punched-in roof of the unused chicken coop, surrounded by rusting junk. The typical American farmer was working too hard at making a living to devote any attention to "artsy-craftsy" matters, to revive the old Scots-Irish phrase.

Yet there were successful professional artists who valued the rural and agricultural scene in America, particularly in the midwest. Grant Wood, John Steuart Curry, and Thomas Hart Benton were born and bred and returned to the American heartland (Dennis, 1975; Schmeckebier, 1943; Baigell, 1975). And all three artists had a large public following, and received government WPA projects, which suggests that they touched on primary themes in the national experience.

As far as a revived "appreciation" of the rural landscape goes, we must turn to two decades -- the Depression years of the 1930's and World War Two in the early 1940's. It had seemed that the American farm scene was left behind long ago; most Americans turned instead to fulfill their dreams to the outpouring of consumer goods from the nation's industrial machine (Terkel, 1970). The American dream lay elsewhere than the historic family farm. The nation's agricultural population descended precipitously from fifty percent in 1900 to about thirty percent in the 1930's (and down to three percent in 1980). The hard physical work, long hours, bad seasons, and low profits drove people away, as well as simple boredom and loneliness. But the economic collapse of the 1930's also meant the collapse of the dream of continuous prosperity and upward mobility by means of industrial development. Americans turned by the droves to a renewed search for roots, meaning, permanency, and past virtues. The return to agricultural roots gained momentum also during the Second World War, when the United States became the world's granary as well as arms merchant to the Allies.

This hankering for roots in the rural landscape was not accidental. Americans had been a predominantly farming people for a large and important part of their history. One is compelled to say that American democratic origins are intertwined with an agricultural world view (Opie, et al., 1982: 11-24). Following independence in 1776 it seemed clear that the new nation was predominantly a nation of farmers and would continue so indefinitely. The future successful course of the United States appeared to depend upon vast open tracts of good farmland which were virtually free to settlers. Ths was the rationale for the new Northwest Territory being made into the public domain in 1787. This was Thomas Jefferson's justification, in part, for the Louisiana Purchase in 1803. The American land quickly acquired a reputation for fertility and agricultural prosperity, beginning with Palatine Germans in southeastern Pennsylvania and the Scots-Irish in the Shenandoah Valley.

Yet it seemed unlikely that the new United States would be any different from the rest of the world. The perennial human condition had been chronic

food shortages, to the extent that all of human history thus far had been marred by hunger. Living conditions in the new nation were primitive; farm tools like the plough, sickle, wheat cradle, hoe, and axe, had not changed significantly since the fifth century. In 1800 America was backward even for its own day.

But a remarkable and unexpected transformation took place which gave Americans a seemingly permanent advantage over all other nations. With the foundation of fertile soil and a temperate climate, the early American farmer became the first in world history to create reliable and increasing food surpluses. The course of human affairs had radically changed in the new American setting, not only from a political revolution but also because of the shift from scarcity to abundance (Potter, 1950). If America were discovered today, it would be characterized as an undeveloped country (UDC). In fact the first 200 years of American history became the prototype for today's UDC: America's emergence as a global food source and consequently an industrial giant, remains the premier example of successful national development. According to the modern philosopher, Alfred North Whitehead, the early 19th century was "an era when even wise men hoped."

This first enduring American symbol -- the yeoman farmer on his independent self-sufficient farm -- was powerfully affirmed in Crevecoeur's indulgent vision in Letters from an American Farmer (1782). He describes an idyllic rural landscape which has echoed through the American experience ever since: "The world is gradually settled ... the howling swamp is converted into a pleasing meadow, the rough ridge into a fine field ... hear the cheerful whistling, the rural song, where there was no sound heard before, save the yell of the savage, the screech of the owl, or the hissing of the snake." Thomas Jefferson in his 1787 classic, Notes on the State of Virginia, also concluded, "Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous, and they are tied to their country, and wedded to its liberty and interests by the most lasting bonds." In a more practical vein, Albert Gallatin used to say that Indian corn made the penniless immigrant into a capitalist between April and October. A South Carolina backwoods farmer described his early 19th century goals: "My farm gave me and my whole family a good living on the produce of it; and left me, one year with another, one hundred and fifty silver dollars, for I never spent more than ten dollars a year, which was for salt, nails, and the like. Nothing to wear, eat, or drink, was purchased, as my farm provided all. With this saving, I put money to interest, bought cattle, fatted and sold them, and made great profit." (Gray, 1958: I; 452) Americans historically have had a deeply-felt conviction that fundamental American democratic institutions and national values got their start on the American family farm, which traced its roots back to the tempering and unique experience of the frontier.

What took place in the 1930's and 1940's was the attempt to reconstruct and revitalize these fundamental beliefs which had emerged a hundred and fifty years earlier. This recovered tradition -- the family farmer, his land, and its abundant produce -- reappeared in many ways -- Willa Cather's

Nebraska novels, the simple and direct virtues in Thorton Wilder's Our Town, Virgil Thomson's music, some of Carl Sandburg's poetry, and the paintings of Wood, Curry, and Benton. Each of the latter three created art so important for the American mood of the era that today they are overly familiar. Wood's American Gothic needs no explanation when it is caricatured in newspapers, political cartoons, greeting cards, and even in Mad magazine. It compares in public visibility with da Vinci's Mona Lisa.

We can begin our story in July, 1933, when Grant Wood, forty-two years old, first met John Steuart Curry, aged thirty-six, at the Stone City (Iowa) Colony and Art School. Grant Wood was an Iowa farm boy who had studied art in the United States, Italy, and Paris, and was already well known as an important and familiar painter through such paintings as Stone City, Iowa (1930), American Gothic (1930), and Birthplace of Herbert Hoover (1931). As one critic observed, Wood's technique was "disturbingly well organized." (Czestochowski, 1981: 14) The viewer suspects some humor and satire in this tidiness, as well as a strong statement of the clean, orderly, precise, and primal midwestern landscape. It is easy to read, readily available, and fundamental. Wood depicts the American farmer's mastery and victory in his war with natural forces -- weather, plants, soil, animals. The American farmer comes out as fiercely independent and master of his domain in Wood's paintings, but also sadly isolated and alone.

Curry was a Kansas farm boy with similar training; his own professional identity had already been established with canvases titled, The Tornado (1929), Spring Shower (1931), and later the famed John Brown (1939). Curry like Wood, depicted an historical struggle between man and nature. Less mannered than Wood, Curry tried to establish for his viewers the lasting values and physical and moral realities of farm life as they emerged in natural sensations and physical activities. The natural background becomes the dominant element in his historical allegories. Curry's Wisconsin paintings focus on the omnipresent natural world and the smallness of man in contrast (Czestochowski, 1981: 68-69).

Unlike many artists in the twentieth century, Wood and Curry were not social critics, but they were certainly social commentators as they selected what they judged to be the most positive values of American society. These were rural, agricultural, and tied to individualism, self-sufficiency, home and family, physical labor in the outdoors, and life associated with the American land. In sum, Wood and Curry helped to reinvent the nation's most powerful symbol -- the private farmer on his land -- which they perceived as a myth rooted in reality.

Wood and Curry both benefited from commissions for murals in public places. During the 1930's, in a most remarkable step, the federal government became a patron of the arts as part of Roosevelt's measures to revive all aspects of national life. Between 1933 and 1943 the Public Works of Art Project (PWAP), later the Federal Art Project of the Works Projects Administration, supported Artists of the American Scene, as the program was called. Wood supervised and contributed to a fourteen-artist mural for the Iowa State University Library in 1934, which led to his settlement in Iowa City in

1935 (Baigell, 1974: 46-54). Curry was sponsored for murals in 1935 and 1936 for the Norwalk (Connecticut) High School, in 1936 and 1937 for murals for the Department of Justice Building in Washington, D.C., in 1938 for the Interior Building, and in 1940 he completed murals for the State Capitol Building in Topeka, Kansas. In a step which would be surprising even today, and is telling evidence of his influence, Curry was appointed in 1936 as artist-in-residence to the College of Agriculture at the University of Wisconsin in Madison. In 1942 he did murals for the university library and the First National Bank of Madison.

Both Wood and Curry died prematurely in 1942 and 1946, respectively, under a cloud because many fellow-artists were convinced they had compromised their art to serve patriotic and even jingoistic interests. From the perspective of decades later, their art may have been patriotic, but not nescessarily compromised. The issue may be whether there is an internal logic to art which depicts deeply-felt myths giving a nation its identity.

But it was Thomas Hart Benton who provided a framework to the 1930's quest for recovered myths and ideals. Benton was already a successful and established artist when he first read Frederick Jackson Turner in 1927 (Baigell, 1975: 124-5). Benton had already committed himself to the formulation of an American art linked directly to the nation's historical traditions, and which would be democratically accessible, like the work of Wood and Curry, to a wide public.

It is not usually acknowledged that Frederick Jackson Turner's notorious and influential "frontier thesis" of American history, first proposed in 1893, depended on, in his own words, "the advance of the more steady farmer," rather than the mountain man, explorer, hunter, or cowboy (Opie, 1982: 23ff). The immigrant farmer, attracted to the New World by good soil on free land, is Turner's typical, original, and unique American. This independent agrarian inhabited the midwestern Middle Landscape, neither part of the effete East nor the untamed West, and exactly the same region that Benton, Curry, and Wood sought to restore to prominence. Geographically, Turner meant the vast midwest, ranging from the ridge of the Appalachians to the hundredth meridian, beyond which the climate demanded other responses.

Between 1919 and 1926 Benton produced his first major work focussed upon American agricultural ideals: two series of five murals titled The American Historical Epic (Baigell, 1975: 70-1). He consciously worked to capture the epic proportions of the settlement of the vast American landscape. Like Turner, Benton believed no distinction could be made between the American environment and the American character. In turn, contemporary national renewal could only take place through the myths and dreams of the American frontier past. Out of this past came the values which were worth keeping, particularly during the modern period of rapid change.

Also with Turner, Benton believed a new highly-charged and vital civilization was emerging out of the midwest. Middle America was not the dull and barren ground that critics made of it. His paintings expressly stressed this dynamism. The midwest was a region full of kinetic energy (kratophany) where the powerful forces of land and farming transformed its inhabitants. The hardworking, pragmatic, yeoman farmers of the region had forged a native set of ideals, aspirations, and realities. Benton searched for a useable past as much as Turner. He consciously combined environmentalism and Americanism, embodied in the midwestern rural experience. Never before had an American artist worked so intently to find a uniquely American art form in a series of connected works. When his critics said that Benton made art subservient to Americanism, he was delighted; this was not failure but victory (Baigell, 1975: 58). Benton became the most Turnerian of American artists.

Benton had lived in New York City since 1912 but was drawn back to his home state of Missouri in 1935 to live in Kansas City until his death in 1975. He returned to fulfill murals commissioned at the State Capitol Building in Jefferson City. Titled A Social History of the State of Missouri, they were perhaps his most satisfying works (Baigell and Kaufman, 1977: 314-21). They combined his internal biography with external landscape history. In these murals space is deeper, scenes are calmer, and the murals take on even more epic proportions more appropriate to his vision of his subject matter.

Benton was at home with midwestern agricultural themes. Cradling Wheat (1938) is a plain, simple, and distinctive Missouri landscape, accurately showing, Missouri farmers tell us, the region's rolling hills and recognizeable cloud formations. Compare July Hay (1942) with pedestrian European wheat-harvest scenes. Benton makes an ordinary scene into an archetype of the agrarian myth through exaggeration, enlargement, telescoping, and selective magnification. The result is eerie, almost like a hallucination. Wood, and to a lesser degree Curry, also worked for the same bizarre effect.

Matthew Baigell (1975: 129), Benton's leading interpreter, concluded that his landscapes point to the final objective of the frontier experience -- a complete and satisfying rural existence: "In the streams, hills, and mountains of the country, populated by people unsuspectingly living out their time, quietly enjoying themselves, living easily on the land, celebrating nothing more than their existence." The modern Missouri essayist, Richard Rhodes, concluded, "How can you steal someone from the patio when the patio has been made so incredibly pleasant?" Samuel Barber's musical setting of James Agee's writing, Knoxville, Summer of 1915, has the same effect.

Wood, Curry, and Benton were carriers of nineteenth century viewpoints and values into the more harried twentieth century. All three artists, like Turner in an earlier day, believed their work contributed to a healthier America in the 1930's. The farm and town scenes of Wood, Curry, and Benton pictured a secure material life based on good land, hard work, family virtues, and personal discipline. Beauty was tied to the economic well-being, long-term security, and prosperity of life on the land.

In turn the people of Wood's Iowa, Curry's Kansas, and Benton's Missouri responded widely and directly to their home-grown artists.

While the rural aesthetic of Wood, Curry, and Benton remained obdurately economic, it did integrate and bring unity to historic and contemporary American values. Americans did experience in the work of these artists a continuity with their past which made sense about the present and seemingly guaranteed a workable and familiar future. While the emphasis was upon American abundance based on exploitation of the land, these American artists did anticipate an environmental land awareness that took hold in the 1960's and 1970's. The American landscape was obviously loved and admired by Wood, Curry, and Benton, and clearly understood as the foundation for American life.

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Edward Fred Knipling and the Remaking of the Insect World

John H. Perkins[1]

Abstract: *Environmental concerns about insecticides are well known, but efforts to control insects without chemicals are poorly understood. E. F. Knipling created strategies for controlling or eradicating insects over wide areas of land with lessened dependence on chemicals. His ideas have not become popular in environmental circles primarily because he believes in dominating ecosystems rather than coexisting with them.*

Introduction

Insecticides have been the most widely used technology for insect control in the United States since about 1950. These toxic chemicals and their associated environmental problems were instrumental in launching the popular environmental movement in the late 1960s. Rachel Carson's book, Silent Spring (Carson, 1962), made the hazards associated with insecticides and other types of pesticides a public issue, and Carson became a heroine of the environmental movement.

Rachel Carson deserves credit for her efforts to move insect-control technology away from insecticides. What has remained unacknowledged, however, is the fact than even before her book was published, a number of scientists articulated research strategies to move insect-control practices away from dependence upon insecticides. These thinkers received little recognition beyond their professional societies, and for the most part they remain unsung heroes of the environmental movement.

Edward Fred Knipling, a USDA entomologist until his retirement in 1973, is one of the most interesting of the scientists who has remained obscure to the public yet who has played a crucial role in the design of new strategies of insect control. This paper explores Knipling's contributions and outlines the reasons for his relative obscurity in the environmental movement. The factors underlying his status as an unsung hero provide important clues about the politics and philosophical nature of the environmental movement.

The New Insecticides

It is impossible to understand Knipling's work without recognizing that his profession, applied entomology, underwent rapid and profound changes after 1870 and particularly after 1945. Knipling began his career in 1931 and

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was an active participant in many of the significant scientific events that transformed his discipline (Anonymous, 1975; Knipling, Personal Interview, 1976).

Reliance upon insecticides for insect control was the hallmark of the changes. Botanical products such as pyrethrum, rotenone, and nicotine were used by the 19th century, but their development was an art form rather than a scientifically-based technology (Hough and Mason, 1951:3-9). In 1868, an unknown farmer discovered that the aresenical dye, Paris green, killed Colorado potato beetles and thereby opened up a new era of insecticide possibilities (Howard, 1936: 64). Lead arsenate and calcium arsenate followed in 1892-94 and 1917, respectively (Forbush and Fernald, 1896: 142-145; Coad, 1918). Organic molecules began to be used after E. B. Blakeslee discovered in 1919 that para-dichlorobenzene was effective against peach tree borers (Blakeslee, 1919).

Despite these early inventions, it was not until DDT's invention in 1939 that insecticides were good enough and cheap enough to enjoy extensive, wide-spread use. DDT truly revolutionized insect control. It also stimulated both the chemical industry and applied entomologists to develop a broad array of synthetic, organic insecticides for use in agriculture, forestry, and urban areas. By 1950, botanical and arsenical compounds had virtually disappeared from the U. S. insecticide market (Perkins, 1978).

The rapid adoption of DDT and other synthetic insecticides after 1945 quickly increased three fundamental problems, each of which had been recognized before 1945 but was considered insignificant. First, insect populations developed resistance to the chemicals. Second, the new insecticides destroyed parasitic and predatory insects, which caused pest insect populations to explode in size and thereby become worse pests than they were before treatment. Third, the new chemicals proved to have unexpected and unacceptable effects on wildlife and on human health (Perkins, 1982: 29-49).

Leading entomologists fully recognized by 1955 that resistance, destruction of natural enemies, and environmental health hazards from the new insecticides posed potentially fatal flaws to insecticide technology. Resistance and destruction of natural enemies were subjects of debate within the entomological profession. Controversy over environmental health hazards, however, first reached the political arena through an extensive investigation by a Special Committee of the House of Representatives in 1950-1952 (U. S. Congress, 1950). A more stringent regulation of insecticide residues in food and feed was enacted by the Congress (68 Stat. 511-517). Carson's book in 1962 opened the doors to a broad-based public debate.

Edward Fred Knipling became one of the most prominent participants in the debate over how to solve the problems associated with the use of the new insecticides. He had also been prominent in the research that developed the new materials, so he was intimately familiar with both their strengths and weaknesses.

Knipling: An Unsung Hero

Edward Fred Knipling was born the ninth of ten children in 1909 in Port Lavaca, Texas. His father was born in Germany, and his mother was born in the United States of German parents. He grew up on his parent's small cotton and livestock farm on the Texas Gulf Coast. While a youngster, he became personally familiar with two insects that would later loom large in his work as a professional entomologist: the boll weevil and the screwworm fly.

Knipling completed his baccalaureate degree at Texas A&M in 1930 in entomology. He immediately initiated graduate study at Iowa State University and received his masters degree in 1932. He began his career with USDA in 1931, but returned to Iowa State after World War II to receive his Ph.D. in 1946.

USDA was Knipling's only employer in a career that spanned over forty years until his retirement in 1973. After his formal retirement, Knipling remained with USDA as an entomological collaborator, a position he still occupies. His career with USDA can only be judged as highly successful. His first assignment as a junior entomologist was to a population survey of screwworm flies in his home state of Texas. He later went on to head a laboratory for mosquito work in Portland, Oregon.

Knipling's major breakthrough came in 1942 when he became head of the USDA laboratory in Orlando, Florida, that was assigned to work on insects of military importance during the war. The Orlando laboratory was one of the first to work with DDT.

After the war and completion of his doctoral work, Knipling became successively the head of the Division of Insects Affecting Man and Animals, the Assistant Chief for Research of the Bureau of Entomology and Plant Quarantine, and, in 1953, the Chief of the newly organized Entomology Research Branch (later Division) of the Agricultural Research Service. From 1953 until 1971, Knipling was administrative head of all USDA research in entomology. From 1971 until his retirement in 1973, Knipling withdrew from administrative duties and devoted more time to writing.

Knipling's administrative position during the critical years from 1953 to 1971, plus his scientific leadership, gave him a position of remarkable strength from which to guide USDA efforts in applied entomology. USDA's entomological research program is probably the largest anywhere on earth, so Knipling played a particularly important role in shaping the efforts made by entomologists to resolve the problems associated with insecticides.

Knipling's work with DDT at the Orlando laboratory brought him into intimate contact with the promise and problems of the synthetic, organic insecticides. He developed an intense, long-term interest in the materials with a view toward capitalizing on their strength and avoiding their faults. Interestingly enough, even before he moved to Orlando, he conducted a simple yet highly unusual experiment to see if he could select

in the laboratory a strain of screwworm files that was resistant to phenothiazine, a compound that showed some promise as a treatment. He was successful in his search, a result that surely influenced his sensitivity to the potential seriousness of resistance and its ability to destroy the utility of an insecticide (Knipling, 1942). The Orlando laboratory developed DDT's first use in the United States as a protector of soldiers from mosquitoes, lice, and other insects that can bring annoyance and deadly disease. Knipling's laboratory quickly found that DDT could be used with great effectiveness in controlling adult mosquitoes over large areas of land. The compound also could be impregnated into underwear to protect soldiers from infestation with body lice (Perkins, 1978).

Although Knipling's team easily showed the effectiveness of DDT for these and other purposes, they also worried about the possible health effects of exposing troops to the compound. Toxicological work by scientists at the Food and Drug Administration quickly demonstrated that no major, immediate hazards were associated with military uses of DDT (Perkins, 1978). Undetected hazards were in any case less than the hazards from malaria, typhus, or enemy action. Knipling's entire experience with DDT during the war years was positive and important in shaping his attitude to the new, synthetic, organic insecticides.

Knipling's post-war work as head of the Division of Insects Affecting Man and Animals provided an opportunity to continue the development of practical insect suppression techniques based upon use of the synthetic organic insecticides that began to pour forth from the chemical industry. The majority of the 36 articles he published between 1947 and 1953 were focused on the use of insecticides. Knipling also remained respectful of the toxicological hazards posed by the chemicals as he organized a program within his Division to work on the toxicology of insecticides to livestock. Knipling's extensive work with insecticides was probably an important factor in his appointment in 1953 as chief for entomological research for USDA (Knipling, Personal Communication, 1977).

Knipling was an advocate of using the new insecticides, but a number of his activities during the decade 1945 to 1955 showed that his promotion of the chemicals had limits. In some ways, his public speeches and publications were more unabashedly in favor of the new materials than his relatively more private development of research pathways and priorities within USDA. In 1937, before the United States entered the war and two years before DDT's invention, Knipling and his colleague R.C. Rushland conceived the germ of the idea for what was later known as the sterile-male technique for insect control (Knipling, 1959: 409-418). Knipling at the time was working on the screwworm fly, an insect that lays its eggs in the wounds and soft tissues of livestock, humans, and other mammals. Maggots hatch and feed upon the hapless animal; death or serious injury is the inevitable result. Knipling recognized that the relative rarity and wide dispersion of the screwworm fly would make the adult virtually invulnerable to insecticide attack. He reasoned, however, that if large numbers of sterilized, male adults could be released into the field, they would mate with and render infertile the natural females.

Knipling had to abandon his idea due to the pressures of war-time demands but he returned to them after the hostilities had ceased. His major stumbling block when he returned to the notion after the war was the lack of a practical way to sterilize the insect in the laboratory. H.J. Muller's work on the genetics of fruit flies provided the clue: X-rays would sterilize insects as well as induce mutations (Knipling, Personal Interview, 1976). In a very real sense, Knipling was able to use the physical power of X-rays to remake an insect into an engine for its own destruction.

Knipling and his colleagues brought their research on the sterile-male technique to a successful fruition as they eradicated a population of screwworm flies from the island of Curacao in the Carribbean Sea in 1954 (Baumhover, et al., 1955). Knipling's persistance in pursuing this highly novel, imaginative, and difficult research problem was based largely on his realization that chemicals, despite their enormous utility, did not provide the answer for all insect pest problems. The sterile-male technique was a highly promising alternative to insecticides if it worked on other species. The theoretical and practical potential for the sterile-male technique to eradicate a pest species was also of extreme importance because it suggested ultimate, long-term solutions to pest problems rather than annually repeated control techniques based on insecticides.

Knipling followed the development of resistance in populations of anopheline and culicine mosquitoes and in various flies that began to be reported in the late 1940's. These examples were troubling enough, but in 1954 an even more potent case of resistance developed. Boll weevils, a pest of cotton in the states from Texas to Virginia, became resistant to chlorinated hydrocarbon insecticides in 1954 (Roussel and Clower, 1955), and threatened to upset a delicate economic balance that allowed American cotton growers to stay in business despite the heavy competition they were receiving from foreign cotton growers and the manufacturers of synthetic fibers. Knipling, then head of all USDA entomological research, gave high attention to finding some method of resolving the danger associated with boll weevils resistant to synthetic organic insecticides.

The success of the sterile-male investigations against screwworm flies, plus the danger to cotton production posed by boll weevils resistant to insecticides, combined by 1955 to prod Knipling into systematic thinking about alternatives to chemically-based control strategies. It is particularly significant that as late as August, 1954, Knipling and his research leaders in USDA gave top priority in their research plans to classical biological control, systemic insecticides, insect vectors of plant disease, and crop resistance to insects (Knipling, 1954). Within one year, two new research lines that were previously absent moved into the top priority list: research on the sterile-male method and research on insect resistance to insecticide. Knipling began to speculate about the possibility of using the sterile-male technique on the pink bollworm, a cotton pest, and the codling moth, a pest of apples (Perkins, 1982: 111-114).

Congress in 1958 appropriated a special allotment of $25,000 to USDA for a study on research needs against the boll weevil. Knipling quickly assembled a committee that toured the South. They recommended that Congress establish the Boll Weevil Research Laboratory near Mississippi State University (Working Group on Boll Weevil Research Programs, 1958). When Knipling spoke at the dedication of the laboratory in 1962, he began his articulation of what was to become within a few years a new strategy for insect control:

> Congress expects more than minor improvement ... Therefore, the objective of the research should be to find ways of reducing losses to a minimum or to eliminate the problem entirely. For my part, I feel that we should gear our thinking and direct our research efforts to the development of practial ways of eradicating the insect (Proceedings of Boll Weevil Research Symposium 1962: 2).

By 1965, Knipling was able to present a new systematic strategy for directing research in entomology, a strategy that I have called Total Population Management or TPM. The key concept of TPM was that entomologists and farmers should aim to attack the total population of a pest over a substantial area of land rather than attacking the pest on a piecemeal basis, field by field. The tactics for attack could include any suppression technique, but Knipling was more explicit in showing how the use of insecticides and the sterile-male technique sequentially could theoretically provide enormous suppression, and, in some cases, even eradication of the pest (Knipling, 1954; 1966).

Knipling's departure from a field-by-field basis of insect control to an ecosystem-wide basis was novel, ambitious, and controversial for both scientific and social reasons. Nevertheless it must be recognized as a highly imaginative response to the problems Knipling saw stemming from the use of insecticides. He personally believed that Rachel Carson had condemned the use of insecticides far too radically (Knipling, 1962), but the pathways for research he began to recommend in the mid-1960s were clearly, explicitly and determinedly aimed at moving U.S. entomologists and farmers away from such massive dependence on chemicals for insect control.

Knipling's ideas were far more important than mere speeches by a science administrator. He was able to use his TPM strategy to design a number of experiments that, if successful, would have paved the way for new insect-control technology that was considerably less dependent upon insecticides. The most noted of these efforts were eradication efforts against the boll weevil in Mississippi (1971-73) and in Virginia and North Carolina (1978-80) (Perkins, 1980; forthcoming). Had these experiments proved unambiguously successful, they would have been used to justify a massive attack to eradicate the boll weevil from Virginia to Texas. Knipling's ideas were also crucial to large-scale experiments directed against codling moths, the pink bollworm, the Oriental fruit fly, the Mediterranean fruit fly, and other important insect pests (Knipling, 1979: 194, 262-263, 353-357, 433-434).

Why Has E. F. Knipling Remained an Unsung Environmental Hero?

Four factors are most significant in the relative inattention Knipling has received for his role in the environmental movement. First, his location for his entire career within the USDA has produced a certain amount of guilt by association. USDA's historical mission was resource development and exploitation. Environmentalists attacked the agency for its actions and efforts in forest management, promotion of capital-intensive farming methods (including the use of insecticides and other pesticides), and general inattention to the disappearance of wildlife and wilderness areas from the North American continent. For their part, of course, USDA people thought that the actions they promoted contributed to environmental improvement by improving the lot of those people who managed to remain in the farming business.

Rachel Carson aimed attacks in Silent Spring against USDA programs to "eradicate" the gypsy moth and the imported fire ant (Carson, 1962: 155-172). Ironically, Knipling never believed the program against the fire ant would be successful due to the lack of proper research support, but he refrained from criticizing it publicly (Knipling, 1957). For his pains of being a loyal company worker, Knipling has been tossed on the discard pile to which most USDA programs have been relegated by the environmentalism of the late 1960s and 1970s.

A second factor of importance in Knipling's public obscurity is the fact that TPM as a strategy and particular experiments inspired by it became enormously controversial among other entomologists and ecologists. The notion of eradicating a well-established species over a wide area was considered unnecessary and infeasible by many scientists. It has been a credit to Knipling's powers of persuasion that he was even able to launch some of his experiments in the face of such opposition from his scientific peers. Despite the controversy generated over his ideas, he received many awards such as the National Medal of Science and election to the National Academy of Sciences. These awards were not sufficient, however, to bring him into the realms of well-known environmental scientists and ecologists.

Knipling's location within USDA produced a third condition that has contributed to his obscurity as an environmentalist. USDA is not a teaching institution, so Knipling produced no Ph.D.s. Intellectually, USDA workers have difficulty reproducing themselves compared to their colleagues in the colleges and universities. It is difficult to estimate the magnitude of this factor, but it seems likely that it was of importance.

Finally and most importantly, Knipling's ideas contained a philosophical basis that was at best incompatible with and at worst anathema to the philosophical foundations on which most of the American environmental movement has been based. Metaphysically, Knipling is a humanist: he believes that man both can and should utilize natural resources to their fullest and that no intrinsic barrier stands between man and total mastery of the processes in ecosystems (Perkins, 1982: 183-205). Knipling's

advocacy of eradication efforts against selected key pests, even over thousands of square kilometers, is perhaps the clearest manifestation of his sense that man's technology can readjust agricultural ecosystems in fundamental ways.

Virtually all those who have identified themselves as "environmentalists" operate on a naturalistic metaphysics in which man is seen as a creature who cannot and should not attempt to master natural processes. The aim of science, in this view, is to learn how to live with natural processes, not remake them. Entomologists of a naturalist persuasion developed the strategy of Integrated Pest Management (IPM). IPM became a rival to Knipling's strategy, Total Population Management.

Knipling accepts no such limitations on the powers of science and technology. He gladly accepted the chemical insecticide as a useful "Machine" to mold nature. He physically remade the insect to serve as the agent of its own destruction when he invested the sterile-male technique. To those who would charge "Hubris!" to Knipling's ideas, he would merely respond "Lack of Vision!".

Conclusions

Knipling's scientific work remains mired in a sea of controversy. Particularly damaging have been the failures to win unanimous, successful interpretations of efforts he inspired to eradicate the boll weevil in the United States, but his undisputed successes in suppressing the screwworm fly in much of North America stands as an inspiration to those who will follow in his footsteps. Given his metaphysical position, he is unlikely to win accolades from present day environmentalists. If we as environmentalists are to draw any lessons from the successes and failures of this imaginative and able scientist, let it be the ability to examine better our own efforts for environmental preservation. Perhaps we do not share Knipling's vision of man's future on earth, but we should at least be able to recognize his contributions and to use the unique features of his vision to gain a broader picture of what the man-nature relationship is all about.

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Environmental Education Research

Environmental Studies: Structural Characteristics of the Undergraduate Curricula

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Abstract: *Twenty-one distinguishing features were identified by which to characterize the structure of curriculum design of 303 undergraduate degree major programs in Environmental Studies located on 221 campuses in the United States. This paper shares the rationale for each feature chosen, as well as summarizes the quantitative results of a portion of a comprehensive survey and analysis of all such programs offered during the 1981-82 academic year.*

Between June of 1981 and August of 1982 this writer engaged in a comprehensive survey and analysis of the curricula of undergraduate degree major programs in Environmental Studies/Science in the United States. For purposes of this study Environmental Studies is defined as:

> 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 (adapted from Davis, 1978, p. 130).

The particular programs surveyed in this study fall within that broad, middle ground of academic inquiry characterized as the liberal arts. Technical, para-professional, professional and monodisciplinary programs were not considered. Thus, excluded from investigation by this survey are undergraduate degree major programs in Conservation/Natural Resource Management, Ecology, Environmental Design, Environmental Education, Environmental Engineering/Technology, and Environmental Health. These fields are all important contributors to Environmental Studies as defined above, but are more narrowly defined and limited in focus than the more generalized programs of study examined in this survey and analysis.

The primary source of data was the College Catalogue Collection produced in microfiche format (Career Guidance Foundation, May, 1981 Supplement and preceding issues). A survey of the literature of the field, including standard college guides, as well as the research endeavors of others, identified over 550 institutions of higher learning as having some form of Environmental Studies program. A review of the indices and tables of contents of the college catalogues of those specific institutions (as well as others, perhaps doubling that number) led to the addition of a dozen or so to that list, and to the elimination of 347. The latter group were disqualified for one or more of a variety of reasons including discontinuance of program; the program being other than baccalaureate,

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MODELS BY STRUCTURAL/ EDUCATIONAL CHARACTERISTICS	Dble-Major: w. Nat.Sc	Dble-Major: w. Soc.Sc	Dble-Major: any Disc.	Env Maj + Minor/Spec.	Env Maj w. Dir.Elect.	Highly Prescr. Curric	Wide Latit. to Select	Student-designed Curr	Non-tradit. Curricul.	Multi-disc NatSc Maj	Multi-disc SocSc Maj	Other than prior 2	50/50 balance:Nat&Soc	Column A/B Distribut	Interdisc Overview Course only	Interdisc Overview + Sr Capstone Course	Senior Capstone Course only	No Interdisc Overv or Sr Capstone	Req/Recomm Internshp	No Internship	No Interdisc Overv, Sr Capstone or Intern	ENV prefixed offering	No ENV prefixed offering	Substantial ENV offer avail Soph/Jr years	No substant. offering avail Soph/Jr years	Technical Orientation	Elect/Req Jr. Year @another Campus	Sr. College (Jr. Sr. yrs only)	#(%) ea Program w/i Model
Model I - Double Major	6	4	28 +6	2 +6	8	1	18 +2?	0	0	2	0	42	2	4	6	20	8	10	23	21	5	31	12	4	40	1	0	0	44 (15%)
Model II - Major with Required Minor	0	0	0	106	0	14	33	0	0	32 +2	8 +2	64	5	8	24	30	26	26	49	57	16	75	32	14	92	3	5	2	106 (35%)
Model III - Major with Directed Electives	0	0	0	0	65	2	36	0	0	35 +1	3 +1	26	8	3	11	7	19	28	34	31	17	44	21	7	58	7	1	5	65 (21%)
Model IV - Highly Prescribed Major	0	0	0	0	0	38	0	0	0	29	2	7	5	0	7	4	11	16	16	22	11	22	16	2	36	3	0	4	38 (13%)
Model V - Flexible Major	0	0	0	0	0	0	22	0	0	8 +2	6 +2	6	1	1	1	2	5	14	5	17	12	12	10	4	18	0	0	0	22 (7%)
Model VI - Student-Designed Major	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21 (7%)
Model VII - Unique Major	0	0	0	2	3	0	5	0	7	0	1	6	2	0	0	3	0	4	7	0	0	7	0	7	0	0	0	0	7 (2%)
TOTALS:	6	4	28 +6*	10 +6*	76	55	114 +2?	21	7	106 +5*	20 +5*	151	23	16	49	66	69	98	134	148	61	191	91	38	244	14	6	11	303
%**	2	1	9	36	25	18	38	7	2	38	7	54	8	6	17	23	24	35	47	52	22	68	32	13	87	5	2	4	(100%)

* = either of adjacent columns
** = columns 1 - 9, & 29 based on population of 303; columns 10 - 28 based on population of 282.

other than a major, or other than the previously defined interdisciplinary liberal arts program. On the basis of catalogue information, the programs remaining (sometimes more than one discrete program at a sponsoring institution) were 'profiled', casting the general degree requirements as well as the major requirements in a common matrix format to facilitate analysis and to allow comparison with counterpart programs. A copy of the individual profile was mailed to each program head, together with a covering letter and a questionnaire. Program heads were asked to proofread the profile(s), correcting any errors, omissions or misinterpretations, and/or modifying the profile to reflect the most recent changes in the curriculum requirements. Non-respondents were contacted by telephone and by follow-up mailings until a response was obtained from each institution. A 100% response was finally achieved after numerous phone contacts, even if several of the responses were less than complete. This effort resulted in 303 programs offered by 221 institutions being validated as undergraduate degree major programs in Environmental Studies/Science during the 1981-82 academic year, qualifying for inclusion in the survey. This technique also provided quality control for the study.

Of the 303 validated programs, 282 were identified as structured, and 21 as unstructured (see #8 below). An analysis of the 282 structured curricula was undertaken, assessing each on the basis of 21 relevant and distinguishing structural characteristics. The summary results of this analysis are displayed in the accompanying table (page 148). Also included in that table are the 21 unstructured programs, but the only characteristic identified for them is that of student-design, all other characteristics being subject to that primary distinction. A brief description of each of these 21 distinguishing characteristics (separately and in their combinations of presence or absence) follows to aid in the understanding and interpretation of this analysis. The discussion follows the order of the 29 column headings of the table, reading from left to right.

1. Double Major: with Natural Sciences

To major in such an Environmental Studies program, a student must select a second major in the natural sciences, completing all the requirements for both majors.

Six programs (2% of the 303 itemized) were identified as being so offered. Only two of these are at institutions that do not offer the option of double-majoring with a social science major (#2 below). Thus, at California State College - Stanislaus and at Bradley University (Illinois), a student can only pair a natural science major with the Environmental Studies major. In the remaining four, Northern Arizona University, Indiana University, Mankato State University (Minnesota), and Emory and Henry College (Virginia), a student has the choice of pairing the Environmental Studies major with either a natural science major or a social science major, thus making the program options at those schools virtually identical to those identified under category #3 below.

2. Double Major: with Social Science

To major in such an Environmental Studies program, a student must also select a second major in the social sciences, completing all the requirements for both majors.

Four programs (1.3% of the 303 itemized) were identified as being so offered, all four of which are at institutions that offer the option of double-majoring with a natural science major (#1 above). In effect, the options available at these four institutions are identical to those available at institutions covered under characteristic #3 below (Double Major: Any Discipline), with the exception that the course requirements on the Environmental Studies side of the double major are slightly different, depending upon whether the second major is a natural science or a social science.

3. Double Major: Any Discipline

To major in such an Environmental Studies program, a student must also select another major, completing all the requirements of both.

Generally, this second major will be chosen from the ranks of the natural sciences or the social sciences, but a number of institutions with this approach do not place such limitations on the student, allowing a dual major to be chosen from the humanities or some other division of the undergraduate curriculum. Twenty-eight programs (9% of the 303 itemized) were identified as being so offered, another 6 programs allowing the option of fulfilling a double major in conjunction with the Environmental Studies major or the option of fulfilling a minor in a traditional discipline (see #4 below).

When these six optional double major programs are added to the 28 required double major programs, the result is 34 such programs (11% of the 303 itemized). The 44 Environmental Studies programs that were identified as being cast as double majors (#1 and 2 above, as well as this #3) were grouped together and designated as Model I, representing one of seven basic approaches to curriculum design. This approach might be likened to partaking of a hearty weekend brunch at a major restaurant or hotel dining room. All the essential components of both breakfast and lunch are combined into one exhaustive bill of fare, challenging all but the most ravenous appetites. The double major likewise satisfies two separate major requirements simultaneously within one degree program.

4. Environmental Major + Minor/Specialization

To major in such an Environmental Studies program, a student must complete the requirements of the program core or major and also select one from among the many possible minors, and/or specializations, options, concentrations, tracks, emphases or concerns, completing all the requirements thereof.

The range of choices depends upon the individual institution and program. The minors tend to be in the traditional disciplines, whereas the specializations, etc. tend to be in environmental theme areas (e.g., water quality control, air pollution monitoring). One hundred and ten programs (36% of the 303 itemized) were identified as being so offered, another 6 programs allowing the option of fulfilling a minor in a traditional discipline in conjunction with the Environmental Studies major or the option of fulfilling a double major (see #3 above). When these six optional minor programs are added to the 110 required minor/specialization programs, the result is 116 such programs (38% of the 303 itemized). This basic approach to curriculum design was designated as Model II. It might be likened to ordering from the group menu at a Chinese restaurant of Cantonese cuisine where a designated number of dishes are to be chosen from Column A and a designated number from Column B. The column with the more expensive dishes and/or the larger number of selections allowed represents the major, the other being the minor.

5. Environmental Major with Directed Electives

To major in such an Environmental Studies program, a student must complete the prerequisites and the requirements of the program core, major or foundation program, and must also select a given number of courses from a list of approved electives.

The student achieves a customized specialization by making choices (generally upon faculty advisement) from among a list which is the result of the faculty's choices from among the entire undergraduate course offerings of the institution. Seventy-six programs (25% of the 303 itemized) were identified as being so offered. This basic approach to curriculum design was designated as Model III. It might be likened to a restaurant dinner menu that allows free access to an ample salad bar and/or a tempting dessert carts the entree and accompaniments being the major and the bar/cart selections being the directed electives.

6. Highly Prescribed Curriculum

The nature of such an Environmental Studies program is that it is highly structured, often narrowly focused, and offers little if any latitude for individual choice of courses.

Fifty-five programs (18% of the 303 itemized) were identified as being so offered. There is a high correlation of programs with this characteristic (28 in all) paired with the characteristic described as Multidisciplinary Natural Science major (#10 below). In order to progress beyond the introductory level in each and every one of the natural sciences and mathematics, there is little room left for elective coursework. Almost no double major programs were characterized thusly, not because they are not rigorous, demanding and probably highly prescribed, but because the amount of freedom in choice of coursework would depend on the particular requirements of the exact double major chosen (and this varies from major to major, even within the same institution). This basic approach to

curriculum design was designated as Model IV. It might be likened to a prix fixe table d'hote dinner. One knows exactly what one will be served in advance, and at what price. There is little or no variation permitted in the bill of fare. Likewise, such a course of study is to be followed exactly as prescribed.

7. Wide Latitude to Selections

The nature of such an Environmental Studies program is that it is loosely structured, offering a large scope to the individual's choice of coursework.

One hundred and fourteen programs, plus two that are questionable (38% of the 303 itemized) were identified as being so offered. Such a program cannot be characterized as Student-designed (#8 below) because there are definite program requirements, although these are minimal in comparison to the electives allowed. Depending upon advisement and depending upon the total undergraduate course offerings of the institution, such a program can be customized to allow a wide variety of thematic concentrations. This basic approach to curriculum design was designated as Model V. It might be likened to a Scandinavian smorgasbord, to a cafeteria with plentiful selections, or to a covered dish supper with numerous offerings. A curriculum so designed can satisfy a wide variety of tastes.

8. Student-designed Curriculum

An Environmental Studies program described thusly is a degree major program formally recognized by the institution's administration, with the designation of an official advisor or advisory committee.

Twenty-one programs (7% of the 303 itemized) were identified as being so offered. The student electing such a major works out with the advisor(s) a customized program catering to that individual's learning goals and career objectives. It would be rare if any two programs so designed at an institution offering such a curriculum option would ever be exactly the same. Outside the general education requirements there are generally no other absolute requirements per se, everything being arranged upon advisement. Thus, no curriculum profiles are possible for this style of program. This basic approach to curriculum design was designated as Model VI. It might be likened to a roomer having kitchen privileges in a home with a well-stocked pantry. The ingredients are all there for the taking, but the menu (or curriculum design) and preparation are one's own responsibility.

9. Non-traditional Curriculum

An Environmental Studies program offered at a non-traditional institution is different in many ways. Its classes may all be team-taught. There may be no letter grading. There may be no set curriculum or graduation requirements. There may be a very well-defined total learning experience through which all students progress. There may be a greater stress on student-initiated and student-designed coursework, both on and off campus.

Seven programs (2.5% of the 303 itemized) were identified as being so offered. They are offered at four institutions: Prescott College (Arizona), World College West (California), College of the Atlantic (Maine), and The Evergreen State College (Washington). Their programs are highly innovative and they defy comparison with those of other institutions utilizing standard nomenclature, because such nomenclature does not normally apply. This basic approach to curriculum design was designated Model VII. It might be likened to a commissary for an exploration party, stocked with some provisions and negotiating for others along the route of the expedition. There is adventure as well as risk. There is also a large degree of group participation in all aspects of the operation.

10. Multidisciplinary Natural Science Major

An Environmental Studies program described in this way consists of a thorough grounding in each and all of the natural science disciplines, including a level of mathematical proficiency prerequisite to such coursework. It requires progression to levels beyond the introductory level in each discipline, and generally provides for some synthesizing experiences that demonstrate the problems and opportunities of multidisciplinary approaches to scientific understanding.

One hundred and six (38% of the 282 structured programs) were identified as being so characterized. Five additional programs are designed in such a way that allows for them to be either a Multidisciplinary Natural Science major or a Multidisciplinary Social Science major (see #11 below). When these five are added to the 106 Multidisciplinary Natural Science major programs, the total becomes 111 (39% of the 282 structured programs).

11. Multidisciplinary Social Science Major

An Environmental Studies program described in this manner consists of a thorough grounding in most if not all of the social science disciplines, generally including a level of statistical analysis sufficient to perform social research. It requires progression to levels beyond the introductory level in each discipline, and generally provides for some synthesizing experience(s) that demonstrate the problems and opportunities of multidisciplinary approaches to social science understandings.

Twenty programs (7% of the 282 structured programs) were identified as being so characterized. Five additional programs are designed in such a way that allows for them to be either a Multidisciplinary Social Science major or a Multidisciplinary Natural Science major (see #10 above). When these five are added to the 20 Multidisciplinary Social Science major programs, the total becomes 25 (9% of the 282 structured programs).

12. Other than Prior Two (#10 and 11 above)

To account for programs other than those of the Multidisciplinary types (either Natural Science or Social Science), a tabulation was made of the difference between their combined number and the total number of structured programs. This difference equals 151 (54% of the 282 structured programs).

13. 50/50 Balance: Natural Sciences and Social Sciences

Recognizing the importance of a balance between the social and natural sciences in contributing to a broad and well-grounded Environmental Studies curriculum, as assessment was made of the profiled programs to see if each came close to a 50/50% distribution between the two.

Twenty-three programs (8% of the 282 structured programs) came close to this balance. Although something is sacrificed in depth in both areas in order to accommodate such a distribution, that depth can be achieved at the graduate level, building on a strong, broadly supported base of multidisciplinary understanding.

14. Column A/Column B Distribution

A particular device used to achieve a desired balance (not necessarily 50/50 between coursework in the natural sciences and coursework in the social sciences is to set out two lists of directed electives, one in the social sciences and one in the natural sciences. Students who double major/minor/concentrate in one of the natural sciences are required to choose a larger number of courses from the social science list of directed electives and a lesser number from the natural science list of directed electives, in addition to the preponderence of coursework in their own natural science double major/minor/concentration. It is vice versa for a student with a double major/minor/concentration in the social sciences.

Sixteen programs (6% of the 282 structured programs) were identified as utilizing this particular device, which is akin to the Chinese menu alluded to in #4 above (Model II).

15. Interdisciplinary Overview Course Only

By way of providing an orientation to the multidisciplinary Environmental Studies program, an introductory overview course is often a program requirement to be fulfilled in the freshman year, or sometimes as late as the sophomore year.

Generally, because no one individual has the competence to teach all aspects of the course, it is team-taught, often achieving interdisciplinarity by having one or more faculty provide continuity by sitting in on all lectures, leading discussion sections and any other labs, workshops or fieldtrips that may be associated with the course. Although 115 programs (41% of the 282 structured programs) were identified as offering such courses, 49 programs (17% of the 282 structured programs) offered this course without balancing it with a synthesizing capstone experience at the senior level (see #17 below).

16. Interdisciplinary Overview Course + Senior Capstone Course

An Environmental Studies program benefits from having both an introductory overview course at the lower division level (see #15 above) and a synthesizing capstone experience at the senior level (see #17 below). Framing the program in such a way provides a meaningful entrance to, and exit from, the undergraduate major.

Sixty-six programs (23% of the 282 structured programs) were identified as having such a frame.

17. Senior Capstone Course Only

By way of providing a synthesizing experience at the conclusion of the multidisciplinary Environmental Studies program, a senior level capstone course is often required.

This may take the form of an integrating, problem-oriented seminar/colloquium with multiple faculty as participants; or a studio/workshop in which the students form a team to undertake a problem-oriented project that takes them into the field and into the community. This culminating experience of their undergraduate career provides students with an opportunity to apply their learning from previous and concurrent coursework to current and/or real-world problems. Although 135 programs (48% of the 282 structured programs) were identified as offering such experiences, 69 programs (24% of the 282 structured programs) offered these courses without balancing them with an interdisciplinary overview course at the lower division level (see #15 above).

18. No Interdisciplinary Overview Course or Senior Capstone Course

Accounting for the balance of the 282 structured programs, 98 programs (35%) offered neither an interdisciplinary overview course in the lower division years nor a senior level capstone experience to provide the framework of an integrating introduction and a synthesizing synopsis.

19. Required/Recommended Internship

An internship is a practical work experience in the public or private sector in which the employer promises to provide close supervision, guidance and evaluation to make the internship a learning experience. Also, the college commits itself to provide necessary preparation of the student for the work experience, and necessary follow-up to the work experience to allow mutual amplification of the work experience by the balance of the student's academic work. Other equally valuable forms of 'learning-by-doing' through off-campus experiences take the names of Cooperative Education, Field Experience, Field Study and Field Analysis.

One hundred and thirty-four programs (47.5% of the 282 structured programs) were identified as having required or strongly recommended internships or their counterparts.

20. No Internships

Accounting for the balance of the 282 structured programs, 148 programs (52.5%) neither required nor strongly recommended an internship or similar experience as part of the Environmental Studies curriculum.

21. No Interdisciplinary Overview Course, No Senior Capstone Course and No Internship

Having developed a strong personal conviction as to the necessity of inclusion of an introductory, interdisciplinary overview course, a senior level capstone course offering a synthesizing group experience, and an internship that allows a student to test his/her own interests and abilities in a realistic work setting, the researcher was interested in determining how many programs are marked by the absence of all three of these curriculum components.

Sixty-one programs (22% of the 282 structured programs) lack all three of these elements.

22. ENV Prefixed Offering(s)

Just as traditional disciplinary departments have course offerings that are made available under their own auspices, jurisdiction and responsibility, and these courses bear a departmental prefix to the number of the course (i.e., BIO 102) indicating the departmental 'home' of the course, so most Environmental Studies programs, whether full departments or not, have developed courses unique to their programs which are offered under their auspices, jurisdiction and responsibility. Not to be included in this assessment are courses that are double-listed, meaning courses that are offered by a traditional discipline under that department's prefix, but also listed as an Environmental Studies program course under an Environmental Studies prefix as well. Whatever the name of the program or whatever the coded abbreviation chosen, such course offerings are herein referred to as being an ENV-prefixed offering, that being a common program prefix.

One hundred and ninety-one programs (68% of the 282 structured programs) were identified as offering their own courses under their own designation.

23. No ENV Prefixed Offering(s)

Some programs depend entirely on the courses offered and sponsored by the participating disciplinary departments, and sometimes even through other interdepartmental auspices. No courses are listed as unique to the Environmental Studies program itself. Although the program designates the course requirements for the major, it is completely dependent upon other departments and faculty for the timely and relevant offerings of those courses, the integration of which is largely the student's responsibility.

Ninety-one programs (32% of the 282 structured programs) were identified as offering no courses under their own designation and auspices. Although not accounted for in the table accompanying this paper, the combined absence of ENV prefixed offerings, an interdisciplinary overview course, an integrating capstone experience at the senior level, and an internship during the upper division years, was tabulated. That count indicated that there are 41 programs offered at 33 institutions (14.5% of the 282 structured programs) where none of these elements are identifiable.

24. Substantial ENV Offerings Available During Sophomore and Junior Years

To distinguish Environmental Studies programs that have a significant number of their own course offerings available (as requirements or as electives) during the middle two years of the normal four-year undergraduate education, an assessment was made of this characteristic. Some programs may have the frame (see #16 above) and a required/recommended internship (see #19 above), but lack distinctive program courses available during the sophomore and junior years where it is advisable to have program courses in order to maintain continuity and reinforcement throughout the curriculum.

Thirty-eight programs (13% of the 282 structured programs) were identified as having a significant number of their own unique courses available to students during the sophomore and junior years.

25. No Substantial ENV Offerings Available During Sophomore and Junior Years

To complement the previous count (#24 above), a tally was made of those programs with few if any courses offered under their own auspices and available to students during the sophomore and junior years.

Two-hundred and forty-four programs (87% of the 282 structured programs) were identified as lacking a substantial proportion of such unique program offerings during the middle two undergraduate years.

26. Technical Orientation

A technical orientation as herein used and applied is intended to convey that an Environmental Studies program requires a substantial number of courses from disciplines and professions outside the sphere of the traditional liberal arts. Such areas include the design professions, engineering, the health professions, teacher education, agriculture, and business and management.

Fourteen programs (5% of the 282 structured programs) were identified as having a technical orientation. For the purposes of this study, Environmental Studies programs that were examined and found to be preponderantly or exclusively of a technical nature, were disqualified for inclusion in the survey.

27. Elected/Required Junior Year at Another Campus

Some programs complement their own course offerings with those available at another institution by requiring or recommending that their students spend the junior year at another campus. In this way a smaller institution can compensate for its own more limited offerings and provide its students, nonethless, with requisite technical depth and/or diversity and breadth.

Six programs (2% of the 282 structured programs) were identified as possessing such a feature. These six programs exist at four institutions. High Point College (North Carolina) requires that its Environmental Studies majors spend the junior year at the Jensen Beach campus of the Florida Institute of Technology where a highly prescribed and largely technical curriculum is predetermined for them. This cooperative relationship, unique among Environmental Studies programs, is adjudged highly successful and mutually beneficial by administrators of both institutions. The University of Maine - Fort Kent and the University of Maine - Machias participate in a consortium with other campuses of the University of Maine system, and they advise their Environmental Studies majors to spend all or part of the junior year at one or more other such campuses to supplement local offerings. New England College (New Hampshire) has its own satellite campus, Arundel, in the United Kingdom, which state-side students have the option of attending during their junior year, thus adding a European dimension to their undergraduate education. To pick up once more our menu analogy, this feature and the next (#28 below) might be likened to a progressive supper where different courses are taken in different locations.

28. Senior College (Junior-Senior Years Only)

To complement the large junior college system that has arisen in the United States, some institutions of higher learning have been created that offer only upper division studies, the lower division studies having been pursued at a junior college or by attending the first two years of a traditional four-year institution.

Eleven programs (4% of the 282 structured programs) were identified as being offered by such senior colleges. These eleven programs are offered at five institutions. Sangamon University and Governors University are both within the state university system of Illinois. The Clear Lake City campus is a satellite campus of the University of Houston (Texas), offering only upper division work, but the main campus offers both lower and upper division level work. Huxley College of Environmental Studies is a separate administrative unit within Western Washington University, but being a distinct upper division institution, students must make separate application for admission, whether from lower division preparatory work elsewhere on the Bellingham campus, or from another institution. The College of Environmental Science and Forestry is part of the State University of New York system. Although its campus is adjacent to that of a private institution, Syracuse University, it is a separate entity with its own admission standards into its junior and senior year degree program.

Because the aforementioned are two-year upper division institutions, they are not comparable in all respects with four-year undergraduate institutions relative to the criteria used herein to characterize programs.

29. Models by Number and Percentage

The final column of the table displays the number of programs assigned to each dominant model of curriculum design, and the percentage that number represents of the 303 programs surveyed.

While this paper summarizes but a small portion of the comprehensive survey and analysis on which it is based, its contents should be sufficient to reveal the great diversity of approaches to the design of curricula for Environmental Studies programs. There appears to be a growing number of programs adopting certain common teaching-learning experiences as part of their curricula, even though these particular experiences are anything but uniform in their mode of offering. Of concern to this writer is the sizable number of programs that fail to evidence any of the structural and educational features that have come to characterize the field across the differences in approach to curriculum design. In a time of increased competition for funding and for students, the field of Environmental Studies can afford only the strongest of programs. And those strong programs have much to share with their counterparts, as well as with the larger academic community in terms of positive results from educational innovation and reform, if others are willing to learn from their example.

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Environmental Education Research: Introduction to the NCEER Reports

Richard J. Wilke[1]

In 1980 the National Association for Environmental Education's (NAEE) National Commission on Environmental Education Research (NCEER) was charged with the responsibility of surveying environmental education (EE) research and reporting on the findings of that research. The Commission members abstracted published research from twenty-six selected journals (1971-1980) using a set of criteria chosen and uniformly applied by Commission members. The results of that effort plus selected abstracts of dissertations and fugitive research studies were published by the Educational Resources Information Center at The Ohio State University in a 413-page document entitled Research in Environmental Education 1971-1980 (L.A. Iozzi, Ed.).

The abstracting of environmental education research comprised the first phase of the Commission's work. In the second phase, the Commission members will evaluate the current status of environmental education research and make recommendations for future research.

A symposium on environmental education research was conducted by Commission members during the 1982 National Association for Environmental Education Conference. The symposium had a threefold purpose: (1) to apprise NAEE members of the Commission's completed work and future plans; (2) to obtain suggestions regarding the second phase of the Commission's work; and (3) to provide examples of how the Commission's document Research in Environmental Education 1971-1980 can be used by those interested in summarizing, analyzing, or synthesizing environmental education research.

Three papers presented during the symposium follow this introduction. In "Ten Years of Research in the Journal of Environmental Education - A Brief Analysis of Volumes 3-12," Harold Hungerford, Audrey Tomera, and Robert Wilson describe the types of research conducted, nature of the studies, populations sampled, modes of instruction, compare the research of the first five years and last five years and offer observations regarding the research conducted. In "Analysis of the Emphasis Placed on Overt Environmental Behavior (Intervention) and Allied Variables in Studies Abstracted in Research in Environmental Education 1971-1980," Hungerford, Tomera and Wilson focus their attention on what many consider to be the ultimate criterion of success for all environmental education efforts - environmental behavior. The final paper, by Richard Wilke and John Leatherman, illustrates how Research in Environmental Education 1971-1980 can be used as an aid in synthesizing research regarding topical areas, specifically preservice and inservice teacher training, community resource use, and field trips.

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The work of the National Commission on Environmental Education Research will continue in 1983. Persons interested in providing input or contributing to the work may contact the Commission's chairman: Dr. Louis A. Iozzi, Cook College, Rutgers University, New Brunswick, New Jersey 08903.

Ten Years of Research in *The Journal of Environmental Education* — A Brief Analysis of Volumes 3-12*

Harold R. Hungerford[1], Audrey N. Tomera[1], and Robert J. Wilson[2]

Abstract: *This paper analyzes ten years of research published in The Journal of Environmental Education (Volumes 3-12). Research is categorized by a number of variables including content arenas, types of research methods used, nature of the studies, populations sampled, and modes of instruction employed (where applicable). The first five years are compared against the last five with respect to content arenas researched. Summary comments are tendered. A bibliography of articles analyzed is included.*

The initial charge of the National Commission on Environmental Education Research (NCEER) having been met by the publication of Research in Environmental Education 1971-1980 (L.A. Iozzi, Ed.), led the present authors to inquire into the character of the research published by the Journal of Environmental Education (JEE), Vols. 3-12, noninclusively covering the years 1971-1981. This inquiry was prompted by a desire to conceptualize the character of the recent research published by the JEE and thereby communicate the major thrusts of researchers plus any inferred areas which might prove profitable for future researchers.

In order to accomplish this task a number of conditions had to be met. First, the analysis necessitated abstracting the research which had been published in the JEE subsequent to that documented by NAEE's Research Commission. Using the same abstracting format as used by the Commission, graduate students at Southern Illinois University - Carbondale completed abstracting research articles in the Journal through Volume 12.

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*Recognition of the data collection efforts leading to this paper is gladly given to the following individuals: Dr. Richard J. Wilke and Dr. Michael P. Gross, University of Wisconsin at Stevens Point and the graduate students enrolled in the Spring, 1982 Environmental Education Research Seminar at Southern Illinois University - Janet Fryman, Tom Marcinkowski, Elaine Middendorf, Maureen Murrin, Archibald Sia, Dan Sivek and Trudi Volk.

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Having abstracts in hand for Vols. 3 through 12, the second condition could be met. This consisted of selecting criteria by which the research could be analyzed. Original abstracts contained standard bibliographic information, research topics, demographic data, research design information, results of the research, and the number of references cited by the researcher(s). A number of arbitrary decisions were made concerning what criteria would be used to classify the research further.

The chosen criteria included, among other things, the overall content arenas on which the research focused. These content arenas, hereafter referred to as goal levels, included ecological concepts (foundations), knowledge of issues (awareness), issue investigation and/or evaluation affective dimensions, and citizenship action dimensions. In addition, an "other" category which would include studies covering more than one of these goal levels and a "not applicable" (N/A) category which would include studies focusing on research topics not associated with goal levels per se were chosen. Analyzing research on the basis of goal levels provided an opportunity to determine where reserach was being focused, particularly where instruction was involved. Was the bulk of the research conducted on affective attributes (e.g., values clarification, sensitivity, moral development), or knowledge of issues, or citizenship action, or some other educational goal level?

In addition, it appeared important to assess what types of research methods were being employed. To what extent were descriptive techniques being used versus experimental techniques, etc.? This analysis would provide an opportunity to determine, in a general sense, the types of designs that were being used by researchers. Similarly, criteria were established to identify the nature of the studies. To what extent were studies associated with program evaluation versus the development of models versus national surveys, etc.?

Also analyzed were variables associated with populations being sampled and the mode of instruction being used where direct instruction was involved. Finally, it seemed cogent to compare the first five years of research reported to the last five to determine if differences existed in the goal levels being researched. These criteria (goal levels, research modes, nature of the studies, populations sampled, mode of instruction, and a comparison of the first five against the last five years of research) are those which will be succinctly addressed herein.

Goal Levels and Types of Research Conducted

Table 1 presents data concerning the goal levels being researched. When one observes the data associated with goal levels it becomes immediately apparent that much of the research has been focused at an issue knowledge (awareness) level (34.8%). Further, over one-fifth of the research involved one or more affective attributes (22%). Thus, nearly 60% of the research reported for Vols. 3 - 12 dealt with affect or issue awareness. Conversely, research focusing on the investigation and/or evaluation of issues or some aspect of citizenship action accounted for only 8.3% of the total.

Table 1

Goal Levels vs Type of Research

Goal Levels	Pre-Experimental Methods	Experimental Methods	Descriptive Methods	Historical Research	Theoretical Research	Other	Total	%
Ecological Concepts (Foundations)	1	2	1	-	-	-	4	3.0
Knowledge of Issues (Awareness)	3	6	29	2	1	4	46	34.8
Investigation & Evaluation of Issues	-	-	3	-	1	1	5	3.8
Affective Dimensions	3	5	19	-	1	1	29	22.0
Action-Oriented Dimensions	-	2	4	-	-	-	6	4.5
Other (Two or More Goal Levels Represented)	3	3	8	-	2	-	15	11.4
Not Applicable (N/A)	-	2	23	1	1	-	27	20.5
Totals	10	20	86	3	6	6	132	
%	7.6	15.1	66.0	2.3	4.5	4.5		100

Table 1 also displays a "not applicable" (N/A) heading under Goal Levels which accounts for 20.5% of all research reported for Vols. 3 - 12. Because N/A involves over one-fifth of the research, it deserves comment. The N/A research represents a potpourri of studies including ones dealing with literature/documentary analysis, teacher certification, hunting, attitude toward EE activities and curricula, needs assessments, and others. Thus, numerous studies have been conducted which are not directly involved with EE goal levels per se. Most of these studies, however, relate in some dimension to the field overall.

Table 1 also displays data concerning research methods employed by investigators. It appears that most of the research conducted was of a descriptive nature (66%), e.g., ex post facto, surveys, etc. Only 15.1% of the research conducted used designs which could be considered to be experimental.

Nature of the Studies

Table 2 displays data which represent categorization of the goal levels by the nature of the studies conducted. Surveys accounted for nearly 50% of all research reported, although the surveys involved a wide variety of topics. Program evaluation contributed over 25% of the research reported. The next highest category was instrument development (10.6%). Thus, nearly 85% of all research reported for Vols. 3 - 12 involved surveys of one kind or another, program evaluation, or instrument development. Only 15% of the studies, then, involved research focused on hypothesis generation, program development and implementation, or model development.

Populations Sampled

Data pertaining to populations sampled are displayed in Table 3. Traditional grade level breakdowns show that middle school, high school, and college populations received more or less equal treatment. Overall, these three groups account for 45.7% of all studies which could be categorized in Table 3. Conversely, elementary populations (K-4) accounted for only 8% of the total. Although teacher education populations were studied in seventeen of the studies, they accounted for only 10.5% of the total. Viewed from the perspective of grade levels, the awareness and affective goal levels account for the bulk of the studies irrespective of populations sampled. This, of course, is consistent with other data analyses reported herein.

Table 2

Goal Levels vs Nature of the Study

Goal Levels	Program Develop.	Program Eval.	Program Implemen.	Instrument Develop.	Hypothesis Gener'n.	Model Develop.	SURVEYS: National Level	State Level	Local Level	Special Interest Gp	Intact Classroom	Other	Total	%
Ecological Concepts (Foundations)	-	3	-	-	-	-	-	-	-	1	-	-	4	3.0
Knowledge of Issues (Awareness)	1	11	-	5	-	2	1	5	6	3	8	4	46	34.8
Investigation & Eval. of Issues	1	1	-	-	1	-	1	-	-	-	-	1	5	3.8
Affective Dimensions	-	10	-	7	1	2	1	3	1	1	3	-	29	22.0
Action-Oriented Dimensions	-	2	-	-	-	-	-	1	1	1	1	-	6	4.5
Other (Two or More Goal Levels Repres't)	-	5	-	-	-	2	3	3	1	-	1	-	15	11.4
Not Applicable (N/A)	1	2	1	2	1	1	9	5	-	2	-	3	27	20.5
Totals	3	34	1	14	3	7	15	17	9	8	13	8	132	
%	2.3	25.7	0.8	10.6	2.3	5.3	11.4	12.9	6.8	6.0	9.8	6.1	100	

Combined % Surveys = 46.9%

Table 3

Goal Levels vs Populations Sampled

Goal Levels	Elementary (K-4)	Middle School (5-8)	High School (9-12)	College Level	Adult Education	Teacher Education	Household Resid's	Special Interest Gps	Other	Total*	N/A
Ecological Concepts (Foundations)	-	1	-	1	-	1	-	1	1	5	-
Knowledge of Issues (Awareness)	4	8	13	3	1	3	8	5	1	46	3
Investigation & Evaluation of Issues	-	-	-	1	1	-	-	1	-	3	2
Affective Dimensions	4	8	6	8	-	7	3	8	1	45	1
Action-Oriented Dimensions	1	2	-	1	-	-	2	1	-	7	-
Other (Two or More Goal Levels Represented)	1	2	5	3	-	2	1	5	2	21	1
Not Applicable (N/A)	3	4	4	5	1	4	6	7	1	35	4
Totals*	13	25	28	21	3	17	20	28	7	162	11
%	8.0	15.4	17.3	13.0	1.9	10.5	12.3	17.3	4.3	100	--

* The totals in each category are inflated due to the use of multi-level sample populations.

Modes of Instruction

Where possible, instructional modes were categorized for purposes of analysis. Although a large number of studies could not be categorized in this manner, Table 4 displays those data which could be analyzed in terms of instructional mode. Interestingly, outdoor education strategies were used in the largest number of research studies in this overall category. They comprised almost 40% of the total of 47 studies retained in this analysis. Traditional lecture techniques were identified in 10.6% of the studies. This percentage was identical for studies utilizing gaming techniques of one sort or another.

Neither inquiry modes nor instruction focusing on moral development could be identified in any of the studies in question. Table 4 also shows that very little research focused on either case study instruction or on process (skill) development.

The First Five Years vs. the Last Five Years

If the decade investigated is broken into two five year periods, a comparison can be made concerning goal level emphasis in terms of percentages between these two periods of time (see Table 5). Substantially more research was reported during the last five years than the first five, making percentage comparisons desirable. Surprisingly, perhaps, only two major changes can be observed. The percent of awareness-type studies decreased by over 10% and research focusing on some affective component increased by about an equal amount. Issue investigation and evaluation studies increased slightly (to 5.4% from 1.8%) and environmental action-oriented inverstigations actually decreased (to 4.1% from 5.3%). Very few studies focused on ecological foundations in either five-year period (less than 3% in both cases).

Summary Comments

While this analysis was in progress and even more so at its completion, several seemingly important observations became apparent. Among these are:

1. The majority of the research analyzed seems to focus on awareness and affect dimensions of EE, two of the lower levels in the EE goal hierarchy.

2. Research focusing on the investigation and evaluation of environmental issues appears to be of low priority among researchers.

Table 4

Goal Levels vs Modes of Instruction

Goal Level	Traditional Lecture	Inquiry	Case Study	Outdoor Education	Games	Moral Education	Process Instruction	Individualized Instruction	Other*	Total	N/A**
Ecological Concepts (Foundations)	1	-	-	2	-	-	-	-	-	3	1
Knowledge of Issues (Awareness)	1	-	1	2	2	-	2	-	6	14	32
Investigation & Evaluation of Issues	-	-	-	-	1	-	-	-	1	2	5
Affective Dimensions	1	-	-	9	2	-	-	-	3	15	14
Action-Oriented Dimensions	1	-	-	1	-	-	-	-	1	3	3
Other (Two or More Goal Levels Represented)	1	-	-	2	-	-	-	-	2	5	10
Not Applicable (N/A)	-	-	-	2	-	-	-	-	3	5	22
Totals	5	[illegible]	1	18	5	0	2	0	16	47	87
%	10.6	0	2.1	38.3	10.6	0	4.3	0	34.1	100	--

* The "Other" subheading for this table includes workshops, specialized activities, textbook analyses and specific situations in which the mode of instruction could not be categorized.

** Not applicable for this analysis.

Table 5

Goal Level Research Emphasis Comparisons for 1972-1976 and 1977-1981

Goal Level	1972-1976		1977-1981	
	Total	%	Total	%
Ecological Concepts (Foundations)	2	3.5	1	1.4
Knowledge of Issues (Awareness)	24	42.1	22	29.7
Investigation & Evaluation of Issues	1	1.8	4	5.4
Affective Dimensions	9	15.7	20	27.0
Action-Oriented Dimensions	3	5.3	3	4.1
Other (Two or More Goal Levels Represented)	3	5.3	12	16.2
Not Applicable (N/A)	15	26.3	12	16.2
Totals	57	100.0%	74	100.0%

3. Research focusing on citizenship action appears to be of low priority among researchers.

4. Experimental methods are employed infrequently in EE research. Descriptive methods predominate.

5. Surveys are extremely popular with EE researchers.

6. Little attention is paid to elementary school populations by EE researchers.

7. Outdoor education strategies appear to be popular vehicles on which to conduct research. Half of this research focuses on affective variables.

8. Research focusing on inquiry strategies or using inquiry methods as an independent variable may be nonexistent.

9. Research focusing on skill development (process acquisition) is almost nonexistent.

10. With the exception of an increased emphasis on affective variables, reserach conducted from 1977-1981 appears quite similar to that conducted during the five years preceding 1977.

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An Analysis of the Emphasis Placed on Overt Environmental Behavior (Intervention) and Allied Variables in Studies Abstracted in *Research in Environmental Education 1971-1980*

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Abstract: *This paper analyzes the research abstracted in Research in Environmental Education 1971-1980 (RIEE) and reports on the extent to which said research focuses on citizenship environmental behavior and allied variables. Summary comments are made. Two bibliographies are included.*

Subsequent to the publication of Research in Environmental Education 1971-1980 (L. A. Iozzi, Ed.), the writers were charged (as NCEER members), by the Commission's Chairman, with the responsibility of analyzing the abstracted research studies to determine how many focused on some aspect of citizenship behavior. The rationale for this investigation centered on the rather prevalent belief among professional environmental educators that variables associated with overt behavior (intervention) need to be better understood. Such an analysis, then, would provide data concerning the extent to which reserachers were studying behavior or variables associated with behavior. In addition, some insight might be gained relative to where such studies were located (i.e., particular journals, dissertations, fugitive literature) and, in general, the content on which they focused. Hopefully, these initial efforts might lead to a synthesis of the research or a meta-analysis centered around variables associated with overt behavior.

Procedures

Abstracts prepared for the NCEER document, Research in Environmental Education 1971-1980 (RIEE) contained a data base which could be used in classifying studies. Among other things, this data base included standard bibliographic information, descriptor terms, purpose of the research, demographic information, research design information, and results of the research. Using this information, the writers analyzed each of the 429 entries. It should be noted that, although 429 abstracts exist in RIEE, a few entries are redundant. For example, in one instance a study appeared as both a journal article and a dissertation. In a second situation, a study appeared as a journal article and a fugitive literature entry. When such a repetition was discovered, the authors of this paper deleted one of the two entries from the analysis.

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An a priori decision was made to select, from the entries in RIEE, two categories of research. One category would contain research which focused directly on human behavior as it relates to citizenship participation/issue remediation (intervention). The second category would contain research which focused on variables related to behavior but was not measuring acts of intervention per se. Research in this category would include, among other things, variables such as attitudes toward action, knowledge of action, value orientations regarding action, and instrument development studies which focused on the measurement of some aspect of citizenship participation.

The analysis per se involved a number of subjective judgments, irrespective of a desire to make the analysis objective. It was determined, for example, that one could not count on RIEE abstract descriptors such as "behavior" or "citizen action" to identify studies appropriate to the two categories. These terms (descriptors) were sometimes applied in RIEE entries to studies not related to issue remediation or citizenship participation as defined in this study, e.g., user surveys associated with recreational facilties. Thus, the analysis had to involve consideration of the statement of purpose, discussion of the research design and the results section. In so doing, the writers had to make, at times, subjective judgments regarding the main intent of the research and, where appropriate, the extent to which the research focused on behavior or allied variables. If, for example, a research study dealt with behavior or variables allied to behavior in an ancillary manner or to a very minor extent, it was not retained for subsequent analysis. Wherever questions existed concerning the appropriateness of a particular study the writers met as a jury to make a final decision.

Once the initial dichotomized categorization was completed, studies were further classified under subtopics for each main category. The sub-categories for studies focusing on overt behavior were chosen in accordance with the issues under investigation. Because it became immediately apparent that most studies revolved around behavior associated with littering, recycling, or energy consumption, these subcategories were used to further analyze abstracts. In addition, an "other" heading was used to accommodate those studies dealing with issues other than littering, recycling, or energy.

Subcategories for studies focusing on variables related to but not dealing directly with overt behavior were created to classify which variables were commonly studied by researchers. These subcategories were identified and defined as follows:

> Knowledge Variables: Those variables related to levels of factual information on aspects of intervention possessed by individuals or groups regarding issue remediation, citizenship responsibility, resource management, or governmental practices/policy.

Attitude Variables: Those variables related to the affective orientation/disposition toward aspects of intervention possessed by individuals or groups regarding issue remediation, citizenship responsibility, resource management or governmental practices/policy.

Preference/Value Variables: Those variables related to the relative worth (importance) or and/or beliefs associated with aspects of intervention possessed by individuals or groups regarding issue remediation, citizenship responsibility, resource management, or governmental practices/policy.

Citizenship Action Variables: Those variables related to some aspect of the intended use or the acquisition of intervention skills/methods by an individual or group. These may involve persuasion, consumerism, political action, legal action, or an ecomanagement form of intervention.

Instrument Development Variables: Those variables related to the development and validation of an instrument or technique used to assess aspects of intervention displayed or possessed by individuals or groups and manifested as either overt behavior or related variables.

Other: Those variables which focus on factors other than those listed above. The include such items as personality type, locus of control, and demographics. This category also contains studies which deal substantially and more or less equally with a combination or two or more of the variables listed above (e.g., attitudes and knowledge).

Results - Overt Behavior Variables

Of the 429 research studies abstracted in RIEE, a total of 38 dealt with overt behavior as a major thrust of the research. Thus, only 8.86% of all studies dealt, in one way or another, with behavior per se. As Table 1 indicates, most of the research categorized under this heading came from journal articles. Only three dissertations abstracted (1976-1980) focused on behavior and only three fugitive studies did so.

Nearly all of the research used littering, recycling, or energy as the content vehicle (27 of 38 studies), with almost half of these focused on littering.

Of the 38 research articles identified as behavior-oriented, over two-thirds of them were reported in the last five years (1976-1980). Only 12 were observed for the first five years. Although one might be tempted to interpret this as a trend toward researching citizenship action, such a prediction would have to be supported with data beyond the scope of this document.

Table 1

Research Studies Focusing on Some Aspect of Overt Environmental Behavior (Intervention) Reported in Research in Environmental Education 1971-1980*

Publ. Yr.	Abstract Numbers for Journal Entries Total n = 263				Abstract Numbers for Dissertations (n = 88)	Abstract Numbers for Fugitive Literature (n = 78)			
	Littering	Recycling	Energy	Other	All Topics	Littering	Recycling	Energy	Other
1971	43;175**	0	0	0	N/A	0	0	0	0
1972	61;62	0	0	0	N/A	0	0	0	0
1973	149;197	106	0	0	N/A	0	0	0	0
1974	58	0	0	92	N/A	0	0	0	0
1975	112;156	0	0	11	N/A	0	0	0	0
1976	107	199;257	150;214	154	0	0	0	423	376
1977	71	9;130	74;101;190	191	0	0	0	0	0
1978	0	0	0	246	0	0	0	0	0
1979	170	167	0	0	0	0	0	394	0
1980	210	0	166	1;208	282;323;327	0	0	0	0
Column Totals	13	6	6	7	3	0	0	2	1
% of Total	3.03	1.40	1.40	1.63	0.70	0.00	0.00	0.47	0.23

Total Abstract n = 429; Total Overt Behavior Studies = 38 (8.86%)

* ERIC, 1200 Chambers Road, Columbus, Ohio 43212; ** Abstract number as referent in all cases.

Results - Variables Related to Behavior

Of the 429 research studies abstracted in RIEE, a total of 38 dealt with variables related to but not dealing directly with overt behavior (8.86%). As Table 2 indicates, nearly one-third (31.6%) of these focused on attitude variables. Six studies (15.8%) fell into the preference/value category and two (5.3%) into the knowledge category. When these three categories are summed, one observes that they account for over half of the studies identified. Conversely, only three studies fell into the citizenship skill category. Thus, only 7.9% of the studies reflected research focusing on some aspect of intended use or acquisition of intervention skills.

Most of the research abstracts reported in Table 2 originated in journals. Only two were located in abstracts of dissertations in RIEE (2.3% of the 88 abstracts reported). Five were found in abstracts of fugitive literature (6.4% of the 78 abstracts reported in RIEE). These percentages are substantially lower than that for research found in abstracts of journal articles (11.8% of the 263 journal articles reported in RIEE).

Of the 38 studies identified in this category (related to but not dealing directly with overt behavior), 22 of them were reported in the last five years, 1976-1980 (57.9%). Only 16 could be identifed from those studies abstracted from 1971-1975 (42.1%). Whether or not this constitutes a research trend is not known at this time.

Conclusions/Inferences/Recommendations

Several conclusions, inferences, and recommendations based upon the data displayed herein appear important enough to be listed at this point. These are:

1. By and large, researchers are not studying behavior as it relates to the remediation of environmental issues. Although this is a difficult research arena, it should undoubtedly receive much greater attention than some of the topics traditionally researched in EE.

2. Where behavior is studied, the issues which serve as vehicles for this research are limited in scope, i.e., they focus primarily on littering, recycling, and energy. Researchers should ascertain whether desired citizenship behavior, as it relates to the issues researched in the past, will transfer to other issues which are environmental imperatives, e.g., population and land use management issues. If transfer is not observed, researchers might choose to utilize crucial issues for research purposes.

Table 2

Research Studies Focusing on Variables Related to But Not Dealing Directly With Overt Environmental Behavior (Intervention) Reported in Research In Environmental Education 1971-1980*

Year of Publ.	ABSTRACT NUMBERS Articles (n=263); Dissertations (n=88); Fugitive Literature (n=78) Knowledge Variables	Attitude Variables	Preference/Value Variables	Citizenship Skill Variables	Instrument Development	Other
1971		41	187			182
1972						
1973						39
1974		55;189 194	6;89	153		18;79
1975		179;381***	82			215
1976	225	83;291**			122	244
1977	40	7;176	2			269**
1978		8;69			254	60;129 352***;375***
1979			395***			28;230
1980				196;410***		
Column Totals	2	12	6	3	2	13

Total Number of Abstracts Counted In This Category = 38 (8.86%)

* ERIC, 1200 Chambers Road, Columbus, Ohio 43212 ** Dissertations *** Fugitive Literature

3. It appears as though research topics chosen by doctoral students for dissertation purposes seldom include citizenship behavior (intervention). Also, minimal attention is given to dissertation research focusing on allied variables. Doctoral advisors and students might well consider viewing citizenship behavior as an area rich in potential for research purposes.

4. Overall, a number of variables associated with behavior have been investigated. However, nearly one-third of these studies appear to deal with attitudinal variables. A number of models exist which promote the notion that numerous variables are involved in citizenship action decisions. Among these are belief systems and locus of control as well as knowledge of and skill in applying action strategies. These variables should probably receive greater attention than they are now being given. In addition, it is recommended that behavior predictors be looked at holistically wherever possible.

5. Research reported in RIEE reflects minimal focus on the development and validation of instruments (or other methods) used to measure behavior. It is recommended that researchers interested in instrumentation review the state-of-the-art with respect to behavior to determine the desirability of working in this area.

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11	Asch, Joseph, and Bruce M. Shore. Conservation Behavior as the Outcome of Environmental Education. The Journal of Environmental Education 6(4):25-33.
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Abstract Number	Reference
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Abstract Number	Reference
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156	LaHart, David E., and Jon S. Bailey. 1975. Reducing Children's Littering on a Nature Trail. The Journal of Environmental Education 8(1): 37-45.
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Conclusions and Generalizations Drawn from *Research in Environmental Education 1971-1980* Regarding Teacher Training Preservice, Teacher Training Inservice, Community Resource Use, and Field Trips

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This manuscript has been prepared to provide readers with a sampling of the information which can be gleaned from the abstracts contained in Research in Environmental Education 1971-1980. The writers have attempted to provide a brief summary of some of the conclusions and generalizations as noted in the abstracts pertaining to the following arbitrarily selected descriptors: teacher training in service, teacher training preservice, community resource use, and field trips. Following each conclusion or generalization the writers have provided the number of the abstract from which the conclusion or generalization was obtained. This method of citation has been used to ease the task of referring back to the abstracts in Research in Environmental Education 1971-1980. The traditional author-date citation is also provided in the references-cited section of this paper.

As noted, the writers relied on abstracts of research rather than the original publications when preparing this manuscript. Researchers and practitioners using this manuscript may wish to consult both the abstracts and the original publications should questions arise regarding conclusions or generalizations summarized herein.

In reviewing the conclusions and generalizations which follow, the reader should be aware that the writers have made no attempt to describe the rigor of the research which led to each conclusion. General information regarding the types of research conducted, extent of literature cited and the assessment of reliability and validity when appropriate is provided in Tables 1-3. In order to generate the tables, the authors were required to make some interpretations regarding the information presented in the research abstracts. The interpretations made are described.

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Type of Research Conducted

Table 1 presents data concerning the types of research conducted. Most abstracts contained within Research in Environmental Education 1971-1980 listed the type of research in the "Descriptor" section of the abstract. In those instances where research type was not specifically listed, a determination was made by reviewing the description provided in the abstract itself. The reader will note that 70% of the 75 studies pertaining to the four descriptors selected were of a descriptive nature while only 20% were of an experimental nature.

Table 1

Types of Research Used

Research Type	Totals	%
Descriptive	53	70.7
Experimental	15	20.0
Pre-Experimental	6	8.0
Theoretical	1	1.3
	75	100.0

References Cited in the Research

Table 2 presents data regarding the numbers of references cited in the research examined. Because the number of references cited was not reported in the abstracts for either dissertations or fugitive literature the totals in Table 2 are less than the totals in either Table 1 or 3.

Table 2

References Cited in the Reserach

No. References Cited	Totals	%
0	9	17.3
1-5	15	28.8
6-10	9	17.3
11-15	11	21.2
16-20	7	13.5
20	1	1.9
	52	100.0

Reliability and Validity of the Studies

Table 3 reports the extent to which reliability and validity were assessed in the research examined. In certain instances where there was no report in the abstract of an assessment of reliability or validity it was not clear whether the researcher failed to assess the reliability and/or validity of the instrument(s) used or the abstractor failed to report it. However, a conscientious effort was made by the authors to insure every possible accuracy in the presentation of Table 3. The reader should note that in 60% of the 75 studies examined either the researcher or abstractor failed to report an assessment for reliability and validity.

Table 3

Assessment of Reliability or Validity

Extent of Assessment	Totals	%
Reported Both	10	13.3
Researcher Did Not Report Either	12	16.0
Abstractor Did Not Report Either	33	44.0
Only Reliability Reported	3	4.0
Not Applicable	17	22.7
	75	100.0

Generalizations Regarding Teacher Training Preservice and Inservice

Teachers at the elementary and secondary school levels are concerned with environmental problems (307) and feel they themselves or their schools have the responsibility to infuse environmental education into student's curriculum (301). Teachers generally have good comprehension of what environmental education is (307) and what its goals are (57), but, however good these intentions, researchers and professionals have called into question the competence and ability of these teachers to accomplish the goals of environmental education (307, 301, 358, 57).

Most teachers at the elementary level are predisposed to include some form of environmental education in their teaching, but do so in a whimsical manner (307). At the secondary level, most teachers feel it is someone else's responsibility to teach environmental education, typically someone in science or social studies courses (301). Indeed, it is only within the realm of science and social studies that teachers tend to have some form of a plan to include environmental concerns in course work (276, 351, 301). In other areas, teachers tend to lack the environmental awareness, knowledge (358), and especially the ability to help students achieve the goals of environmental education (58).

Looking to current preservice training, we find little being done to improve the competency of teachers. A survey of U.S. colleges of education reveals that only 25% require any environmental education at all (337), and those that do stress content in environmental science as opposed to methods of teaching environmental science (239). One study concludes that the population of preservice teachers is not prepared to help build environmentally literate students (196), while another finds preservice students have little competency in environmental action skills, know they have little competency, and have incomplete or no plans for future involvement in environmental action (331).

Environmental education professionals have made suggestions to help correct these deficiencies. At the preservice level, students should include one or two environmental education courses, develop a good understanding of biological sciences, and stress an interdisciplinary approach to biology, geography, political science, and natural resources (359). Also, preservice teachers need training in environmental methods, preparation of environmental education resource units, conducting field trips, and use of simulations and other activities (337). At the inservice level, professionals suggest developing a comprehensive, statewide K-12 environmental education program that stresses an interdisciplinary approach to teaching (307, 301, 358), and inservice workshops (307, 301, 57) that provide reinforcement for the implementation of environmental education (88).

The use of inservice workshops can be an effective method of helping teachers develop necessary environmentally related skills. Workshops can positively enhance teachers attitudes toward teaching environmental education in their classrooms (138, 327), can result in more idealistic and socially oriented attitudes (165), more environmental awareness (234) and higher knowledge levels (327). However it must be noted that while workshops can result in positive gains in awareness, attitudes and knowledge, they do not necessarily result in behavior changes in the teachers (165, 327). The important components to stress in workshops are the methods and techniques whereby teachers can help others to learn to become environmentally effective (234). It should also be noted that inservice training of teachers has resulted in subsequent attitudinal and knowledge gains by their students (125, 343, 233).

A large number of research reports have evaluated various specific workshop programs and formats for teacher training (86, 404, 406, 283, 64, 180, 142). The reader must return to the original research for complete descriptions of these programs and discussions of their effectiveness.

A notable exception in this area relates to the enhanced use of community resources as instructional tools. It was found that teachers participating in workshops for the purpose of developing community resource guides subsequently used those resources more frequently and effectively than teachers who simply received completed guides (344, 104). Inhibiting factors in the use of community resources and field trips include transportation, finances (168), teacher liability and administration policies (104).

A number of researchers have endeavored to develop various types of instruments to measure the values or attitudes of teachers (95, 177, 216). The reader should refer to the original reports for detailed discussions regarding scale development and effectiveness.

Generalizations Regarding Field Trips and Community Resources

The use of field trips and other community resources by teachers can enhance students in-class learning, stimulate more realistic perceptions of the community, and help to show the relationships between education and working world activities (193). Other beneficial impacts include students' positive attitude shifts toward the environment (109, 69, 232, 417), student motivation to learn is enhanced, and students report having fun while learning (309). Positive behavioral changes are also seen in an increase in the frequency of conservation behavior and a decrease of destructive behavior in natural settings (11).

The desirable effects of a field trip can be enhanced by using pre-field trip activities (193). It is also important for the leader of a field trip to model desired behavior, to give specific instructions regarding appropriate behavior, and especially to provide incentives or give rewards for correct behavior (156).

Deterrents to the use of field trips include school administration policies, cost of trips, and teacher liability for student safety (104).

The ways people get information affects what they know, feel, and do (161). Teacher knowledge of, attitudes toward, and use of community resources for environmental education can be enhanced by involving them in the development of a community resource guide (344). The actual involvement of teachers in the development of such a guide will predispose them toward greater use of both the guide and the resources described therein than by simply giving teachers such a guide (344, 104). Teachers who are formally trained in the use of a community resource guide will also use resources more frequently than those who merely receive a resource guide (344).

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Inservice Teacher Education

A Longitudinal Study of the Cognitive and Affective Impact on Inservice Teachers Participating in an Intensive Environmental Education Institute

Arthur W. Edwards[1] and Louis A. Iozzi[2]

Abstract: *Teacher in-service programs have been utilized as the dominant approach to updating knowledge and teaching methodologies of educators in all fields. While such proactices have generally been regarded as effective, few studies have attempted to determine whether such experiences have a positive impact on the in-service teacher's own lifestyle; none have reported whether such changes were enduring.*

A summer institute/workship for in-service teachers was conducted at Cook College, Rutgers - The State University of New Jersey, during the summers of 1979 and 1980. The course was designed to expose teachers to a wide variety of environmental problems. Activities were designed to promote cognitive and affective growth related to environmental issues and to introduce new methodologies for translating those experiences into classroom applications.

The objectives of this study were to determine:

how successful this intensive course format and content were in promoting positive environmental growth in both the cognitive and affective domains.

whether any cognitive and/or affective changes resulting from participation in the Institute continued to exist after two years.

The intensive summer institute format and activities are described as well as the research techniques, instruments and results of this longitudinal study.

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Introduction and Rationale

In recent years it has become acutely clear that environmental quality here and indeed throughout the world is deteriorating. Moreover, the world's supplies of natural resources are becoming rapidly depleted as a result of both over-utilization and excessive consumption. The challenge with which society is now confronted becomes even greater when one realizes that technology alone cannot solve the world's environmental problems. Rather, changes in human behavior and existing attitudes and values must combine with and complement the efforts of science and technology (Strickland and Staver, 1979). The environmental crisis is, in fact, a values crisis (Iozzi, 1978).

Education traditionally has been viewed as a major means of dealing with societal problems and promoting social change in America. If, indeed, environmental quality is a critical social issue of our times, then educators have an important role to play in making our youth more knowledgeable, concerned, and committed to improving our surroundings. While no attempt is made here to diminish the significant role of the environmental education specialist, it seems obvious that such specialists alone cannot accomplish the tasks that lie ahead. Just as all teachers are typically viewed as teachers of reading, so too should all teachers be considered teachers of environmental education. Every teacher must contribute to preparing youth to improve and preserve environmental quality.

In-service teacher education programs have served as the dominant approach to updating knowledge and teaching methodologies of educators in all fields. While such practices have long been generally regarded as effective, in recent years leaders in the area of in-service teacher education have been encountering increased criticism for what has been perceived as their "ineffective" efforts (Fisher, 1971; Harris and Bessent, 1969; Moore and Blankenship, 1978; Rubin, 1971; Smith, Otto, and Harty, 1970). A large part of the criticism has been directed particularly at the ineffectiveness of attempts to change in-service teacher attitudes through participation in teacher workshops (Hasan and Billik, 1975; Moore, 1975; Stronck, 1976). While in-service workshops continue to emphasize "content" at the expense of affective concerns, the comment of Gabel and Rubba (1979) is particularly instructive:

> "In a workshop for in-service teachers ... it is important to select activities and content that will bring about the most positive changes in attitudes toward science and teaching science ..." (1979, p. 19)(author's emphasis).

Since 1977, Cook College of Rutgers - The State University of New Jersey, in conjunction with the American Society for Environmental Education, has conducted an interdisciplinary environmental education institute for in-service elementary and secondary school teachers. Participant feedback from the first three summer sessions has proved to be extremely encouraging in terms of knowledge gained and apparent positive shifts in

environment-related attitudes, values, and teaching skills. An added benefit expressed by participants was their increased confidence in integrating environmental education into existing curricula.

The course was designed to expose teachers to a wide variety of environmental problems ranging in scope from local issues to international problems. The four-week, five credit hour course was open to in-service teachers of all disciplines, kindergarten through grade 12. Unlike many typical efforts in which teachers are exposed to a steady diet of passive lectures and non-involvement, this program was designed around a core of participatory activities. All teachers were actively involved in the learning process.

Activities were designed to promote cognitive and affective growth related to environmental issues and to introduce new methodologies for translating those experiences into classroom applications.

This was accomplished by utilizing an extensive array of resources:

- field trips to environments typically found throughout the nation (woodland, urban, coastal, mountain), but also to areas unique to New Jersey (Pine Barrens)
- acclimatization activities
- development and presentation of environmental education lessons as part of a unit assignment
- faculty comprised of approximately thirty Rutgers University scholar/specialists plus over fifty representatives of local, state, and federal governmental agencies, business and industry, and private environmental organizations
- panel debate/discussions
- role-playing simulations
- audio-visual materials

Critical to the program, however, were two major ingredients:

1. throughout the Institute, participants were engaged in extensive interactions with faculty and each other; and
2. informal get-togethers, i.e., cookouts, games, sports activities, etc. and after-hours "bull sessions." Such activities were possible because most participants lived on campus while only a few commuted on a daily basis.

This combination of factors created camaraderie and feelings of mutual concern and support. In 1979 the program was formally evaluated and follow-up studies were conducted one year later (1980) and again, two years after completing the course (1981).

Objectives of the Study

The major objectives of this study were to determine the effectiveness of the intensive institute format and content in promoting positive change among in-service teachers in the cognitive and affective domains, and to determine if any changes induced in the participants were enduring. More specifically, and stated in the null hypothesis format:

As a result of participating in the Summer Institute, there will be:

1. no significant change in affect (emotionality) regarding environmental problems,
   a. at the conclusion of the four-week Institute
   b. one year after completing the Institute
   c. two years after completing the Institute
2. no significant change in verbal commitment regarding efforts to improve environmental quality,
   a. at the conclusion of the four-week Institute
   b. one year after completing the Institute
   c. two years after completing the Institute
3. no significant change in actual commitment (behavior) to improving environmental quality,
   a. at the conclusion of the four-week Institute
   b. one year after completing the Institute
   c. two years after completing the Institute
4. no significant growth in knowledge about environmental issues,
   a. at the conclusion of the four-week Institute
   b. one year after the completing the Institute
   c. two years after completing the Institute.

A secondary objective of this study was to identify any relationships which might exist between and/or among knowledge of environmental issues, affect (the degree to which the subjects [Ss] were emotional about environmental issues), verbal commitment (what did the Ss say they were willing to do for environmental quality), actual commitment (what did the Ss in fact do to improve environmental quality), as well as several personal characteristics of the Institute participants.

Methodology and Design

A pre-experimental longitudinal time design was employed in this study (Campbell and Stanley, 1963; Kerlinger, 1973). Participants in the Environmental Education Institute were pre-tested at the beginning of the first day of the workshop and post-tested on the last day of the workshop. Additional "post-tests" were administered one year after the Institute and again two years after completing the Institute. This design can be diagrammed thusly:

$$O_1 \times O_2 \; O_3 \; O_4$$

The same instrument was employed for pre-testing and all post-tests. Because a comparable group was unavailable during the summer of 1979, no control group could be included in this study.

Sample

Twenty-nine in-service teachers (18 females and 11 males) ranging in age (at the time of pretesting) from 22 years to 54 years (mean age 39.6 years) participated in this study. Teaching experience ranged from one year to sixteen plus years. The sample included sixteen teachers with bachelor's degrees, four with Master's degrees, and nine with Master's degrees plus thirty or more credits. Thirteen of the Ss were science teachers, with the remaining coming from social studies, industrial arts, English and language arts, home economics, environmental education, and self-contained elementary classrooms. Twelve were senior high school teachers, six were junior high school teachers, and eleven were elementary school teachers.

Instruments

The Ecology Attitude Inventory (EAI) developed by Michael P. Maloney and Michael P. Ward (1973) was utilized in this study. This instrument includes four subscales: (1) Verbal Commitment (what do you say you are willing to do to improve environmental quality?), (2) Actual Commitment (what do you in fact do to improve environmental quality?), (3) Affect (how emotional are you about environmental issues?) The fourth subscale, knowledge, was designed to determine how much one knows about the environment. All four subscales were used in this study.

There are two forms of the Ecology Attitude Inventory (EAI), a long form consisting of 130 items and a shorter 45-item form (Maloney, Ward, and Braucht, 1975). Items for both forms of the inventory were selected from a pool of approximately 500 items. Since the results achieved using the short form correlate .95 with the results attained using the long form, the shorter version was employed in this study to reduce the time required for administering the instruments to the Institute participants.

Maloney, Ward and Braucht (1975) reported the reliabilities (Cronbach's Alpha) for the short form scale as .85, .81, and .89 for Affect, Verbal Commitment and Actual Commitment, respectively. Internal consistency of the three short forms -- Affect, Verbal Commitment and Actual Commitment -- were reported as .358, .296, and .442.

In responding to the questions comprising the "Attitude' subscales (Affect, Verbal Commitment, and Actual Commitment), the respondent indicates "true" if he/she agrees with the statement, if the statement represents the way he/she feels, or if it is true of something he/she has done. If the statement is not true of the way the respondent feels or if it refers to something he/she has not done, "false" is indicated on the answer sheet.

The knowledge subscale of the EAI consists of 15 multiple choice items which measure specific factual knowledge related to environmental issues. Reliability was determined using the split-half technique with a randomly selected group of college students. Reliability was reported to be .89 (Maloney, Ward, and Braucht, 1975).

A biographical questionnaire was developed and included in this study to determine whether any relationships could be identified between and among the variables measured and personal characteristics about the Ss. Personal data collected included age, sex, education, college major, number of years teaching experience, and teaching assignment (grade and subject).

Results

Mean scores and standard deviations were computed for the total Inventory (combined subscales) and for the individual subscales - Affect (A), Verbal Commitment (VC), Actual Commitment (AC), and Knowledge (K) - separately (Table 1).

Comparison of pre-test mean scores with post-test mean scores reveals that in all cases post-test scores exceeded pre-test scores. When comparing post-test scores with scores achieved after one year and scores achieved after two years, the Affect subscale, Actual Commitment subscale and Combined scales show an additional increase after one year followed by a slight decline the second year after completing the Institute. Scores achieved on the Verbal commitment subscale and on the Knowledge subscale indicate that although obvious growth took place during the four-week Institute, the gains began to diminish one year after completing the Institute and continued to decline slightly during the second year. All scales show declines between the first and second years after completing the Institute. The data were graphed to indicate these changes more clearly (Figure 1).

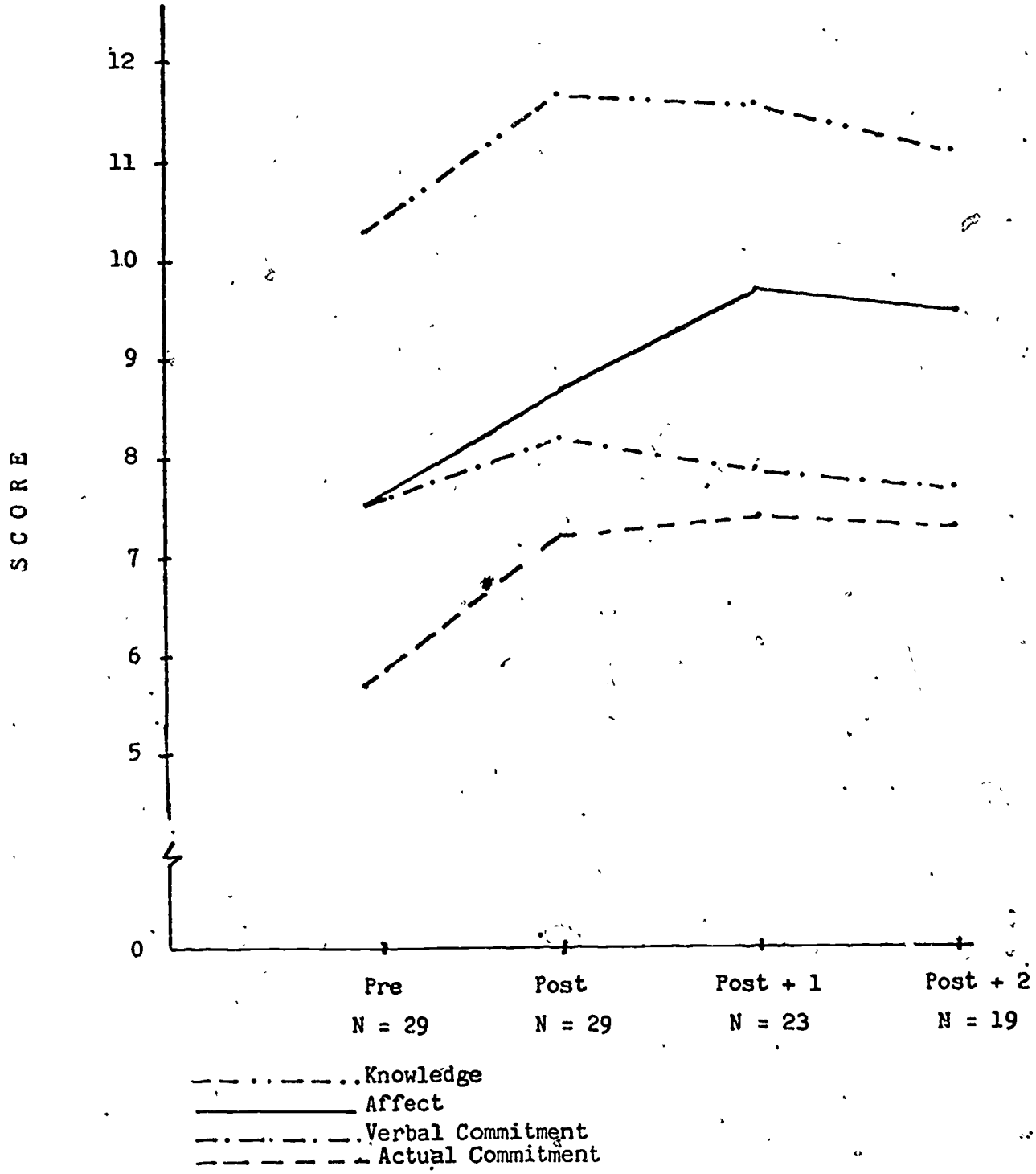
TABLE 1

Pre-test and Post-test Mean Scores and Standard Deviations Achieved by Ss on Ecology Attitude Inventory (Combined) and Individual Subscales.

	Pre-test	Post-test	Post-test + 1 year	Post-test + 2 years
COMBINED	$\bar{x}$ = 31.14	$\bar{x}$ = 35.38	$\bar{x}$ = 36.61	$\bar{x}$ = 36.37
	sd = 5.77	sd = 4.49	sd = 3.82	sd = 4.03
(A) AFFECT	$\bar{x}$ = 7.55	$\bar{x}$ = 8.69	$\bar{x}$ = 9.73	$\bar{x}$ = 9.52
	sd = 2.16	sd = 2.09	sd = 1.38	sd = 1.37
(VC) VERBAL COMMITTMENT	$\bar{x}$ = 7.55	$\bar{x}$ = 8.03	$\bar{x}$ = 7.83	$\bar{x}$ = 7.73
	sd = 2.02	sd = 1.74	sd = 1.70	sd = 1.30
(AC) ACUTUAL COMMITTMENT	$\bar{x}$ = 5.72	$\bar{x}$ = 6.97	$\bar{x}$ = 7.43	$\bar{x}$ = 7.42
	sd = 2.45	sd = 2.02	sd = 2.04	sd = 1.51
(K) KNOWLEDGE	$\bar{x}$ = 10.31	$\bar{x}$ = 11.69	$\bar{x}$ = 11.61	$\bar{x}$ = 11.16
	sd = 2.63	sd = 1.84	sd = 2.08	sd = 1.46
	N = 29	N = 29	N = 23	N = 19

FIGURE 1

Pretest and Post Test Mean Scores
Achieved by Ss on Subscales of
Ecology Attitude Inventory.



218

Combined Scores

In order to determine whether the increases in scores achieved from pre-test to post-test were significant and, moreover, to determine whether such growth was enduring, the data were compared using Analysis of Variance (ANOVA). Analysis of Variance comparing combined pre-test, post-test, post-test +1 year and post-test +2 years mean scores yielded an F value of 7.539 (Table 2). This F value is highly significant ($p \leq .0001$).

TABLE 2

Analysis of Variance for Pretest, Post Test Post Test + 1 Year and Post Test + 2 Years Combined Mean Scores (all Four Subscales).

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F Value
Between Treatments	3	517.385	172.462	7.539*
Within Treatments	96	2196.175	22.877	
Total	99	2713.560	27.410	

* $p \leq .0001$

To determine whether the growth achieved was significant (pre-test vs. post-test) and to determine whether that growth continued to be significant after one and two years, pre-test scores were compared with post-test, post-test +1, and post-test +2 years scores (Table 3). This analysis revealed that the combined scores were signficantly different (pre-test vs. post-test) ($p \leq .001$) and that the growth achieved as a result of participating in the course was significant after 1 year ($p \leq .000$) and still significant even after 2 years ($p \leq .000$).

TABLE 3

Paired F-Tests after Significant ANOVA
Comparing Pretest with Post Test Scores,
Pretest with Post Test + 1 Year Scores,
and Pretest with Post Test + 2 Years Scores,
for Combined (all Four Subscales) Mean Scores.

	N	$\bar{x}_1$	sd	$\bar{x}_2$	sd	t	sig.
Pre vs. Post	29	31.14	5.77	35.38	4.50	11.398	.001
Pre vs Post + 1	23	31.14	5.77	36.61	3.82	15.213	.000
Pre vs Post + 2	19	31.14	5.77	36.37	4.03	13.725	.000

An Analysis of Variance was computed comparing the combined data obtained on post-test +1 year and post-test +2 years to determine whether the gains achieved as a result of participating in the Institute changed significantly over time (Table 4). That Analysis yielded an F value of .546 which is statistically not significant ($p \leq .582$). Hence, analysis of paired F tests after ANOVA is not warranted.

TABLE 4

ANOVA for Post Test, Post Test + 1 Year
and Post Test + 2 Years for Combined
(all Four Subscales) Mean Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	2	19.478	9.739	.546*
Within Treatments	68	1212.832	17.836	
Total	70	1232.310	17.604	

* $p \leq .582$ (N.S.)

While it is useful to know that participation in the Environmental Institute produced statistically significant cognitive and affective growth regarding the environment, the format of the Ecology Attitude Inventory provided an unusual opportunity to identify which dimensions -- affect, verbal commitment, actual commitment, knowledge -- changed. The direction, amount, and significance of change -- if any -- could also be readily determined.

Affect (Emotionality)

The Mean series achieved on the pre-test, post-test, post-test +1 year and post-test +2 years were compared (Table 1). Ss post-test scores (8.69) exceeded pre-test scores (7.55). The post-test +1 year mean score (9.73) exceeded the post-test score. While the mean score achieved 2 years after participating in the Institute declined when compared to the mean score achieved 1 year after participating in Institute, the post-test +2 years mean score continued to exceed both the pre-test mean score and the post-test mean score (Figure 1).

To determine whether the changes in mean affective scores were significantly different, all four scores were compared using analysis of variance.

TABLE 5

ANOVA for Pretest, Post Test, Post Test + 1 Year, and Post Test + 2 Years for Affective (Emotionality) Mean Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	3	75.689	25.230	6.644*
Within Treatments	96	364.550	3.797	
Total	99	440.240	4.447	

* $p \leq .0004$

Analysis of variance revealed that the mean affective scores compared were significantly different. That is, the F value obtained (6.644) comparing the affective pre-test mean scores with affective mean scores achieved on the post-test, post-test +1 year and post-test +2 years (Table 5) was highly significant ($p \leq .0004$).

Paired F tests were computed to determine if (a) the affective post-test score was significantly higher than the pre-test score, (b) whether that growth was still significant after 1 year and (c) whether that growth was significant after 2 years (Table 6). That analysis reveals that post-test scores were significantly higher than pre-test scores ($p \leq .028$), post-test +1 year scores were significantly higher than pre-test scores ($p \leq .0001$), and post-test +2 years scores were significantly higher than pre-test scores ($p \leq .0009$).

TABLE 6

Paired F-Tests After Significant ANOVA Comparing Pretest and Post Test Mean Scores, Pretest and Post Test + 1 Year Mean Scores, and Pretest with Post Test + 2 Years Mean Scores for Affective (Emotionality) Data.

	N	$\bar{x}$	sd	$\bar{x}$	sd	t	Sig.
Pre vs Post	29	7.55	2.16	8.69	2.09	4.972	.028
Pre vs Post + 1	23	7.55	2.16	9.73	1.38	16.108	.0001
Pre vs Post + 2	19	7.55	2.16	9.52	1.37	11.758	.0009

To determine if the growth in Affect was enduring, the post-test mean scores, post-test +1 year mean score, and post-test +2 years mean score were compared (Table 7). That analysis indicated that these mean scores were not significantly different and that the results achieved had in fact remained significant after 2 years. No paired F tests were warranted.

TABLE 7

ANOVA Comparing Post Test, Post Test + 1 Year, and Post Test + 2 Years Mean Scores for AFFECT.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	2	16.058	8.029	2.380*
Within Treatments	68	229.379	3.373	
Total	70	245.437	3.506	

* $p \leq .100$ (N.S.)

Hence, hypotheses 1a, 1b, and 1c are rejected. There is a significant increase in emotionality regarding environmental problems at the conclusion of the four-week-long Institute. That increase, moreover, remained significant after one year, and indeed, two years following participation in the Institute.

Verbal Commitment

A similar analysis was made to determine if participation in the Summer Institute had a statistically significant impact in the S's verbal commitment to environmental quality and/or improvement. An analysis of variance was performed comparing the mean verbal commitment pre-test scores with those scores attained on the post-test, post-test +1 year, and post-test +2 years (Table 1 and Table 7). That analysis revealed that where the pre-test score was exceeded by the post-test scores and those scores achieved 1 year and 2 years later, the differences are not significantly different.

TABLE 8

ANOVA for Pretest, Post Test, Post Test + 1 Year and Post Test + 2 Years for Verbal Commitment Mean Scores.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	3	3.464	1.155	.347*
Within Treatments	96	319.126	3.324	
Total	99	322.590	3.258	

* $p \leq .7912$ (N.S.)

Since ANOVA yielded an F value of .347 ($p \leq .791$) paired F tests were not warranted. Hence, hypotheses 2a, 2b, and 2c are accepted. That is, participation in the Summer Institute resulted in very little or no positive change in the verbal commitments of the Ss.

Actual Commitment

Perhaps of greatest importance is the impact of participation in the Summer Institute on what the Ss actually do to improve and/or maintain environmental quality. The pre-test, post-test, post-test +1 year and post-test +2 years mean actual commitment scores were compared (Table 1). An ANOVA (Table 8) yielded an F value of 3.447 indicating that indeed the four mean scores compared were significantly different ($p \leq .019$).

TABLE 9

ANOVA for Pretest, Post Test, Post Test + 1 Year and Post Test + 2 Years for Actual Commitment Mean Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	3	50.958	16.986	3.447*
Within Treatments	96	473.042	4.928	
Total	99	524.000	5.293	

* $p \leq .019$

Paired F tests were made to determine if the actual commitment post-test mean score was significantly greater than the pre-test mean score (Table 9). That analysis revealed that the pre-test to post growth was significant ($p \leq .034$). The pre-test mean score was also compared to the post-test +1 year mean score and to the post-test +2 years mean scores (Table 10). In both cases the differences in mean scores were significantly different ($p \leq .019$).

TABLE 10

Paired F Tests After Significant ANOVA Comparing Pretest and Post Test Mean Scores, Pretest and Post Test + 1 Year Mean Scores, and Pretest with Post Test + 2 Years Mean Scores for Actual Commitment Data.

	N	$\bar{x}_1$	sd	$\bar{x}_2$	sd	t	Sig
Pre vs Post	29	5.72	2.45	6.97	2.02	4.606	.034
Pre vs Post + 1	23	5.72	2.45	7.43	2.04	7.614	.007
Pre vs Post + 2	19	5.72	2.45	7.42	1.51	6.738	.011

To determine whether the impact of participating in the Institute deteriorated over time, the actual commitment post-test mean score, post-test +1 year and post-test +2 years mean scores were compared (Table 11).

TABLE 11

ANOVA for Post Test, Post Test + 1 Year and Post Test + 2 Years Mean Scores for Actual Commitment

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	2	3.680	1.840	.418*
Within Treatments	68	299.249	4.401	
Total	70	302.929	4.328	

* $p \leq .66$

The results of that analysis yielded an F value of .418 ($p \leq .660$). Since the differences among scores were not significant, no additional joint F tests were necessary. Indeed, the growth achieved was enduring.

Hence, hypotheses 3a, 3b, and 3c must be rejected. That is, there was significant positive growth in actual commitment as a result of participating in the four-week Institute. That growth, moreover, continued to endure both one year and two years after completing the Institute.

Knowledge

Comparing mean pre-test knowledge score (10.31) with mean post-test knowledge score (11.69) and with post-test +1 year (11.61) and post-test +2 years (11.16) resulted in an F value of 2.282 (Tables 1 and 12).

TABLE 12

ANOVA for Pretest, Post Test, Post Test + 1 Year and Post Test + 2 Years for Knowledge Mean Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Treatments	3	33.692	11.231	2.282*
Within Treatments	96	472.418	4.921	
Total	99	506.110	5.112	

* $p \leq .084$

While[a] $F=2.282$ ($p \leq .084$) does not meet the criterion level for significance ($p \leq .05$), the large increase from pre-test to post-test and the rather substantial decrease between post-test +1 year and post-test +2 years scores seemed to indicate that paired F tests would prove to be useful (Table 13).

TABLE 13

Paired F Tests After ANOVA Comparing Pretest and Post Test Mean Scores, Pretest and Post Test + 1 Year Mean Scores, and Pretest and Post Test + 2 Years Mean Scores for Knowledge Data.

	N	$\bar{x}_1$	sd	$\bar{x}_2$	sd	t	Sig
Pre and Post	29	10.31	2.63	11.69	1.83	5.612	.019
Pre vs Post + 1	23	10.31	2.63	11.61	2.08	4.406	.038
Pre vs Post + 2	19	10.31	2.63	11.16	1.46	1.685	.197

Although the pre-test to post-test growth was significant ($p < .019$) and continued to remain significant after 1 year ($p < .038$), two years after completing the Institute the growth in knowledge deteriorated to a point where it was no longer statistically significant ($p < .197$). Since the difference between the pre-test mean score and post-test +2 years mean score was not significant, it is evident that no further comparisons are necessary.

Therefore, hypotheses 4a and 4b are rejected, but 4c is accepted. That is, there was a significant positive growth in knowledge after participating in the Institute but that growth only endured, significantly, for 1 year. After 2 years the amount of knowledge gained was no longer significant.

An attempt was made to determine what, if any, relationships existed among affect, actual commitment, verbal commitment, and knowledge (Table 14). Pearson Product Moment Correlation ratios were computed for each comparison at pre-test time and again at post-test time.

TABLE 14

Pearson Product Moment Correlations Comparing Affect, Actual Commitment, Verbal Commitment and Knowledge

	A	AC	VC	K
Affect (A)	-	.525** .326*	.269 .640**	-.036 -.298*
Actual Commitment (AC)		-	.350* .405*	.088 -.013
Verbal Commitment (VC)			-	.045 -.128
Knowledge (K)				-

Upper Figure = correlation ratio based on Pretest scores.
Lower Figure = correlation ratio based on Post Test scores.
* = significant at .05 level.
** = significant at .01 level.

Affect vs. Actual Committment

Comparison of affect and actual commitment yielded a moderate r value when using pre-test scores (r = .525) and a lower, but still significant, relationship using post-test scores (r = .326). Before taking the course, the Ss who showed the highest actual commitment scores were also the most emotional about environmental issues. After completing the course, the more committed (actually) seemed to be less emotional about environmental issues.

Affect vs. Verbal Commitment

Prior to participating in the Summer Institute, the Ss showed no relationship between emotionality (A) and verbal commitment (r = .269). After participating in the Institute, the relationship betwee verbal commitment and emotionality became highly significant (p ≤ .0

Affect vs. Knowledge

There was no relationship between knowledge and emotionality prior to enrolling in the Institute. After completing the Institute, the Ss who were most knowledgeable were less emotional about environmental issues.

Actual Commitment vs. Verbal Commitment

The Ss who were more committed actually were also more verbally committed both prior to and after participating in the Institute. Simply, those who said they would do more for environmental quality reported that they actually did more. This relationship was stronger after participating in the Institute (r = .405) than it was prior to participating in the Institute (r = .350).

Actual Commitment vs. Knowledge

There was no relationship between how much the Ss knew about the environment and how much they actually did to preserve/improve environmental quality.

Verbal Commitment vs. Knowledge

There was no relationship between what the Ss said they were willing to do to preserve/improve environmental quality and how much they knew.

A correlation matrix was completed comparing affect, actual commitment, verbal commitment, and knowledge with such personal variables as age, sex, major, years of teaching experience, amount of education, and the grade level(s) the Ss taught (Table 15).

The only personal variables yielding significant r values related to sex of the S and major. Verbal commitment did not correlate significantly with any of the personal variables included in this study.

TABLE 15

Pearson Product Moment Correlations Comparing Affect, Actual Commitment, Verbal Commitment, and Knowledge with Selected Personal Variables of Ss.

	A	AC	VC	K
Age	-.159 -.028	-.059 -.051	-.261 -.051	-.198 .033
Sex	-.147 .314*	.255 -.307*	-.023 .058	-.303* -.452**
Major	-.126 -.047	-.520** -.236	-.176 -.101	-.367* -.255
Years Teaching	.214 .241	.204 -.034	-.178 .044	-.042 .034
Education	.104 .228	.221 .053	-.035 -.040	-.046 .230
Grade Level	.007 .072	-.095 .000	.117 .261	-.043 -.001

* = significant at .05 level
** = significant at .01 level
Upper Figure = correlation ratio based on Pretest scores
Lower Figure = correlation ratio based on Post Test scores.

Sex 1 = male
2 = female

Teaching 1 = 0-5 years
2 = 6-10 years
3 = 11-15 years
4 = 16+ years

Education 1 = BA
2 = MA
3 = MA + 30
4 = Doctorate

Major 1 = Science
2 = Social Studies
3 = Elementary

Grade 1 = High School
2 = Jr. High School
3 = Elementary

230

Sex vs. Affect

Prior to participating in the Institute there was no difference between males and females insofar as emotionality was concerned. At the conclusion of the Institute, women were more emotional about environmental problems and issues than were males ($r = .314$).

Sex vs. Actual Commitment

Males were slightly more committed to actually doing more to preserve/improve environmental quality than were females. Before participating in the Institute this relationship ($r = -.225$) was not significant. After completing the Institute, this relationship not only continued, but, in fact, increased.

Sex vs. Knowledge

Males were slightly more knowledgeable about environmental issues before participating in the Summer Institute. This relationship continued to exist, and even increased after completing the Institute.

Major vs. Actual Commitment

Prior to participating in the Summer Institute, science teachers were significantly more committed (actual) to environmental quality than were social studies teachers and elementary school teachers ($p \leq .01$). After completing the Institute, there was no significant relationship between major and commitment.

Major vs. Knowledge

Prior to participating in the Summer Institute, science teachers were most knowledgeable about environmental issues ($p \leq .05$) as measured by the Ecology Attitude Inventory. After completing the Institute, there was no significant relationship between how much the S knew about the environment and his or her major.

Discussion

While the results of the combined scores analysis indicates that overall the Interdisciplinary In-Service Institute format and content succeeded in promoting environmental growth in the participants, analysis of the subscale data - knowledge, affect, verbal commitment, actual commitment - produced useful insights and additional intriguing information. The followup data collected one and two years after completing the Institute, moreover, provided a measure of how enduring those changes were - a rather rare phenomenon in research.

Typically most in-service teacher education programs are effective in increasing knowledge about topics -- science and environment included. While growth in knowledge as a result of participating in a program is obviously satisfying, such growth is not unusual. This study showed,

moreover, that growth in knowledge alone -- the area most emphasized in schools today -- results in rather short-lived gains. Even if this was not the case, the increasing rate at which knowledge is accumulating daily makes an education based essentially on information exchange rather short-lived and of questionable value anyway.

The study also shed some light on the relationship between knowledge, stated values, and behavior -- an age-old question. Most professional educators are familiar with comments such as "changing attitude, values and behaviors are extremely difficult to do with children -- much less adults." Clearly, the study showed that measureable and enduring change in a positive direction can be achieved by adults in attitude, values, and behavior -- if appropriate strategies and methods are employed. Such enduring changes can, moreover, be accomplished in a relatively short period of time. The Summer Institute, for example, lasted only four weeks and the participants had a relatively short period of time and few opportunities to change their life styles.

Clearly the impact of the Institute can be substantiated when one examines the pre-test -- post-test actual commitment difference and compares that figure with the pre-test -- post-test +1 year difference. When comparing the pre-test -- post-test difference -- a period of only 4 weeks -- the Ss had limited time to actually do anything to improve environmental quality. Nevertheless, there was a significant difference after only 4 weeks. If the program was not effective, one would expect to find the post-test +1 year score to be about the same as the post-test score -- in fact, more than likely lower (as was the case in comparing knowledge scores). This was not the case. The Ss had greater opportunities (1 full year) to do more and they, in fact, did more!

When one compares the verbal commitment score with the actual commitment scores, it is apparent that most people say they would be willing to do more to improve and/or preserve environmental quality (verbal commitments) than they actually reported doing (actual commitment). But, while verbal commitment mean scores decreased after one year and still more after two years, actual commitment scores continued to increase after one year and remained essentially the same after two years.

Several relationships appearing in Table 14 merit further comment; some raise rather intriguing questions. For example, why did the relationship between affect and verbal commitment increase from no significance ($r = .269$) to a rather high ($r = .640$) significance ($p \leq .01$), while the relationship between affect and actual commitment decreased? Why were more knowledgeable Ss less emotional about environmental issues after completing the Summer Institute? One might speculate that the more the Ss learned, the more objective they became in dealing with environmental problems and the less excited and/or emotional they felt about them. One could speculate further that the highly emotional Ss were more motivated to say much more than they were willing to do to improve the environment.

232

Strickland, et al. (1977), and Strickland and Staver (1979) found in their studies that more experienced teacher groups received the lowest scores on the Ecology Attitude Inventory. The results of this study (Table 15) are different from theirs in that scores on all four subscales individually and collectively were correlated to age, years of teaching experience, educational level and the grade levels (elementary or secondary) which the Ss taught.

The major finding of this study is that positive cognitive and affective changes can be induced in in-service teachers as a result of participating in an intensive Environmental Education Institute utilizing strategies and methods described earlier. These changes, moreover, endured over the three-year time period covered by this longitudinal study. Such experiences not only benefit the teacher personally (as evidenced by written testimonials), but also provide him/her with added methods and techniques for developing confidence in teaching environmental education. Such experiences should contribute toward helping in-service teachers become more effective in preparing their students to deal with the environmental challenges of the future.

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Needs in In-service Teacher Education as Perceived by Professional Environmental Educators: Report on a National Survey

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Abstract: *The researchers conducted a nation-wide survey of professional environmental educators regarding their perceptions of inservice teacher education needs in environmental education. In-service needs were assessed relative to the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton & Wilke) and at each of four educational levels: elementary, middle school, secondary, and college. Results indicate needs at all educational levels.*

Introduction

Educators generally agree that the goal of environmental education should be to develop environmentally literate citizens, that is, citizens who are "both competent to take action on critical environmental issues and willing to take that action" (Hungerford & Peyton, 1976:11). As recommended by participants at the 1977 Tbilisi conference, objectives necessary for attaining the literacy goal would include the development of an awareness and sensitivity to the environment and its problems, a knowledge of the environment and its problems, attitudes of concern for the environment and motivation for participation in environmental improvement/protection, skills requisite to identifying and resolving environmental problems, and participation in environmental problem solution.

Selim (1977) made the point that teachers hold the key to that part of environmental education which occurs in the formal realm. More aptly stated, "competent teachers are basic for the implementation of environmental education" (Selim, 1977:127). It would seem then, that the achievement of environmental literacy presupposes a cadre of classroom teachers equipped with appropriate knowledge and skills.

Numerous surveys conducted in the United States, however, suggest a lack of preparation on the part of teachers who are at present involved in, or who will be involved in, environmental education (Bottinelli, 1976; Champeau, Gross & Wilke, 1980; James & Potts, 1981; Pettus & Schwab, 1978; Tewksbury & Harris, 1982; Trojcak & Harvey, 1976). Similarly, a major international survey of needs and priorities in environmental education indicates "a

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Note: The data reported herein were collected in the context of a comprehensive assessment of environmental education curriculum needs. Those portions of the study which pertain to in-service teacher education are presented in this paper.

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general insufficiency, in all the countries, of personnel indispensable for the promotion of environmental education" (Unesco, 1977:12). Further, this survey identifies the training and retraining of teaching personnel as a fundamental need in the United States.

Because of concerns associated with teacher preparation throughout the world, it would appear worthwhile to attempt an assessment of teacher education needs relative to the skills and knowledge necessary to accomplish the goals of environmental education. Such an assessment would permit those responsible for teacher education to focus on the identified weaknesses and to better assist teachers in the development of appropriate competencies.

The purpose of this particular research was to survey professional U.S. environmental educators concerning their perceptions of the need for in-service teacher education associated with a prescribed set of goals for environmental education. These perceptions were assessed with respect to needs at the elementary, middle school/junior high, secondary, and college/university levels. It should be noted that Champeau, et al. (1980) have also reported research addressing this question. Their research, however, was limited to the state of Wisconsin and focused on formal education at the kindergarten through secondary levels. In order to provide a comprehensive picture of in-service teacher education needs in the U.S. it would seem valuable, as recommended by Champeau, et al., to conduct further research on a broader geographic basis.

Selecting Appropriate Curricular Goals

In an assessment of teacher education needs, those needs are assessed relative to a set of criteria. Because the Tbilisi objectives have been endorsed by leading environmental educators at the international and national level, those objectives could serve as an authoritative set of criteria against which to assess perceived needs in in-service teacher education. Since the Tbilisi objectives are written in broad terms and are actually general goals, difficulties might arise in an attempt to assess needs relative to those objectives. A definitive set of goals would be desirable. Such a set of twenty goals can be found in the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton, & Wilke, 1980).

Although these goals were developed independently of the Tbilisi Conference, they bear a marked correspondence to the general categories of objectives endorsed at the conference. Additionally, the curriculum Goals have been subjected to a rigorous validation process, involving comparison against the Tbilisi objectives and content validation by a jury of nationally recognized environmental educators. In essence, the Goals for Curriculum Development in Environmental Education operationalize the general goals of environmental education and furnish a set of definitive subgoals to guide environmental education curriculum developers in interpreting the more general Tbilisi objectives.

Because of their consistency with the Tbilisi objectives, the Goals also provide a suitable framework within which to conduct an inquiry into the status of environmental education inservice teacher education needs in the U.S. Similarly, the Goals provide a valid and definitive translation of the objectives into manageable goals and thus can serve as a set of criteria against which to measure the status of teacher knowledge and skills, i.e., inservice teacher education needs.

Instrument Development

None of the instruments used in previous environmental education assessments or surveys (Bottinelli, 1976; Champeau, et al., 1980; Childress, 1978; Disinger, 1981; James & Potts, 1981; National Education Association, 1970; Pettus & Schwab, 1978; Tewksbury & Harris, 1982; Trojcak & Harvey, 1976) included the variables specifically addressed in the present study. Therefore, an instrument entitled the Environmental Education Curriculum Needs Assessments Questionnaire (EECNAQ) was developed.

The EECNAQ was in the form of a self-administered questionnaire which had as its basis the Goals for Curriculum Development in Environmental Education (Hungerford, et al., 1980). Since the inclusion of all the components and subgoals of these Curriculum Goals on the EECNAQ would have resulted in an instrument of extreme length, a set of fifteen goal statements was synthesized from the original Goals (See Table 1 for the four goal levels and associated goal statements).

On the instrument itself, respondents were asked to consider the question, "To what extent would inservice teacher education be needed for new curricula addressing this goal?" as it applied to each of the goal statements. Further, respondents were asked to consider that question at each of the four academic levels: elementary, middle school/junior high, secondary, and college/university.

A five-point response scale was employed on which respondents were asked to indicate their perceptions concerning the extent of need for teacher education by selecting the response which most accurately reflected that perception. A sixth response category was also included to allow respondents to indicate an inadequate knowledge of need at a particular level. The range of usable responses included on the needs of assessment was:

(5) A complete extent
(4) A considerable extent
(3) A moderate extent
(2) A very little extent
(1) No extent
(0) I do not have sufficient knowledge at this level

TABLE 1

Environmental Education Goal Levels and Associated Goal Statements

(Adapted from Goals for Curriculum Development in Environmental Education)

(Hungerford, Peyton & Wilke, 1980)

LEVEL I: ECOLOGICAL FOUNDATIONS ... THE KNOWLEDGE OF KEY CONCEPTS AND ALLIED ECOLOGICAL PRINCIPLES

1. Students gain sufficient knowledge of ecology to permit them to make ecologically sound decisions with respect to both humans and the environment.

LEVEL II: THE AWARENESS OF ISSUES AND HUMAN VALUES ... THE KNOWLEDGE OF HOW HUMAN ACTIVITIES MAY INFLUENCE THE RELATIONSHIP BETWEEN QUALITY OF LIFE AND QUALITY OF THE ENVIRONMENT

2. Students gain an understanding of the ways in which human cultural activities (economics, religion, politics, social customs, etc.) influence the environment.

3. Students gain an understanding of the ways in which individual human behaviors impact on the environment.

4. Students gain an understanding of a wide variety of environmental issues and both the ecological and cultural implications of these issues.

5. Students gain an understanding of the various alternative solutions for solving (or partially solving) particular environmental issues. The ecological and cultural implications of these solutions are considered.

6. Students gain an understanding of the roles played by differing human values in environmental issues.

LEVEL III: THE INVESTIGATION AND EVALUATION OF ISSUES AND SOLUTIONS ... THE DEVELOPMENT OF SKILLS NECESSARY FOR THE ACTUAL INVESTIGATION AND EVALUATION OF ENVIRONMENTAL ISSUES AND OF THE ALTERNATIVE SOLUTIONS TO THOSE ISSUES.

7. Students develop those skills which will enable them to identify and investigate environmental issues using both primary and secondary sources of information.

8. Students develop those skills which will enable them to analyze environmental issues and the associated value perspectives with respect to their ecological and cultural implications.

9. Students develop those skills which will enable them to identify alternative solutions for particular issues and to evaluate those solutions with regard to their cultural and ecological implications.

10. Students develop those skills which will enable them to identify and evaluate their own value positions related to particular issues and to the solutions proposed for those issues.

11. Students are provided with opportunities to apply skills in investigating and evaluating environmental issues and solutions.

12. Students are provided with opportunities to participate in the valuing process in order to examine their own values with respect to both quality of life and quality of the environment.

LEVEL IV: CITIZENSHIP ACTION ... THE DEVELOPMENT OF THOSE SKILLS NECESSARY FOR STUDENTS TO TAKE APPROPRIATE ENVIRONMENTAL ACTION

13. Students develop those citizenship skills which will enable them to take either individual or group action (i.e., persuasion, consumerism, political action, legal action, ecomanagement) where such action is appropriate for the purpose of solving, or assisting to solve, particular environmental issues.

14. Students are provided with opportunities to apply citizenship skills in making decisions concerning appropriate environmental action strategies to be used with respect to particular environmental issues.

15. Students are provided with opportunities to take citizenship action on one or more environmental issues.

In order to further assess content validity, the instrument was submitted to a panel of three professional environmental educators and to twelve students enrolled in a graducte seminar on survey methodology at Southern Illinois University, Carbondale, Illinois. Revisions were subsequently made according to their suggestions and the questionnaire was deemed content-valid.

Due to the lengthy and complex appearance of the EECNAQ instrument, serious concerns arose over the possibility of respondents falling into a pattern in their responses, therby failing to discriminate between items on the questionnaire. In order to collect and test data for evidence of response patterning, a pilot survey involving a 2.4% random sample (n=20) from the parent population was conducted. Four "foil" goal statements were included on the pilot instrument and means for both foil and legitimate goal statements were compared. In all cases, mean values for the foil statements were observed to be lower than for the legitimate goal statements. In most cases, these differences were statistically significant at an alpha level of .05. It was thus concluded that respondents did, indeed, discriminate between items on the instrument.

In an effort to establish similar item discrimination in the investigation reported herein, an item regarding training in civil disobedience was included on the instrument. Statistical analysis using the means indicated statistically significant differences, in all cases, between responses to the civil disobedience foil and to the three allied citizenship action goal statements (alpha=.05). Additionally, these means were consistently the lowest values obtained at each educational level. Mean values calculated for the civil disobedience foil statements at each of the educational levels can be seen by referring to Table 2.

Data Collection

Questionnaires were mailed to the participants in early November, 1981. Each of the environmental educators included in the sample received, via direct mailing: (a) a copy of the Environmental Education Curriculum Needs Assessment Questionnaire, (b) a cover letter explaining the purpose of the study and requesting assistance, (c) a demographic data sheet, and (d) a preaddressed, stamped envelope for instrument return. Two-and-one-half weeks after the first mailing, a postcard, extending the deadline, was sent to those who had not responded. Approximately two weeks later, a second copy of the questionnaire was sent to non-respondents in order to encourage a higher return rate.

Sample

The memberships of two professional organizations, the National Association for Environmental Education and the Conservation Education Association, were identified as the desired population for this study. After deleting the names of members who resided outside of the United States, and cross-referencing the two membership lists in order to avoid duplication of names, a 20% random sample (n=169) was selected for inclusion in the investigation.

Of the 169 subjects who were mailed questionnaires, 99 (58.5%) returned questionnaires either totally or partially completed which were used in the analysis. Twenty (11.8%) surveys were returned as non-usable, with the subjects either unable or unwilling to participate in the survey.

Geographically, the usable responses were widely distributed with 29 states and the District of Columbia respresented among the respondents. Fourteen percent of the responses were from the western United States, 18% from the eastern U.S., 18% from the South, and 50% from the Midwest. The ages of the respondents ranged from 18 to 79 years ($\bar{X}$=42 yrs.) and the respondents had been active in environmental education from 1 to 35 years ($\bar{X}$=12 yrs.). The sample was composed of 65 males and 34 females. Fifty-one individuals reported a major focus on formal environmental education, while 39 indicated a non-formal environmental education emphasis. Twenty students responded and 78 of the respondents were non-students.

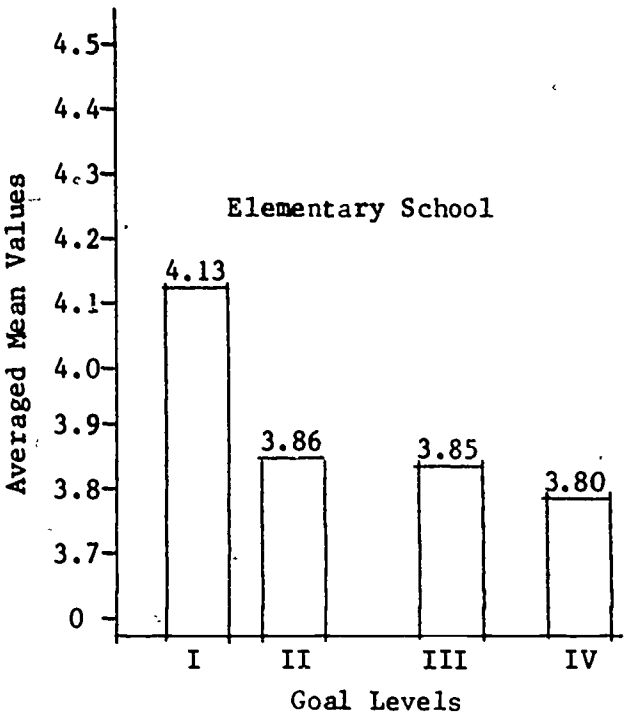
Results

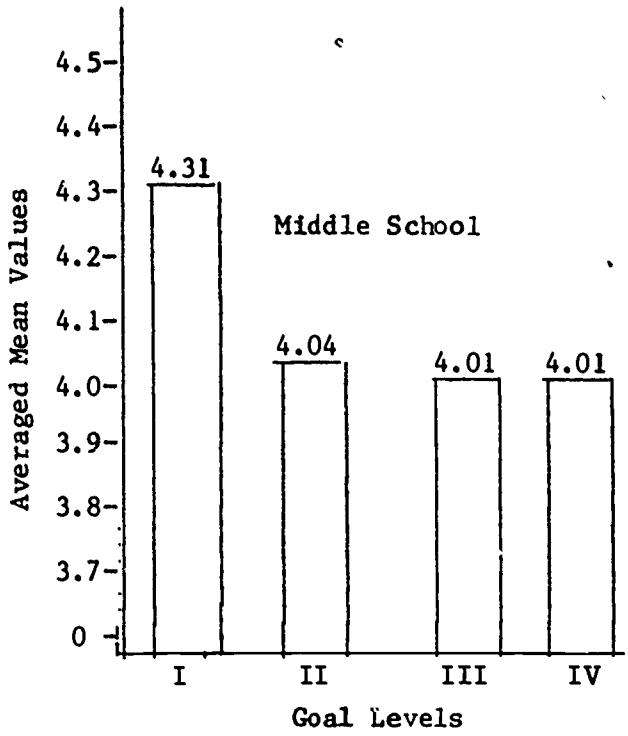
Means and standard deviations were computed for perceived needs in inservice teacher education as they related to the fifteen goal statements and at each of the educational levels (these mean values ranged from 3.59 to 4.31). Mean responses for all goal statements at a particular goal level (ecological foundations, issue awareness, issue investigation/evaluation, and action) were then collapsed to yield an average measure of inservice needs at the goal level. By using these averaged means, the relative inservice needs, as they pertain to each goal level, were identified for every educational level (See Figure 1).

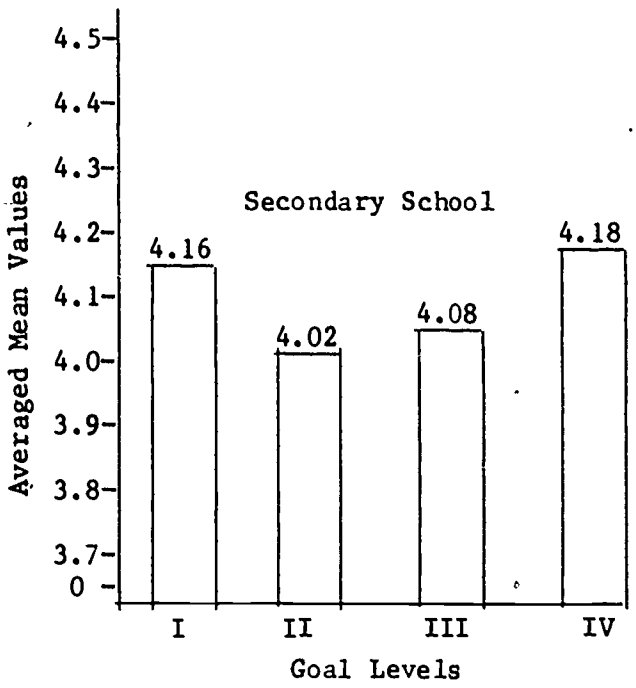
A comparison of averaged mean values does not reveal great differences in inservice teacher education with regard to goal levels. Indeed, the greatest difference, at the elementary school level between Goal Level I - Ecological Foundations (4.13) and Goal Level IV - Citizenship action (3.80), is only 0.33. However, Figure 1 does graphically illustrate the perceptions of environmental educators regarding the inservice needs in a relative sense.

It would appear that at the elementary level the primary needs in inservice teacher education are associated with ecological foundations, with lower needs at the issue awareness, investigation/evaluation, and action levels. Similarly, ecological foundations appears to be the major area of need for middle school inservice teacher education, although the other three goal levels exhibit high average means.

The profile of need shifts at the secondary level, as inservice education relative to citizenship action is perceived as an area of high need. Inservice education relative to ecological foundations is an area of considerable need, although inservice needs in the investigation/ evaluation and awareness areas are rated almost as high.







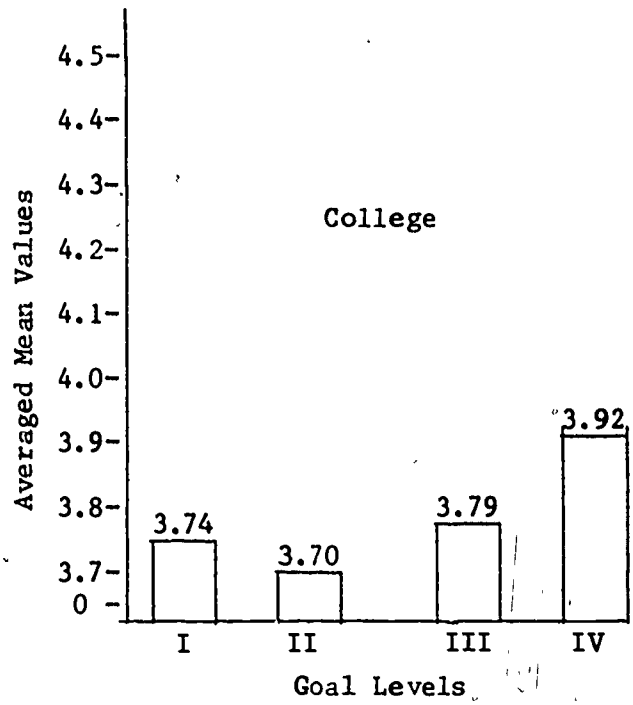


Figure 1. Inservice needs at each goal level as determined by averaged mean values for all educational levels (averaged mean values were obtained by averaging the means of all goal statements within each goal level).

At the college level, inservice needs seem to be similar to those at the secondary level, although the mean values are not as high. Again, education relative to citizenship action is of major concern, while needs associated with the investigation/evaluation, ecological foundations, and awareness areas are perceived as less serious.

Although the above information is, in and of itself, useful, greater insight might be gained by focusing on specific goal statements which repondents identified as areas of need. When the five greatest needs in teacher education (as determined by the five highest means) at each educational level are considered, some interesting trends occur. Overall, the greatest needs in teacher education appear to be associated with ten of the fifteen goal statements. Those statements and their rankings and means at each educational level are presented in Table 2.

At the elementary level, respondents perceive the greatest need for inservice teacher education at the ecological foundation level (goal statement 1). High needs are also associated with the awareness level (goal statements 2 and 6), and the investigation/evaluation level (goal statements 7, 11, and 12).

At the middle school level, inservice teacher education needs seem to be greatest at the ecological foundation level. Again, the awareness level (statements 2, 5, and 6) and the investigation/evaluation level (statements 11 and 12) are also highly ranked.

A different picture of inservice needs appears at the secondary level, where the action level goal statements (13 and 14) receive the highest means. Additional prominent needs appear at each of the four levels: ecological foundations (statement 1), awareness (statement 6) and investigation/evaluation levels (statements 11 and 12).

The fact that several of these goal statements are given prominence at more than one educational level is worthy of mention. Two goal statements are included among the five highest areas of inservice need at <u>all</u> levels of education. These goal statements pertain to providing students with opportunities to apply issue investigation and evaluation skills (statement 11), and to helping students gain an awareness of the roles which human values play in environmental issues.

An associated goal statement, providing students with opportunities to participate in the valuing process in order to examine their own values (statement 12), received ratings which places it among the five greatest needs at three of the educational levels: elementary, middle school, and college. Also among the top five areas of need at three educational levels (elementary, middle school and secondary) is inservice teacher education focusing on the development of ecological foundations knowledge (statement 1).

Table 2

The Five Highest Observed Mean Values with Assigned Rankings at each Educational Level Compared Against the Goal Statements[a] Represented

Educational Levels	Ecological Foundations Goal Statement...	Issue Awareness Goal Statements...			Issue Investigation and Evaluation Goal Statements...			Citizenship Action Goal Statements...			Foil Comparison...
	1	2	5	6	7	11	12	13	14	15	16
Elementary											
Rank	1	2		4	5[b]	3	5[b]				
X	4.13	4.00		3.90	3.86	3.94	3.86				2.76[c]
Middle School											
Rank	1	3	4[b]	4[b]		2	5				
X	4.31	4.09	4.08	4.08		4.11	4.05				2.80[c]
Secondary											
Rank	3			5		2		1[b]	1[b]	4	
X	4.16			4.09		4.18		4.21	4.21	4.13	2.99[c]
College											
Rank				5		3	4	1	2		
X				3.84		3.91	3.88	4.01	3.92		2.89[c]

[a] See Table 1 for complete goal statement(s).

[b] Equal mean values at a particular education level.

[c] Lowest mean value in all cases.

Although two goal statements associated with citizenship action are identified as priority needs at only two educational levels, their rank with respect to other goal statements is quite high. Inservice needs relative to the development of citizenship action skills have the highest mean values at both the secondary and college levels. Similarly, the goal statement associated with providing opportunities for applying those skills in decision-making has the highest mean value at the secondary level, and the second highest at the college level.

An overall pattern of inservice needs emerges when Table 2 is reviewed as a whole. That pattern seems to describe a progession of needs across goal levels and across educational levels. Specifically, as one examines inservice needs across the educational continuum, one discovers that prerequisite goals are emphasized at the lower educational levels while those goals more closely associated with overt behavior are emphasized at the secondary and college levels.

Discussion

One of the most important observations arising from this study is the overwhelming consensus concerning inservice teacher education needs in environmental education as perceived by professionals in the field. In every instance (with the notable exception of the foil statement) mean values fell between 3.0 and 5.0 indicating moderate to considerable inservice needs. This was the case with each of the fifteen goal statements as well as with collapsed means at each goal level. Thus, if professionals in the field are competent to judge inservice needs, there exists a substantial requirement for upgrading teacher content and skills in environmental education. One is also tempted to recommend that inservice teacher education programs be established nationwide in order to meet this challenge. These programs should be developed for teachers of teachers as well as for K - 12 populations.

Given the character of the data displayed herein, one might be lulled into a misinterpretation of the information presented. For example, it appears as though the need for inservice education with regard to ecological foundations is substantially greater at both elementary and middle school levels than for any of the other three goals. Similarly, it appears as though inservice needs at the college level are substantially below those for K - 12 populations (see Figure 1). The writers believe that these interpretations should be made cautiously, if at all. The basis for this concern lies in the differences observed between collapsed mean values. The lowest mean value is 3.70 (at the college level) and the highest value is 4.31 (at the middle school level). The difference between these values if .61, certainly a moderate difference at best. Thus, even though patterns emerge when the data are displayed as they have been in this paper, these patterns should probably be viewed as suggestive only, although they may have promise for those responsible for planning instruction dealing with inservice teacher needs. The writers believe that said patterns should suggest emphasis but that all goal levels should probably be addressed at all educational levels.

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Other Refereed Papers

New Paths for Environmental Education in the Post-Values Clarification Era

Richard A. Baer, Jr.[1]

Abstract: *Scholarly arguments against the use of values clarification in public education are summarized. Environmental educators should abandon the method and develop other approaches, including focusing on public morality concepts and teaching values descriptively. The philosophical relation between facts and values is examined and also the practical necessity of assent and commitment.*

Developed in the mid-1960's by social scientists Louis E. Raths, Merrill Harmin, and Sidney B. Simon (1966), values clarification is a method for teaching values that has gained wide currency and popularity over the past fifteen years. It is widely used today in environmental education. Teachers using the method are not to indoctrinate the student in someone else's values but should rather help students get clear about their own personal values and how these affect their lives.

Proponents of values clarification claim that for many individuals the method facilitates a genuine shift from aimless drifting, inconsistency, and role playing to purposeful involvement, consistency, and the open presentation of one's real self. Specific techniques and strategies help students relate more satisfactorily to other people and to the world around them. Students show significant improvement in their schoolwork, and life takes on new and deeper meaning for them (Raths, Harmin, and Simon, 1966, 5-8).

Values clarification has provoked a storm of protest from individual parents and from groups of "concerned parents." But public school teachers and administrators by and large have failed to take this protest seriously. In many cases the protestors were quickly labeled "right wing extremists," "fanatical fundamentalists," and "anti-intellectuals," and their objections were brushed aside. They were often portrayed as uneducated and as opposed to progress. To be sure, many of these people were politically and religiously conservative, but few were extremists. And not a few were extremely thoughtful, sensitive, and intelligent. None that I personally met had any connections with the John Birch Society -- one of the allegations frequently made. But school principals, teachers, and boards in many cases made only minimal efforts to understand their objections. Schools continued to use values clarification.

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Over the past eight years the basic objections of these concerned parents have been confirmed by more than a dozen major scholarly articles. This literature includes pieces by William J. Bennett, chairman of the National Endowment for the Humanities (1978, 1979); Edwin J. Delattre, president of St. John's College in Annapolis (1978, 1979); Kenneth A. Strike, professor in the Department of Education, Cornell University (1982); Alan L. Lockwood, professor of education at the University of Wisconsin-Madison (1975, 1977, 1978); and Martin Eger, professor of philosophy and physics at the City University of New York (1981). I have also written several pieces, including two recent articles in The Journal of Environmental Education (1974, 1977, 1980, 1981, 1982).

These articles point out, first of all, that values clarification, in spite of its tendency to present itself as values-neutral or as not taking specific values positions, in fact, strongly indoctrinates students in ethical relativism. On the level of what philosophers call "metaethics," that is, theory about the nature of ethics as such, values clarification simply assumes that all ethical judgements are subjective or relative and that they are basically equivalent to personal preferences or tastes. All values are "personal values" in the sense that the individual self is the final arbiter of value truth, of what is good, bad, right, and wrong. But the proponents and practitioners of values clarification do not defend this metaethical position. They simply assume its truth and press it upon their audiences. They do not require the student even to consider non-subjectivist alternatives. Indeed, the few times other positions are even mentioned it is in biased and distorted terms. Teachers who adopt more traditional approaches to values, they claim, "moralize" and "preach" (Simon and deSherbinin, 1975). They "manipulate" the child and do not hesitate to rely on "religion and cultural truisms" (Raths, Harmin, and Simon, 1978). It has become clear, they claim, that "kids just don't seem to be buying what the moralizers are selling anymore" (Kirschenbaum and Simon, 1973).

Secondly, several authors persuasively argue that values clarification constitutes a serious invasion of privacy of the student and the student's family. For instance, by asking open-ended questions and using projective techniques it brings about situations where children, particularly younger children, may divulge more about themselves and their families than either the child or the family later feels good about. Lockwood argues that even though the method allows the hesitant child to "pass," nonetheless the projective nature of some of the techniques used, coupled with the general immaturity and lack of sophistication of the child, means that students often are led to reveal sensitive material about themselves and about their families and friends. Also, built into the method is a certain pressure towards self-disclosure, which can be accentuated by pressure from peers. Lockwood's conclusion is quite explicit: "A substantial portion of the content and methods of values clarification constitutes a threat to the privacy rights of students and their families" (Lockwood, 1977).

A third criticism is that values clarification indoctrinates students in very specific views about human nature and the purpose of life. Again, I

use the term "indoctrinate," because these views are presented as true without any serious discussion of alternatives. A secular humanist view of human nature is presupposed. It is assumed that the purpose of life is self-fulfillment and the happiness of the individual self. But such a view is only one position among many, and to take a single quasi-religious position of this sort and present it without discussion as the truth about human beings is improper in a pluralistic and democratic society. Jews, Christians, and Muslims, at least insofar as they were true to their respective traditions, would disagree with this particular view of human nature. They would argue that the purpose of life is to love God and to serve one's neighbor. Jesus, for instance, said that he who would save his life will lose it, and the one who is willing to lose his life will find it (Mark 8:35). The Gospels teach that we need to learn to die to the self, not to focus our attention on fulfilling it. When public schools employ values clarification, they are, in effect, giving a kind of state-sponsored advantage to a form of secular humanism and a state-sponsored disadvantage to competing positions, including those of Judaism and Christianity.

The issue is particularly sensitive in America today insofar as the public schools constitute a state monopoly system with a captive student audience. Unless parents are affluent or have access to subsidized schools, they have no reasonable option other than to send their children to public schools.

In the fourth place, insofar as values clarification presupposes the relativity of all values it not only competes with basic views of Christianity and Judaism but also undercuts the foundations of a liberal democracy. If one takes seriously the position that all values are matters of personal choice and preference, then this necessarily includes such democratic values as fairness, justice, equality, respect for other persons, and so forth. As persons, Simon, Harmin, Kirschenbaum, and other proponents of values clarification are committed to these democratic values. Nevertheless, their theory fails because it makes no attempt to sort out such values from other values. Their theory rather lumps all values together and consigns them all to the realm of subjectivity. Thus, it is accurate to say that values clarification not only conflicts with other philosophical and religious views; it also threatens the ethical and philosophical basis of our American political system.

The resolution of the values clarification issue has been complicated by the refusal of Simon, Kirschenbaum, and others to enter into sustained dialogue with their critics.[2] By and large they have simply ignored scholarly criticism of their method. And when they have upon occasion responded to criticism, they have given little indication that they have really understood its substance. Even worse, they have sometimes resorted to attacking the critics as persons. Simon, for instance, in response to a balanced and, on the whole, generous and fair article by John S. Stewart

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[2]Clifford E. Knapp's recent article, "The Value of Values Clarification: A Reaction to the Critics," The Journal of Environmental Education 13, no. 2 (Winter 1981-82), 1-4, is a notable exception to this generalization.

251

(1975, 684-688) in the Phi Delta Kappan writes this:

> If John Stewart had been less petulant and cranky, I might be willing to listen to him, but as it is, I don't trust him. I don't think he is really concerned with making this life better for teachers and children.
>
> His real interest seems to be with dazzling his academic, ivory tower peer group....
>
> On the other hand, perhaps he is envious about the many ways we in the values clarification movement have been useful to thousands of teachers. Our popularity makes some stuffy people rage for our jugular veins. More likely it is simply his propensity for splitting hairs.
>
> Well, while he mouths his philosophical pretensions, I will continue to devcte my own energies to inventing more and more creative ways for people to look at their lives and making this world better for kids who have to go to school (Simon, 1975, 688).

My own judgement is that the use of values clarification by public schools or by such quasi-public agencies as Planned Parenthood or publicly supported environmental education centers involves a serious violation of the First Amendment rights of students and their families, notably the prohibition of a government establishment of religion: "Congress shall make no laws respecting the establishment of religion or prohibiting the free exercise thereof." Indeed, I must conclude that the case against values clarification is now so well established that for educators, including environmental educators, to use the method at this time in any kind of public or quasi-public situation is to act irresponsibly, unfairly, and outside of any reasonable doctrine of public accountability.

Whether teachers and pupils like values clarification and enjoy using it or whether it is considered educationally effective or not is quite beside the point. In the realm of constitutional rights, such considerations are largely irrelevant. If the use of values clarification in the public schools violates the establishment clause of the First Amendment, then the questions of enjoyment and effectiveness are immaterial, as they are in cases of civil rights. For instance, it is not a matter of whether a white enjoys sitting next to a black on a bus or in a public school (or, for that matter whether the black enjoys it) but rather a question of what are the constitutional rights of that black person.

If educators continue to use values clarification in the public schools, then parents may feel they have no alternative but to take them or their employers to court. One such suit has already been initiated in the Superior Court of the State of California.[3]

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[3]No. 300449, August 27, 1982. Thomas M. Burton, attorney for plaintiffs.

I am not arguing that the courts in California or elsewhere will in fact rule against values clarification, for the myth of the neutral secular has dominated court decisions over the past several decades. This myth wrongly assumes that there is a secular realm that can and should be religiously neutral and that once we have rid the schools of overt religious commitments and practices (prayers, Bible readings, the celebration of Christian holidays, and so forth) we will have achieved a condition of religious neutrality or even-handedness. But, of course, such a position quite overlooks the fact that some view of human nature and destiny and of the nature of ultimate reality is an absolute necessity if education is to proceed at all. And the view of values clarification that the purpose of life is self-fulfillment is by no means religiously neutral. At the very least, it contradicts the Biblical view of the purpose of life and is a direct competitor of the Biblical view. Humanists such as Sidney Hook typically assume the fundamental rationality of their own ethical positions. Christians base their ethics on faith and dogma, Hook argues, whereas humanists base their ethics on reason (Hook, 1976, 5-7), and, therefore, the humanist position somehow must be viewed as religiously neutral and worthy of universal acceptance. But positions like that of Hook's are philosophically debatable (MacIntyre, 1981), and they also easily lead to a cultural and philosophical arrogance not unlike that of the Roman Catholic Church during the middle ages.

If environmental educators discontinue using values clarification, what alternatives are there? Does my critique of values clarification imply that we should not deal with values in environmental education? No.

In the first place, we need to distinguish between private and public morality. In our society the courts have allowed public school teachers substantial freedom to inculcate in students such values as honesty, courtesy, civility, justice, fairness, equality, and respect for other persons. The courts consistently have recognized and supported a realm of public morality reflected preeminently in the Declaration of Independence and the Consitution (but also in such documents as Lincoln's Gettysburg Address and in presidential inaugural addresses and state of the union messages) which clearly reflects values such as these. Teachers should not just discuss these values objectively and dispassionately but should present them to students as the proper way for free and civilized people to relate to each other in a democratic society. It would seem quite consistent to extend these concepts to include respect and care for the earth.

I should add one caveat, however. In dealing with the theme of love for the earth, it is critically important that the public school teacher not simply ground this theme in one particular world view. For instance, in some environmental education writings there has been a tendency to present Native American religions as possessing the truth about how we should relate to the land, while at the same time uncritically following Lynn White, Jr.'s (1967) debatable thesis about the role of Christianity in bringing about our current environmental problems. It is -- as I shall argue presently -- appropriate to discuss the ideas about nature found in

253

various religious traditions, but this must be done objectively and without arguing for the truth of the overall world view as such (or even of major parts of it). Thus, it would be appropriate in the public schools to discuss how Native Americans felt and thought about the earth but not to argue -- as I have more than once heard environmental educators do -- that the non-anthropocentric, animistic religous views of Native Americans are superior to the theology of Jews or Christians. Such discussions become particularly precarious when they are based on substantial ignorance of the theological subtleties of one or both positions.

In the second place, the courts have left educators free to deal with values and religion on a descriptive, historical, objective level. That is, it is quite within the realm of legality and propriety within the public schools and in other quasi-public agencies to describe and help students understand what are the basic value commitments that have informed Western culture. Thus, teachers should discuss such basic values of the classical Graeco-Roman tradition as clear thinking, democracy, justice, equality, and so forth. In dealing with the Judeo-Christian heritage, teachers could focus on the meaning of love, self-sacrifice, justice and humility within this tradition. Students would be expected to understand the historical significance of the Socratic dialogues, the Decalogue, and the Sermon on the Mount. Modern thinkers such as John Locke, Adam Smith, and Karl Marx should also have an important place in the curriculum. In each instance, students would be expected to understand not just the values of these various thinkers and traditions but also something of the basic world view that supported and nurtured the particular values.

Although the primary focus would be on Western values and ideas (just as we focus more on American history than, say, on Japanese history), students should also be required to learn something about the ethical norms of other peoples. In describing different value traditions, the teacher should be fair, objective, interesting, and efforts should be made to show how these various traditions deal with specific ethical problems, for instance, our relation to the land and natural resources.

Obviously, one very big problem in trying to deal with values on such a descriptive level is that relatively few public school teachers or environmental educators now possess the solid background in history, philosophy, theology, and ethics which would be necessary to do such a task. Some experienced teachers could be granted sabbatic leave for study in the area of descriptive ethics, and when hiring new staff to teach ethics courses schools could require the appropriate educational background. Broadening the intellectual resources of the teaching staff in this way would be advantageous for at least two reasons: (1) it would enable teachers to deal more thoroughly with the basic cultural roots of current environmental problems rather than simply discussing and messaging symptoms, and (2) it would permit teachers to offer an attractive alternative to current behavioral science approaches to values.

This brief discussion of public morality concepts and of the possible role of descriptive ethics in the public school curriculum is meant to be suggestive and illustrative. Above all, it is meant to make the point that public school educators are not left with the unhappy alternative of using values clarification (or some similar method) or not dealing with values in the classroom at all. Obviously, both individual teachers and the entire school system also impart values in other important ways. School regulations and expectations regarding lateness, dress, and the use of profanity communicate very powerfully certain values, as does also the fact that most schools pay more attention to science and mathematics than they do to art and music. Moreover, such subject areas as history and English literature deal with values in rich and diverse ways. Indeed, part of the current values "crisis" in the schools stems from the lack of emphasis these traditional disciplines sometimes receive.

But rather than commenting further on these substantive curricular matters, I would prefer to discuss briefly one or two critical philosophical issues that have to do with the nature of values as such.

In today's world it is not uncommon to assume a radical split between facts and values and to take the position that it is possible to know the truth or falsity of alleged facts but not of alleged values. This is basically the position of Logical Positivism and of the philosopher Bertrand Russell -- one of the brightest and most productive intellects of the 20th century.

Most professional philosophers today do not accept the metaethics of Bertrand Russell and of the Logical Positivists. But even if one could make a reasonably strong theoretical case for such a metaethics, on a practical level these positions entail great difficulties. Russell's own life history nicely illustrates the problem.

Russell spent the last decades of his life passionately speaking out against the war in Viet Nam, against the production of thermonucluear weapons, and against many forms of injustice. But on the basis of his own understanding of facts and values, this was a very curious (if not downright arrogant) thing to do. Indeed, it would appear that he was doing something roughly equivalent to trying to persuade someone to prefer strawberry ice cream to chocolate or vanilla. He had already informed us that values are a matter of personal preference, taste, and feeling. We cannot <u>know</u> whether any given value is true or false, right or wrong, better or worse than any other. But then Russell proceeds to argue for the superiority of <u>his</u> values to other people's values. But on what possible basis? Why should the designer or manufacturer of thermonuclear weapons prefer Russell's values to his own?

Now, I want to ask you as environmental educators the same question. If value judgments are all subjective and relative--as values clarification claims--then what possible business do you as environmental educators have trying to push your own personal values on someone else? Why should you even insist that students discuss environmental problems at all? That seems to me the height of arrogance, a not-very-subtle exercise in raw power. To require students to study environmental issues implies that

your values (or the values of your school system) are better or truer than someone else's. According to values clarification theory, you have no way of knowing whether they are or not, but, like Russell, you prefer them and apparently have no qualms about impressing them on young, immature students --and a captive audience at that![4]

Not only does Russell's life constitute a strange problem for those who, like Russell himself, hold to a radical fact-value split; there are other difficulties with this position as well. For instance, it has become increasingly clear to philosophers that even facts are more difficult to pin down and describe than many people realize. Facts as well as values are theory-laden or theory-based. That is to say, what for you counts as a fact is almost always based on your understanding of the nature of reality. You see what you are looking for, you hear what you are listening for, and so on.

But the problem is not just that facts are not independent of values -- including both one's basic world view and one's particular interests. On a practical level life becomes quite impossible apart from some initial commitment to certain basic values. For example, a child will not learn to speak unless his immediate community has made an initial commitment to telling the truth. Imagine how confusing and linguistically crippling it would be if a child pointed to a wrist watch and was told that it was a wrist watch, later that it was an alligator, and finally an airplane or a rose. Although language involves more than naming, still such a child would never learn to speak and thus would not be able to think in a distinctively human way. The very possibility of learning language depends on a prior commitment to truth-telling. Even Descartes' radical skepticism that led him to formulate his famous cogito ergo sum -- I think therefore I am -- did not doubt the validity of the language in which he did his doubting. Had he attempted to do so, his intellectual endeavor would have come to a grinding halt.

Here is a simple test for you. How many of you know that the following statement is true: "It is wrong for any human being to torture any other human being just for the hell of it."? I add "just for the hell of it" to the proposition to rule out that situation where one might deem it proper to use torture, say, to force the terrorist to disclose where he had hidden the thermonuclear bomb which in four hours will wipe out an entire city. For my part, I know the truth of this proposition about torture far more certainly than I know that $E=mc^2$, or that the methane molecule has four hydrogen atoms and one carbon atom, or even that the water molecule has two hydrogen atoms and one oxygen atom. All of these latter scientific truths

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[4]Teachers who started with some understanding of this particular dilemma faced by the radical subjectivist understandably were attracted to values clarification, which claimed that it was not teaching someone else's values to the student but only clarifying the student's own values. But, as I have already argued, the apparent value neutrality of values clarification is, on the metaethical level, thoroughly deceptive.

I accept or know because basically I believe scientists are telling me the truth about these matters. I have neither done the critical calculations and experiments to back up these assertions nor would I at this point even know how to do them.

Let me be as provocative as possible. If you do not know the truth of the proposition about torture I have put before you, you probably can make no sense at all out of human social life. In the practical realm of human relationships and social morality I would have to conclude that you have not yet advanced as far as have astrologers and members of the Flat Earth Society in the realm of science. If I know anything at all, then I know the truth of this propostion about torture. Apart from its truth, life as I experience it is totally impossible for me to understand. Regarding my children, I do not ask for their opinion about the truth of this proposition. I present it to them as true and expect them to accept it, just as I teach them that the earth is round or that certain kinds of chemical pollutants will kill fish in our lakes and streams. If they question its truth, I will, of course, try to give them reasons for its veracity. I will present arguments in its favor, a rationale for believing it -- just as I would if they said to me, "But the earth looks flat, not round."

That one can legitimately make knowledge claims about values as well as facts certainly does not imply that values are the same as facts or that we know them in exactly the same way. Scientific method, with its use of critical doubt and empirical verification as well as theory, has proven to be an extremely useful tool for gaining knowledge about the world in which we live. But it is of only limited value in dealing with normative ethics.

As English professor Wayne Booth of the University of Chicago argues in his book Modern Dogma and the Rhetoric of Assent (1974, 106-111)--a volume that has strongly influenced the direction of this paper, in the realm of values it is essential to start where you are, that is, with the ideas with which you grew up. Start by affirming these values -- which is what we all do in any case. But, you might ask, would not such a procedure result in all kinds of bias and questionable values as well as some good ones? Not necessarily for one can start with assent or commitment and still keep his or her mind open to new data and new ideas. On the other hand, by doubting everything it is not possible to continue living at all. To take a rather obvious example, if every morning you radically doubted the safety of your food -- after all, someone with a grudge against you might have slipped into the house and laced the milk with cyanide -- you would have to go without breakfast. Similarly with lunch and dinner. You would soon starve. If you want certainty, you had better say goodbye to life as it is actually possible to live it. Actual living always demands prior assent or commitment, not just facts. Science itself demands certain initial assumptions and commitments: the assumption of the fundamental regularity of the universe through time, the law of non-contradiction in our thinking, the commitment of scientists to truth-telling. All of these are necessary for the success of science.

257

Consider again the torture example. It might be possible to rephrase the knowledge claim and say that I find it necessary to assume the truth of this statement if I am to make any sense at all out of life in society as I experience it. This claim would then be epistemologically similar to the scientist's assumption regarding the regularity of the universe or his assumption that there is a genuine correspondence between how his mind functions and the reality of the external world. These are difficult, philosophical issues, and I am sure we will not resolve them here. What is clear, however, is that the facile way in which values clarification presupposes a radical epistemological split between facts and values (facts can be known to be true or false, but values are matters of personal preference and feeling) is open to serious questioning. In actuality, most of what we claim to know we do not know absolutely but only with greater or lesser degrees of certainty. In general, what we call facts are less difficult to warrant or justify than what we call values, but in some sense all knowledge is theory-dependent, facts as well as values.

If the field of environmental education is to progress beyond the level of clarifying people's likes and dislikes, environmental educators will have to pay more attention to value theory and questions of epistemology, not just from a behavioral science standpoint but also in terms of basic philosophical considerations. This is a big assignment, one that will require help from philosophers, theologians, historians, and others. But the task is essential -- at least if environmental education is to maintain its academic credibility.

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Androgyny and Environmental Orientation: Individual Differences in Concern and Commitment

Richard J. Borden[1] and Patricia H. Powell[2]

Abstract: *This study investigated the relationship between sex-role identification and degree of environmental concern, knowledge, and personal commitment. Compared to traditionally sex-typed individuals, androgynous and cross sex-typed individuals were more concerned about environmental problems. Furthermore, it appears that a synthesis of the "feminine" and "masculine" dimensions of contemporary sex-role identification may enhance the translation of environmental concern into active forms. Broader theoretical and philosophical implications are also discussed.*

The decade of the 1970's was highlighted by two important social reorientations. One of them has been referred to with various terms, including "women's liberation," "feminism," or the "sexual equality" movement. The other was the growth of concern for environmental issues, as well as an increased public commitment to the solution of these problems -- the "environmental movement."

As these trends emerged, they also became the focus of social scientific inquiry. In the case of the women's movement, significant academic interests evolved in the psychology of women (Bardwick, 1971; Williams, 1977), the development of sex roles (Maccoby and Jacklin, 1974), and sex differences in behavior (Deaux, 1976).

The awakening of concern about environmental problems was fostered by several popular writers who heralded the perils of over-population (Ehrlich, 1968), pesticides (Carson, 1962), and pollution (DeBell, 1970). The initial responses of social, governmental, and academic institutions centered primarily around political and technological solutions for these problems (Caldwell, 1975; Fanning, 1975). It was also suggested, however, that the solution of population, energy, and limited resource problems "does not lie in traditional technological approaches, but rather in the alteration of human behavior" (Maloney and Ward, 1973, pg. 583). According to this point of view, many environmental problems will be alleviated only when widespread personal concern and commitment develop. Such an approach to environmental problems falls squarely within the domain of the social sciences.

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At the broad social level, environmental sociologists have examined the association of political attitudes (Straayer and Meek, 1972; Dunlap, 1975), norms and values (Heberlein, 1972; Heberlein and Shelby, 1977), and other demographic factors such as age, race, and socio-economic status with environmentally responsible living (Tognacci, Weigel, Wideen, and Vernon, 1972; VanLiere and Dunlap, 1979). These studies have shown that a high degree of environmental concern is most often observed among younger, well-educated, upper middle-class liberals. While such studies serve to describe who is concerned with environmental issues, they often fail to reveal the dynamic processes through which these attitudes develop within an individual.

In response to this question, environmental psychologists have examined the intra-individual factors involved in environmental concern (cf. Lipsey, 1977; Stokols, 1978; Borden, 1977, 1983). Some of these investigators have developed techniques for measuring environmental feelings, beliefs, and behaviors (Maloney, Ward and Braucht, 1975; Weigel and Weigel, 1978), while others have concentrated their attention on psychological characteristics associated with these attitudes. Borden and Francis (1978), for example, examined a broad range of personality dimensions related to environmental attitudes. Two groups of people who differed substantially in degree of concern about environmental problems were administered the California Psychological Inventory (Gough, 1957). Of particular interest was the discovery that socially "extroverted" women and socially "introverted" men were much more concerned about environmental problems than their introverted female or extroverted male counterparts. These findings point to an important conclusion -- namely, that as fundamental psychological changes are taking place in the ways in which men and women perceive their own abilities and future societal roles, these changes in turn influence their environmental orientations.

Sex Role Differentiation

Recently, it has been argued that psychological sex differences do not necessarily parallel biological sex differences. To clarify this distinction, several psychological theorists have introduced the concept of androgyny (Bem, 1974; Constantinople, 1973). The androgynous person is described as possessing both masculine and feminine psychological characteristics.[3] S/he is viewed as "both masculine and feminine, both assertive and yielding, both instrumental and expressive" (Bem, 1974, pg. 155). Bem (1974) has developed a psychometric technique for measuring androgyny, i.e., the degree to which an individual has both traditionally masculine and traditionally feminine psychological characteristics. Further refinements have been added by Spence, Helmreich, and Stapp (1974) and Spence and Helmreich (1978) who suggest eight distinct sex-role

[3]Use of the terms "masculine" and feminine" to describe these personality clusters is based on sterotyped conceptions of what is masculine and what is feminine in today's society. Reliance on these terms is a convenience of communication until such time as the stereotypes are dissolved or redefined.

groupings. Based on the three relevant factors of biological sex, degree of masculinity, and degree of femininity, these researchers maintain that it is meaningful to delineate the following groups: undifferentiated males and females (low in masculinity and low in femininity), traditionally sex-typed males and females (masculine-males and feminine-females), cross-sexed males and females (feminine-males and masculine-females), and androgynous males and androgynous females (males and females high in both masculinity and femininity).

Research using these sex-role classifications has shown that androgynous individuals are higher in self-esteem (Spence and Helmreich, 1978; Wetter, 1976) and more comfortable in a wider range of social situations (Bem and Lenney, 1975). Related research on individuals possessing a high degree of cross-sex traits suggests that such people have lower anxiety (Gall, 1969; Sears, 1970; Harford, Willis and Deabler, 1967) and greater intellectual and more moral development (Maccoby, 1966; Block, 1973) than educationally and socio-economically comparable sex-typed males and females.

Statement of the Problem

The purpose of the present study was to investigate the relationship between biological sex, psychological sex roles, and environmental concern. It was hypothesized that individuals who possess androgynous or cross-sexed psychological identities would be more concerned about environmental problems than undifferentiated or traditionally sex-typed individuals. This expectation is derived from two separate sources, both of which point to the same conclusion. First, research on the personality determinants of environmental concern indicates that highly concerned individuals score higher than unconcerned individuals on measures of social maturity, self-assurance, responsibility, and ethical conscientiousness (Borden and Francis, 1978). Conversely, androgynous and cross-sexed persons often score higher than sex-typed persons on these same personality dimensions (Spence and Helmreich, 1978). Taken together, these convergent findings underscore an expectation that sex-role identification may be an important antecedent of environmental awareness and responsibility.[4] Other support

[4]In this paper we employ terms and phrases like "environmental concern," "environmental responsibility," and "positive regard for ecological issues." They are meant to parallel the terminology of other psychologists, sociologists, and philosophers who are working toward the definition and facilitation of attitude and/or value based changes involving an evaluative response coupled with beliefs andd behavioral responses toward corrective action in environmental/ecological spheres. These labels vary in the locus of change along a dimension of psychological depth in roughly the following order: Maloney and Ward's (1973) "environmental commitment"; Weigel and Weigel's (1978) "pro-ecology behavior"; Gray's (1983) "ecological orientation"; Leff's (1978) "ecological consciousness"; Borden's (1983) "ecological identity," and finally, Naess' (1973), Devall's (1980), and Sessions' (1981) "deep ecological" transformation. We recognize that these are value-laden notions for use within a circumscribed historical and cultural context. Nonetheless, they have been the impetus for much of the current research on environmental attitudes and must be considered as important theoretical dispositions.

for this notion comes from a study by Allgeir (1975), who found that androgynous females embraced the desire for smaller families, a position consistent with the need and value of reducing population. A further parallel also exists between the liberal political orientation associated with increased environmental concern, and indications that androgynous individuals share this political orientation. In addition, they view themselves as instrumentally effective in political matters (Hershey and Sullivan, 1977).

To test this hypothesis Spence, Helmreich and Stapp's (1974) Personal Attributes Questionnaire (PAQ) was administered to 204 undergraduate students. Based on established classification criteria, 10 males and 10 females with extreme undifferentiated, traditionally sex-typed, cross sex-typed, or androgynous scores were selected and tested for environmental concern with Weigel and Weigel's (1978) Environmental Concern Scale (ECS) and Maloney, Ward and Braucht's (1975) Environmental Attitude and Knowledge Scale (EAKS). The first of these instruments provides a general measure of environmental concern. The latter instrument is composed of four subscales, measuring the individual's level of environmental (a) affect, (b) knowledge, (c) current commitment, and (d) willingness to make future commitments.

A second purpose of the study was to examine whether parallels exist (a) between the intensity of environmental feelings and the feminine dimension of androgyny and (b) between the degree of environmental knowledgeability and the masculine dimension of androgyny. Support for these coextensions would reinforce the notion that a theoretical isomorphism may underlie both contemporary sex-role models of personality and more traditional, social psychological, conceptions which address environmental activism through affective, cognitive, and behavioral attitude constructs (Lipsey, 1977; Borden and Schettino, 1979).

Method

Subjects

Subjects were 101 males and 103 females who participated in the study as partial fulfillment of their requirement in introductory psychology class at Purdue University.

Instruments

1. Personal Attributes Questionnaire (PAQ). This instrument was developed by Spence, Helmreich, and Stapp (1974) to assess masculinity and femininity independently, and provides a scoring system for classification of males and females into undifferentiated, traditionally sex-typed, cross sex-typed, and androgynous categories. The test consists of 24 bipolar Likert-type items. Eight of these items serve to measure masculinity (e.g., competitive, independent, etc.); eight measure femininity (e.g., kind, emotional, etc); and eight other items that comprise a unidimensional M-F scale which is not used in this sex-role classification procedure. Scores

on the masculinity and femininity subscales can range from 0-32. Classification of a subject into one of the four sex-role categories is based on the subject's scores on these two subscales as determined by cutoffs provided by Spence, Helmreich and Stapp (1974).

2. Ecological Attitudes and Knowledge Scale (EAKS). This 45-item test was developed by Maloney, Ward and Braucht (1975) and is composed of four subscales: Affect, Knowledge, Verbal Commitment, and Actual Commitment. The Affect subscale consists of 10 true-false items measuring the degree of emotionality relating to environmental issues (e.g., "It frightens me to think that much of the food I eat is contaminated with pesticides.") The Knowledge scale is composed of 15 multiple choice items measuring specific factual knowledge related to ecological issues (e.g., "What is the harmful effect of phosphates on marine life?"). The last two subscales measure behavioral intention and behavioral self-report, respectively. The first of these is referred to as the Verbal Commitment subscale and is made up of 10 futuristic-probabilistic, true-false items which the person states s/he would be willing to do in reference to environment-pollution issues (e.g., willingness to purchase only recyclable beverage containers, distribute environmental literature). The last scale consists of ten true-false items of Actual Commitment assessing behaviors in which the individual is currently engaged (e.g., having switched products for ecological reasons, recycling waste materials). Finally, the authors of the scale (Maloney and Ward, 1973; Maloney, Ward and Braucht, 1975) provide contrasted-groups criterion validity and split-half reliability data demonstrating that their instrument is a useful tool for measuring environmental attitudes.

3. Environmental Concern Scale (ECS). This test has recently been developed by Weigel and Weigel (1978) as a general measure of an individual's concern about conservation and pollution issues. The scale consists of 16 Likert-type items which are summed to produce an environmental concern score ranging from 0-64. Further evidence (Weigel and Weigel, 1978) indicates that the scale exhibits satisfactory internal consistency, test-retest stability as well as having the capacity to predict involvement in environmentally conscious behaviors (e.g., recycling).

Procedure and Experimental Design

All three questionnaires were administered to subjects in small groups. At the conclusion of the testing situation each subject was fully debriefed about the purpose of the study. None of the subjects indicated any suspicion regarding the questionnaires or other aspects of the study.

In accordance with the PAQ classifications provided by Spence, Helmreich and Stapp (1974), the sample of 204 subjects consisted of 13.5% undifferentiated, 29.3% traditionally sex-typed, 17.7% cross sex-typed, and 39.5% androgynous individuals. Within each of these groups the proportion of males and females remained nearly equal. Since some subjects who were classified into a particular category were quite close to the cut-off

lines, an extreme groups strategy was employed in order to provide discriminable levels of sex role typology. The procedure used was to take the ten most extreme males and females within each category. This provided a 2 (biological sex) X 4 (sex-role classification) between-subjects design with ten subjects per cell and five dependent measures.[5]

Results

Biological Sex

An initial 2 X 4 multivariate analysis of variance was conducted for the five dependent measures (the scores on the four EAKS subscales and the ECS). According to this analysis there was a significant overall effect associated with biological sex, F (5,68) = 5.02, $p < .001$. Subsequent univariate analyses revealed that most of this effect was due to a higher level of Environmental Knowledge among male subjects, F (1,72) = 10.30, $p < .002$. Conversely, females scored significantly higher than males on the Verbal Commitment subscale, F (1,72) = 5.30, $p < .05$. The remaining univariate tests of the EAKS Actual Commitment and Affect subscales and the ECS scores showed no indication of biological sex differences (all $Fs \leq 1$).

Sex Role Classification

A multivariate analysis of variance comparing the four sex-role categories showed an overall main effect for this factor, F (15,188) = 2.11, $p = .01$. Subsequent univariate test revealed significant main effects on four of the five dependent measures: EAKS Actual Commitment, F (3,72) = 5.90, $p < .001$, Verbal Commitment, F (3,72) = 5.52, $p < .002$, Affect, F (3,72) = 2.95, $p < .05$, and the ECS, F (3,72) = 3.70, $p = .01$. There was no indication of any difference between sex-role types on the EAKS Environmental Knowledge subscale, $F < 1$.

The mean values for undifferentiated, traditionally sex-typed, cross sex-typed, and androgynous subjects appear in Table 1. In addition, an EAKS Total score for each subject in these categories was calculated by summing his or her scores on the four subscales. Thes EAKS Total scores, also presented in Table 1, showed a significant effect for sex-role classification, F (3,72) = 4.13, $p < .01$. Newman-Keuls analysis of the EAKS totals indicated that undifferentiated and traditionally sex-typed subjects exhibited similar but significantly lower overall scores than did cross sex-typed or androgynous subjects. An identical pattern was revealed by Newman-Keuls analysis of the ECS scores. In general, then, these two measures indicate that the androgynous and cross sex-typed subjects share a high level of positive regard toward environmental problems. On the other hand, undifferentiated and traditionally sex-typed subjects share a significantly lower level of positive regard for these issues.

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[5]The present design utilized equal N in all cells. An additional analysis of variance was conducted with cell sizes proportional to the sex role classification percentages. The results of this proportionally unequal N ANOVA did not differ substantially from the present results.

TABLE 1

ECS and EAKS Total and Subscale Scores as a Function of Sex-Role Classification†

	Undifferentiated	Traditionally Sex-Typed	Cross-Sex Typed	Androgynous	F	p
Weigel (ECS)	42.15a	41.60a	47.55b	47.55b	3.70	.01
Maloney, Ward & Braucht (EAKS)						
Knowledge	7.65a	7.10a	8.00a	7.20a	< 1	n.s.
Affect	5.00a	5.20a	6.75a	6.95a	2.95	.05
Verbal Commitment	5.80a	5.60a	7.40b	7.25ab	5.52	.002
Actual Commitment	1.80a	2.60ab	3.70b	3.75b	5.90	.001
Total (EAKS)	20.25a	20.75a	25.85b	25.15b	4.13	.01

† Means with different subscripts differ at or beyond the .05 level.

Closer inspection of the mean values of each of the EAKS subscales for the four sex-role classifications revealed a number of interesting findings. Of particular importance was the fact that, while the groups exhibited no differences in Environmental Knowledge and only small differences in Affect, both measures of commitment were strongly influenced by sex-role characteristics. Apparently, the primary difference betweeen undifferentiated and traditionally sex-typed individuals on the one hand, and cross sex-typed and androgynous individuals on the other hand, is the extent to which their Environmental Affect and Knowledge take active form. In other words, individuals who possess an equally high amount of opposite-sex characteristics (i.e., androgynous) and individuals who possess predominantly opposite-sex characteristics (i.e., cross sex-typed) are more personally involved in the solution of environmental problems.[6]

Finally, a multivariate test for interactions of biological sex and sex-role classification failed to reveal an overall multivariate interaction. However, univariate tests for interaction indicated a significant biological sex X sex-role classification interaction on the Affect subscale, F (3,72) = 2.63, $p < .05$. All other univariate analyses of subscales showed no indication of interactive tendencies, all Fs ≈ 1, n.s. The mean Affect scores for undifferentiated, traditionally sex-typed, cross sex-typed, and androgynous males and females appear in Figure 1. Inspection of these means shows that undifferentiated, cross sex-typed, and androgynous males and females differed little from each other within their class, whereas traditional males and females showed a difference equivalent to one-third the range of the entire (10 point) scale. An *a posterori* test of this difference was highly significant, $p < .02$, while corresponding tests for the other three sex-role classifications showed no significant tendencies, all ps $\geq .20$.

Discussion

Results on the Weigel and Weigel general measure of environmental concern (ECS) support the hypothesis that the development of a personal style which incorporates qualities that go beyond a traditionally sex-typed identify is accompanied by a heightened concern about environmental issues. While the high degree of concern among androgynous and cross sex-typed subjects was virtually identical, traditionally sex-typed subjects scored lowest of all. The absence of any differences on the ECS for biological sex and the consistent results found for sex-role classification further supports arguments concerning the importance of a psychological sex-role classification system (cf. Spence, Helmreich and Stapp, 1974; Bem, 1974; Spence and Helmreich, 1978).

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[6] Another way to demonstrate this notion would be to show differential correlations of affect with the masculinity and femininity dimensions. Such correlations for the total sample of 204 subjects between affect and masculinity and femininity were found to be -.18 and .28 , respectively. These correlations differed significantly from each other at the .001 level.

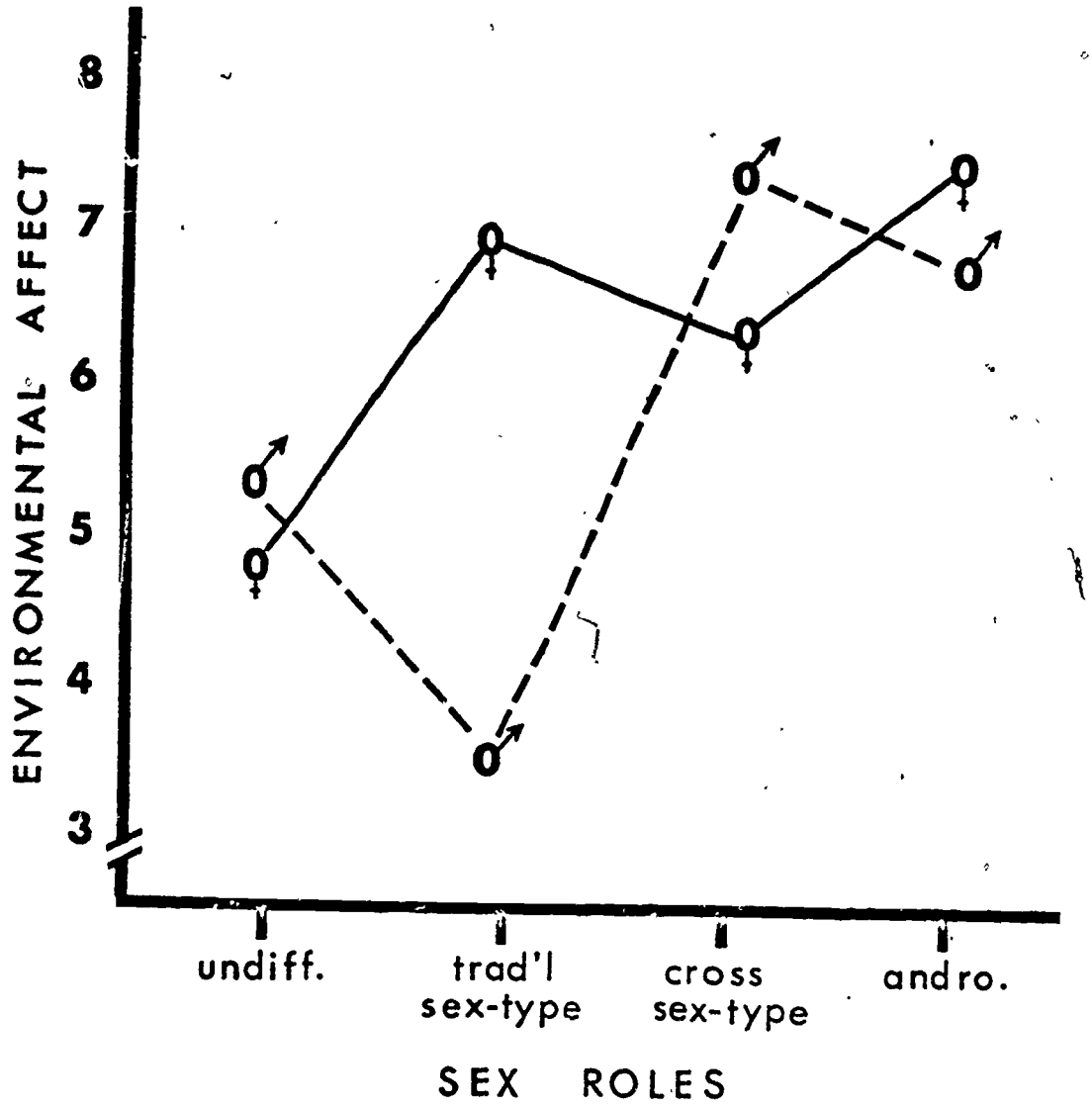

Figure 1. Environmental Affect as a Function of Biological Sex (Gender) and Sex Role Classification

269

The EAKS Total Scores (Maloney, Ward and Braucht, 1975) paralleled results found with the ECS (i.e., a highly significant difference for sex-role classification but relatively little indication of biological sex differences or interactions). A closer inspection of the separate EAKS subscales clarifies these overall sex-role classification differences.

First, it should be noted that there were no significant differences among the sex-role categories on the Environmental Knowledge subscale. On the other hand, there was a significant effect of biological sex, with males scoring higher than females on this measure. Comparison of the configuration of Knowledge scores revealed no parallelism of environmental knowledge with commitment; the significant sex-role differences on the Verbal and Actual Commitment subscales were not accompanied by differences in degree of Environmental Knowledge. Conversely, the significant difference in Environmental Knowledge between males and females was not accompanied by a biological sex difference in either Verbal or Actual Commitment.

Second, analysis of the EAKS Affect subscale indicated an overall significant effect in accordance with our initial sex-role expectations. While a posteriori tests failed to reveal significant differences between any of the groups, inspection of the means shows that androgynous and cross sex-typed individuals tended to admit stronger feelings in response to environmental problems than undifferentiated and traditionally sex-typed individuals. Further clarification may be found by examining the biological-sex X sex-role interaction of the Affect subscale. Here, it was found that males and females within the undifferentiated, the cross sex-typed, and androgynous groups had similar levels of Affect. Traditionally sex-typed males and females, however, differed dramatically. These females responded with as high a level of emotional reaction to environmental problems as did cross sex-typed and androgynous males and females. Traditionally sex-typed males, on the other hand, admitted the lowest level of affective reaction among all groups. This sex-typed, male-female difference is in perfect accord with the theoretical position that traditional females are characterized by sensitivity, emotionality, and willingness to admit their feelings, whereas traditional males are not (Bem, 1974).

Analyses of the remaining two EAKS subscales, Actual and Verbal Commitment, revealed that androgynous and cross-sex-typed subjects were currently more involved, as well as more open to future personal involvement in environmentally responsible behavior. While differences on these two measures seemingly parallel the differences in Affect, it would be presumptuous to argue that level of Commitment is determined solely by level of Affect. One notable finding which argues against such an interpretation is the aforementioned difference in the level of Affect of traditionally sex-typed males and females. These two groups, as it turned out, differed more than any others in their level of Affect but differed least in their level of Actual Commitment.

Before firm conclusions can be drawn, of course, it is necessary to go beyond the basically correlational analysis presented here. In the introduction, we noted that there is considerable flux in the stereotyped conceptions of what constitutes "appropriate" self-perceptions, expectancies, and/or behavioral roles for men and women in contemporary society. Therefore, it would be premature to conclude that the sex-role categories employed here are "stable" dimensions of personality that cause the observed differences in environmental orientations. They very well may be coterminous and causally interdependent.

An adequate explanation must await further research which is designed to answer these questions more precisely. In this regard, two presently unrelated lines of research hold promising approaches that could be combined. One is the research on the antecedents of masculinity and femininity (e.g., Spence and Helmreich, 1978); the other is the role of "significant life experiences" involved in environmental sensitivity (Tanner, 1980; Peterson and Hungerford, 1981). A combination of these two approaches could provide substantial clarification of the current topic, as well as a more balanced human ecological perspective for such varied fields as environmental education, environmental sociology, and environmental psychology.

Finally, we agree with Bakan (1966) and Bem (1974) that a balanced fusion of the "agentic" and "communal" modalities within a single individual may free that individual from the restrictions of culturally imposed sex-role stereotypes. We also recognize, however, that these stereotypes may be superseded by a new cultural ideal of "self-contained individualism" (cf. Hogan, 1975; Sampson, 1977). While this ideal, if realized, may be accompanied by increased personal sensitivity and responsiveness to environmental problems, we suggest that there are also much broader philosophical questions to be considered. In particular, we refer to the potential discordance between a highly individualistic perspective and -- what several contemporary eco-philosophers are calling for -- a non-anthropocentric, biocentric egalitarian, perspective (Naess, 1973; Devall, 1980; Sessions, 1981). Admittedly, these issues go beyond the scope of the present paper. Nonetheless, we introject them as a final note because we have recognized, in the course of this research, that there may be much deeper and more fundamental underpinnings that join the environmental movement and the women's movement. Understanding of these interpenetrations will involve a thorough examination of current assumptions about humans, nature, and the deep meanings of ecology and justice. A rapprochement of these potential contradictions might begin, at least psychologically, with theoretical conceptions like Jung's (1953-1978) fusion of opposites through processes of "individuation" and "self-realization" and end in a balanced "ecological identity" -- a "union" within the individual, and with the whole.

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Citizen Participation in Environmental and Natural Resource Planning, Decision-Making, and Policy Formulation

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Introduction

This paper concerns citizen participation and a technique which shows promise for facilitating it. It examines the different views on citizen participation held by citizen theorists and elitists. It reviews the reasons behind the demand for increased citizen participation and the responses to those demands, and assesses the citizen participation movement. Since one of these responses has been the search for better techniques of involving citizens, it examines techniques for facilitating such participation and research needs related to techniques. A major need exists for empirical testing of mechanisms for citizen participation which are undergirded by sound theory.

Visual preference, a methodology based on a theoretical model which provides an understanding of citizen participation and its significance in human behavior, is presented. Visual preference has proven useful as a tool in visual resource management. In addition, visual preference has distinct advantages over techniques traditionally employed in citizen participation efforts, and it has potential for facilitiating citizen involvement in planning for a wide variety of environmental and natural resource projects.

Background

Citizen participation or public involvement -- participation of the governed in their government -- is one of the revered cornerstones of our American democratic heritage. America prides itself on civic responsibility, grass roots political activism, and the opportunities for those affected by decisions to affect those decisions.

Everyone expects participation, yet only a tiny minority of the citizenry actively participate. Langton (1978b) attributes this to a paradox in civic attitudes and behavior in America. In response to dissatisfaction with government and society, Americans simultaneously (1) withdraw and become apathetic because of their alienation and distrust, and (2) make efforts to make government more accessible, accountable, and responsive to citizens.

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Citizen participation is complex, and issues are rarely clear-cut. It has many meanings and connotations, depending on the ideology, motivation, and orientation of the users. It is perceived differently by people, depending on their status (whether they are in or out of power), their responsibilities, their constituencies, their goals, whether they are part of a private group or public agency, etc. Some view public participation as a means; to others, it is an end in itself. And the motiviations for advocating increased citizen involvement range from strong beliefs in citizen participation as a democratic goal to a "jumping on the band wagon" approach (Wengert, 1971).

Various typologies for citizen participation have been devised. Differences in these typologies reflect differences among the perspectives of social advocates (Arnstein, 1969), administrators (Burke, 1968), and social analysts (J. VanTil and S.B. VanTil, 1970).

Participatory Democracy Versus Elite/Expertise Model

Differences in perspective among social advocates, administrators, and social analysts reflect more fundamental differences in position along the participatory democracy-elite/expertise continuum. Advocates of the pole positions on this continuum respond differently when asked what the role of participation in society should be.

Participatory Democracy

Citizen theorists, who advocate the participatory democracy model, build on the concept of Greek citizenship. In classical Greek thought, it was believed that a person must take an active role in the affairs of the community to be a fully-developed, virtuous, fulfilled individual. Participation was thought to be essential to the development of a human's capabilities. Only by sharing in the formulation of the rules of the game and policies which determine his life could a person truly be free. The funeral oration by Pericles summarizes this view of Greek citizenship:

> We are lovers of beauty without extravagance, lovers of wisdom without unmanliness. Wealth to us is not mere material for vain glory, but an opportunity for achievement. And poverty we think it no disgrace to acknowledge, but a real degradation to make no effort to overcome. Our citizens attend both to public and private duty and do not allow absorption in their own and various affairs to interfere with the knowledge of the city. We differ from other states in regarding the man who holds aloof from public life not as quiet, but as useless.

Citizen theorists believe that the democratic process -- as opposed to the elitist -- has a higher probability of success because it provides for representation from those who are affected, which provides a better information base as well as perception of justice and equity. They acknowledge that in the short run citizen participation appears to cost more, take longer, invite stress, challenge the technicians, and confuse

values with facts. But they also believe that the human costs of inaction are immeasurable, that the public has valuable contributions to make, and that in the long run involving the public is the only viable way to go.

The major advantages of citizen participation cited by citizen theorists are:

(1) Citizens have an inalienable right to be involved in formulation and implementation of programs that affect them. For proprietary reasons, then, the views and preferences of people are necessary input to responsive decisions, since government is designed to serve people.

(2) Better plans and decisions are reached for four reasons. First, conflicts among different groups are brought into the open and often resolved during the planning process, rather than being left to a political decision or a staff decision by the planning agency. Second, more and better information is obtained. Affected persons likely to be unrepresented in environmental assessment and decision processes are provided an opportunity to present their views. Members of the public may provide useful additional information to the decision maker, especially when values are involved that cannot be easily quantified. Planners and managers become aware of a wider array of alternatives from assessing the opinions of publics. They are able to identify the issues better and to share their perceptions of the most desirable management alternatives. Third, impacts are assessed better. Finally, incidence of costs and benefits on societal groups is made more equitable.

(3) The decision-making process is legitimized. Groups are convinced that their needs have been fairly considered and treated, even if their demands are not fully satisfied. So long as people have the opportunity to provide their input and have it heard, they will accept the process as legitimate, even if the ultimate decisions are not actually influenced. In adddition, accountability of political and administrative decision-makers is likely to be reinforced if the process is open to public view. Openness puts pressure on administrators to follow the required procedure in all cases. Also, public confidence in the reviewers and decision-makers is enhanced, since citizens can clearly see in every case that all issues have been fully and carefully considered.

(4) Actions taken with public participation are less likely to be capriciously reversed or modified, and are more likely to be supported by the public. Citizens are more likely to accept plans which they feel they helped create. The implementation process is eased and sped up for projects that formerly were being slowed down, halted, or subjected to adverse publicity. Legal challenges are reduced or eliminated. Delays and inconveniences from carrying out citizen participation efforts are small compared to those resulting from lawsuits filed by angry groups that have been left out of the planning process. Citizen participation serves as an early warning system that permits organizations to avoid decisions that could prompt legislation or legal battles that could interfere with the expeditious administration of environmental resources; it can provide a sounding board for agency proposals as well as a source of new ideas.

(5) Better communication takes place between the governed and the governors. This improved interchange of ideas between planners and the public leads to development of confidence, trust, and support. Since citizen participation involves other public agencies as well as citizens and citizen organizations it improves interagency cooperation as well.

(6) Public understanding of proposed projects is increased. Group leaders and citizens become more knowledgeable. Citizen interest in programs is activated.

(7) Public participation leads to more use of the environment, less vandalism and turnover, and greater promotion of the planned environment to others.

(8) Those who participate feel more creative, responsible, and helpful -- and less alienated and anonymous -- than those who do not. They are able to design an environment more congruent with their own needs and values. In doing so, they gain a sense of mastery and control over their environment which makes them feel competent and confident in their ability to mold events shaping their lives.

Elite/Expertise Model

Proponents of the expertise model believe the elitist process allows those who are best qualified and most knowledgeable to make societal decisions. Professional planners, decision-makers, and politicians -- reminding critics that a basic thesis of a profession is that its members know what is best for their clients -- believe they know what is best for the public, especially in technical areas, and have the public interest at heart. Further, they think they abrogate their responsibilities if they do not present the public with their best solutions.

Elitists see many decisions as involving complex technical issues beyond the competence of the lay public to understand. They think scientific and technological training and expertise are required to understand the nature of societal problems, the various alternative solutions, and the impact of each. They believe that much of governmental decision-making requires merely technical advice and that the public is simply not qualified to provide such advice.

Elitists believe that the government through the political process represents the public, and that more direct public participation is a challenge to that political process. Further, they believe that politicians know what the public wants and do not want input on each decision. They desire not to expose the decision-making process to public scrutiny, and are unwilling to admit non-professionals into the decision-making arena. They prefer to limit decision-making largely to fellow professionals and administrators, where the predictability of their task environment is increased. In short, most elitists feel existing procedures provide adequate channels for the public to make their views known, and fear delays. They believe that public participation is cumbersome and time-consuming, and that, by prolonging the planning process, it bogs down efficient decision-making.

Proponents of the expertise model believe successful public participation reduces the power and prestige of planners and politicians, who are jealous of their prerogatives. Such planners and politicians view demands for increased participation as revolutionary and potentially subversive, and as a challenge to their expertise. Furthermore, they recognize that citizen participation requires highly trained skills of communication and problem-solving seldom found among resource managers today. They also realize that citizen participation actually makes the managers' decisions more difficult by alerting them to a wider range of complexities and conflicts:

> Increased participation does not mean a reduction in conflict and social tension. Public preferences rarely reflect consensus, for in most situations, even with complete participation, there will be winners and losers. Participation may clarify and alter social issues, and it may contribute to a better understanding of difficulties, but it rarely serves as a means of conflict resolution; in most cases, it will make the task of the planner and administrator more difficult (Wengert, 1976b).

Elitists point out that those who participate comprise only a small portion of the total population. They fear that forums for public participation may become platforms for radical, unrepresentative groups to spout their concerns, and that citizen participation may encourage the mobilization of antagonistic interests.

Elitists also feel that participation programs raise unrealistic expectations from citizens, and may prove to be counterproductive by making highly committed and motivated citizens frustrated, resentful, and cynical about the political process.

Finally, elitists play down the benefits of participation -- and are sometimes even condescending and insulting -- because they believe that citizens are concerned primarily with gratifying immediate needs, lack a comprehensive view of problems, are unwilling to make trade-offs and compromises, and lobby only for their own parochial interests.

Presures for Greater Power Sharing

In the past two decades in the United States, there has been a growing awareness of the general public concerning matters likely to affect them and a desire for additional information and involvement in the resolution of these matters. The underprivileged in urban areas, minorities, consumer groups, environmental advocates, students, the aged, prisoners, and many others have taken initiatives to increase their role in decision-making affecting their interests. These efforts have spilled over into private institutions and industries as well. There has been an explosion in the numbers of citizen organizations and public interest groups working to make government more responsive to the governed.

It used to be generally accepted that individuals' rights to power were delegated by the elective process to politicians, who set policy and made decisions concerning public goods and welfare. A non-elected technical bureaucracy carried out the public needs as translated into law by the legislature. These managers with administrative agencies, given adequate training and resources, were able to produce plans in the public interest. These professionals used to be trusted and taken on faith. They generally did not seek out citizens' suggestions. If they involved the public at all, it was usually through public hearings held after the key decisions had already been made.

Such approaches seemed to work when decisions used to be made locally, where decision processes and inputs to them were generally known and understood by the people in the community. With increasing complexity in science and technology, however, decisions were increasingly made for citizens by technicians further removed. As a result, citizens often believed they had lost control over many aspects of their lives and felt alienated.

Consequently, these approaches are no longer satisfactory. Planning and decision-making processes dominated by individuals, government experts, and politicans no longer work. People who are apprehensive when decisions which affect their lifestyles are made without consulting them have demanded more direct voice. Those who have felt that their views and interests have been ignored and who have felt excluded from policy making have expressed their dissatisfaction through confrontation, protests and demonstrations, and court challenges to gain public access to decision-making processes. The public has insisted upon a more active role at every level of government.

Reasons for the demands for increased citizen participation in a wide range of issues include many interrelated factors. Certainly the increase in size and complexity of modern society and issues facing it, rising levels of education, and questioning of the concept of growth as measured by economic growth provide some explanations. Others include a recommitment to democratic ideals and compensation for the decline of traditional consensus-making provided by such mediating institutions as the church, political parties, and fraternal organizations.

The public has become increasingly alienated from government decision-making and distrustful of government agencies which have grown tremendously and which have assumed discretionary power in decision-making. The rise in the influence of the mass media makes more people aware of the problems associated with government. People have become aware of failures by planners and politicians to deliver the intended benefits or unintended consequences in environmentally-related projects, and believe these mistakes might have been eliminated by broader canvassing of potentially affected interests.

Greater concern for environmental quality has led to more public interest in activities of environmental and natural resource oriented agencies. Increased environmental awareness has brought with it a broadening of public scrutiny question-asking, and requests for detailed information on every aspect of administration. There has been a rise in the number of environmental groups demanding formal access to decision-makers and significant increases in the membership of such groups. With more competing interest groups, there is greater potential for conflict and for dissatisfaction by one or more groups with action taken by agencies.

Pressure for an expanded public role in policy formulation in the U.S. began in the 1960's with programs affecting the poor and underprivileged in urban areas. Under the "New Frontier" and "Great Society" administrations, centrally-planned social change via the Community Action and Model Cities programs sought grass roots participation. The concept of "maximum possible participation," coined by Daniel Moynihan, was incorporated into legislative policy in the Economic Opportunity Act of 1964, which initiated the "War on Poverty." The Office of Economic Opportunity's Community Action Program attempted to provide citizens with increased access to and control over the decision-making process through self-help efforts to improve their sense of power and esteem. Later, Housing and Urban Development attempted to insure "widespread citizen participation" in its urban renewal efforts under the Model Cities Program initiated by the Demonstration Cities and Metropolitan Development Act of 1966. Many other Great Society programs aimed specifically at the victims of inequality -- such as those dealing with delinquency, public housing, day care, Head Start, job training, neighborhood law offices, community health services, etc. -- sought to increase citizen participation through decentralization schemes, advocacy planning, and local control.

In the late 1960's and early 1970's, these efforts expanded into the environmental and natural resource arena. While the Administrative Procedure Act and the Freedom of Information Act of 1967 were useful to persons seeking to participate in environmental decision-making, the National Environmental Policy Act of 1969 was one of the first pieces of environmental protection legislation which required citizen participation in the planning of projects that receive federal funding or licensing. Management of public lands and waters, location of transportation networks and facilities, water supply reservoirs, pollution control facilities, gas pipelines, electric utilities, etc. all become issues in which citizens became involved.

Demands for increased citizen participation in the environmental and natural resource arena were not a uniquely American phenomenon. While most Americans are familiar with such issues as the SST, Miami jetport, dams on the Colorado River in the Grand Canyon and the Alaska pipeline, they do not realize that Canada, the United Kingdom, France, and other nations experienced similar pressures for increased public involvement.

Responses to Pressures for Increased Citizen Involvement

Erickson and Davis (1976) and Langton (1978b) distinguish between two types of responses to the demands for increased citizen participation in environmental affairs: (1) citizen action, which is initiated and controlled by citizens for purposes that they determine and which involves such activities as lobbying, public education, protest, public advocacy, civil disobedience, and class action suits, and (2) citizen involvement, which is initiated and controlled by government to improve decision-making and services and to develop consensus and support for decisions and which involves such activities as advisory committees, public hearings, goals, programs, surveys, hot lines, and volunteer programs.

Case study accounts of citizen action on behalf of the environment illustrate a wide variety of environmental issues at the local, state, regional, and national levels involving a wide range of private organizations and public agencies and utilizing a variety of techniques. Fanning (1975) acknowledges the valuable contributions to citizen action on the environmental front by such voluntary environmental organizations as environmental public interest law firms, environmental lobbies, national voluntary environmental organizations, public interest research/activitist organizations, specialized voluntary environmental organizations, and catalysts for local action on water-related issues. Robertson and Lewallen (1975) provide accounts of eighteen grassroots environmental activists who, instead of decrying national or global problems that no human could cope with, tackled local issues they could handle. Caldwell, et al. (1976) describe ways in which citizens have organized and acted in response to perceived threats to their environments; their sixty-eight case studies recount the efforts of organized citizens to protect or improve the quality of their environments, and illustrate the various roles of citizens in environmental politics and responses of government agencies faced with conflicting demands. Tanner (1976) provides six case studies of citizen action of behalf of the environment as part of a curriculum package. Schoenfeld and Disinger (1978) offer twenty-seven case studies of environmental education in the form of citizen participation in resource policy-making.

In addition to increased citizen action, there have been active responses to the pressures for increased citizen participation in environmental matters by governmental agencies at the federal, state, county, and local levels. The responses by government to pressures for an expanded public role in policy formulation have varied in nature and scope (Sewell and O'Riordan, 1976). One response has been to make more effective use of existing institutions. Such attempts have included developing scenarios to help the public understand implications of different schemes, improving information programs, scheduling meetings at more convenient times and places, expanding hearings to cover a wider range of subjects or broader numbers of interests, holding public inquiries, and making requirements relating to preparation of briefs less restrictive. Another response has been enacting new legislation making it mandatory that views of the public be actively sought and even establishing new agencies. As mentioned previously, the National Environmental Policy Act of 1969 required citizen

participation in the planning of projects that receive federal funding. Most federal environmental legislation since has required agencies to solicit public views and to develop procedures to assure public understanding of proposed actions. And a third response has been expanding research and experimentation to discover more effective ways of involving the public.

Assessment of Citizen Participation Movement

Over the past two decades the public has generally taken a more active role in environmental planning, decision-making, and policy formulation. As mentioned previously, responses to pressures for increased citizen participation have varied in nature and scope, with some administrators taking the initiative and others responding to legislative mandates. Just as people have different interpretations of what citizen participation is and should be, so, too, do they differ on its effectiveness and future direction. As before, peoples' perspectives on these issues depend on whether they are social advocates, administrators, or social analysts, and on where they stand on the professional elite - participatory democracy continuum.

In some cases planners, administrators, and politicians have enthusiastically welcomed greater interaction with the public. Their experience with public participation has helped develop or reinforce their commitment to the process. While they acknowledge that citizen participation is not a panacea, that it provides no easy answers or simple formulae for better planning, and that the ideal of full participation by the governed in the policy-formulation process has not been achieved, they cite the many advantages discussed previously.

However, planners, administrators, and politicians generally adopt a rather cautious view of citizen participation. As a result, small, incremental changes in existing mechanisms for involving the public have been the rule more often than sweeping measures.

Mazmanian and Nienaber (1976) indicate that most citizens -- believing that the costs of participation are greater than the gains -- are apathetic and unconcerned about most issues, and are content to let their representatives decide on their behalf. Further, they argue that most government officials -- satisfied with traditional procedures and unwilling to change them unless they think there will be improvements in efficiency, power, and prestige -- resist change. Thus, unless the public feels that increased participation will provide demonstrable gains over the long term, and unless officials are convinced that the process will be improved, little change in the level of citizen participation may be expected.

Such an outlook is compatible with Down's (1972) theory of the issue-attention cycle. Downs identifies five stages in the evolution of attention to political issues: (1) pre-problem; (2) alarmed discovery and euphoric enthusiasm; (3) realization of the cost of significant progress; (4) gradual decline of intense public interest; and, (5) post-problem

stage. He believes problems come into prominence, remain there for a while and, although perhaps unresolved, fade away, to be replaced by other problems which are perceived as more urgent. If Mazmanian and Nienaber are correct, perhaps we are at stage 3 of Down's cycle with regard to citizen participation, about to experience a decline in the level of public involvement. Even if that were to happen, legislation and changes in public policies and administrative procedures will insure that the level of citizen participation in the environmental and natural resource arena will be higher than before the movement began in the 1960's.

Sewell and O'Riordan (1976) raise the possibility that the results of participatory innovations in environmental policy-making may not only fail to reduce political inequality, but may actually exacerbate the division between those who can exploit the political culture and those who cannot, thereby increasing the alienation and frustration that the whole participatory idea is designed to eliminate. They point out that:

> most of the benefits spilling over from the recent upsurge of interest in participatory politics are accruing to those who already enjoy a certain degree of social and political privilege, the middle income, well-educated, politically articulate people who have traditionally formed the core membership of pressure groups.

Sewell and O'Riordan (1976) believe that, ultimately, increased participation by citizens in environmental and natural resource planning, decision-making, and policy formulation will occur only if there is an escalation of environmental education curricula which channel students' political consciousnesses into constructive participatory enterprise and if there is a reformed political culture more responsive to the nature of democracy and true fairness.

In the final analysis, the level and importance of citizen participation in the future depends on the resolution of six questions posed by Wengert (1971):

1. Who should participate?
2. Who is likely to participate?
3. How much participation is possible and desirable?
4. On what issues and at what stages in decision-making is public participation desirable?
5. What weight should be attached to the views of well-organized articulate interest groups as against the views of the unorganized public?
6. How can meaningful views on regional and national issues be obtained?

and five questions raised by O'Riordan (1971):

1. To what extent should public opinion influence technical judgments which affect the nature of the environment in which all of us live?

2. To what extent is the opinion expressed that of a public knowledgeable of the issues and competent to make judgments?

3. To what degree are the views of the participating groups representative of the general public will (if such a thing exists and can be measured)?

4. How can we resolve the growing conflict between the "expert," who believes his professional judgment should be paramount and seldom considers the "lay" public competent to advise on questions of technical specialty, and some members of the public, who are becoming dissatisfied with the traditional posture of accepting technical opinion and who wish to be directly involved in the decision-making process?

5. Assuming that the public's view should be considered, in what way can this be identified and most suitably incorporated into the decision-making process?

Techniques for Facilitating Citizen Participation

This third response to pressures for an expanded public role in policy formulation, seeking to find more effective techniques for facilitating citizen participation, has been the subject of the majority of the literature on citizen participation in environmental planning. There have been numerous summaries of the wide variety of techniques for gaining citizen input and evaluations of their capabilities for facilitating participation and education. Sinclair (1977), Sewell and Coppock (1977), Hampton (1977), and Rosener (1978) list more than forty techniques among them. Some are used to receive input on a massive scale (e.g., public meetings, hearings, soliciting written input); some from small groups (e.g., workshops, ad hoc committees, advisory groups); and others from individuals (e.g., key contacts). There is a consensus among social science researchers that no one technique is a panacea, that each has its own advantages and disadvantages, and that practitioners should therefore utilize a combination of mechanisms.

For example, Bultena and Rogers (1973) claim that

> the public interest is best identified and advanced through a multi-dimensional approach in which several techniques are employed simultaneously. Reliance on any one technique is likely to produce only a partial and perhaps seriously biased account of the public interest (Bultena and Rogers, 1973).

Hendee, et al. (1974) point out that public input should take different forms at different stages of the policy process. Some methods are more effective than others at one stage. The stages are: (1) collection process and public meetings, advisory groups, informal contacts, etc.; (2) analysis process and measures of public sentiment by type and source; (3) evaluation process and obtaining a rank ordering of importance; (4) decision implementation and choosing the desired alternative; and (5) action and cooperation, or review and reinterpretation of decisions. They suggest that:

> the appropriateness of each techniuqe will vary with the issue and with local and regional conditions. To best serve decision-making purposes, a balanced program of collection activities is needed. The objective is to collect a broad range of ideas, ideally from all who are interested or affected and, practically, from as many of them as possible. Every technique has strengths and weaknesses, and only a combination can do an adequate job; a tailor-made approach is needed for each issue (Hendee, et al., 1974).

Wilkinson (1976) believes a variety of mechanisms is needed to perform each of the three functions of participation -- (1) education/information; (2) review/reaction; and, (3) interaction/dialogue -- and flexibility is necessary to meet the needs of the given situations. Finally, Herberlein (1976b) believes that the manager and planner, once they understand the function citizen participation serves in a given situation, can pick the form of public involvement best suited to their purpose. He believes public involvement can perform four functions: (1) informational: giving information to the public and getting information from the public; (2) interactive: the public and the planner or manager working together jointly and sharing on a problem; (3) assurance: assuring the public that its views have been heard and that it has not been ignored in the planning process; and (4) ritualistic-legalistic: meeting the legal requirements.

Public Hearings

When the topic of citizen participation is mentioned, public hearings come to the minds of many people as the major technique. Yet there appears to be some concurrence among social science researchers that public hearings have some drawbacks, and should be used in conjunction with other techniques. While public hearings are easy to organize and administer, quick, inexpensive, and reach many people, they are subject to manipulation. Their formal approach inhibits many speakers, and their format does not encourage discussion of alternatives. They usually attract only a small segment of the general population, and may disproportionately reflect the views of members with organized interest groups. Hearings often are held when people work and at places that are difficult for people to get to. They sometimes involve procedural costs (e.g., providing copies of materials) and other responsibilities (e.g., rounding up experts). Most authors believe public hearings would be better after a public information program had been underway for a while so citizens could present well-formulated testimony.

New Approaches to Citizen Participation

Bultena and Rogers (1973) identify some common features of new approaches to citizen participation: (1) early involvement of interested citizens at the problem identification stage; (2) continuing dialogue between citizen groups and agency through a series of public meetings scheduled at each stage of decision-making; (3) agency preparation of informational materials; and (4) ready availability of agency personnel to citizens wishing information on the nature or rationale of proposed plans. The successful introduction of new forms of participation depends upon willingness both inside and outside government to experiment with new ideas, innovate, and assume new roles.

One relatively new form of participation which Reidel (1971) and Wilkinson (1976) advocate is open planning, similar to what Sargent (1972) terms "fishbowl" planning. The U.S. Army Corps of Engineers experimented with these approaches on some of its water resources planning projects in the 1970's. Open planning

> recognizes that various publics exist in any given locale at any point in time, and that these publics express themselves through a variety of formal and informal organizations depending on the issues in question. A key concept of an open planning program is to discover and adapt to these ever-dynamic public constituencies throughout the planning process (Reidel, 1971).

Open planning is distinguished from other conceptions of public participation in that it is a joint planning process; it is more than a two-way communication process. The public is incorporated into the planning process rather than merely communicated with. And where traditional planning approaches have focused on technical and economic feasibility, the open planning process puts at least equal stress on the social and political feasibility of alternatives.

Commitment to open planning requires genuine honesty with the public. It requires tenacity and perseverence. It is costly in time and budgets. And it does not reduce conflict and public controversy. But by being highly flexible in order to deal with different needs and exploratory so that it can be improved and refined, open planning brings all the issues into focus early in the planning process, increasing the likelihood that conflicts can be resolved before decision-makers are so committed to positions of opposition that retreat is impossible. And, hopefully, plans generated through the open planning process will reflect vital public goals and values and include those aspects of social and political feasibility crucial for public acceptance and ultimate success (Reidel, 1971).

For open planning and other new forms of citizen participation, identification of publics is important. While identifying publics is only one part of the entire process of public participation in planning, and public participation is only one part of the entire planning process, it is a major task. The public is not a unitary mass; many publics exist.

Willeke (1976) draws on the concepts of audience segments from communications researchers and market segments from market researchers to offer suggestions to planners on identifying publics and communicating with them: (1) self-identification: legal actions such as petition, appeal, public hearing, election, and suit; protest and publicity; correspondence; (2) third party identification: use of citizen committees to identify groups and individuals who should be involved in planning or who are affected by proposed plan alternatives; and (3) staff identification: analysis of associations, geographic analysis, demographic analysis, historical analysis, comparative analysis, general lists, field interviews, analysis of affected publics.

Research Needs Regarding Citizen Participation Technique

While literature on citizen participation is abundant, very little of it is based on empirical work. Most consists of case studies. There have been few comparative evaluations of alternative approaches, and few tests or experimental investigations of effectiveness of programs and techniques. But, as Gundry (1978) points out, "those who have been involved in designing and studying involvement programs have expressed a need for real research into citizen involvement programs and techniques." The practitioners seeking to involve the public in decision-making seldom know how to do so effectively because they are either unaware of existing research with direct implications for their efforts or they view the basic and theoretical research as inappropriate and of little utility at the operational level. One reason for the latter view is that much of the research is aimed at identifying structural changes deemed necessary in the institutional setting rather than at working effectively within existing management structures (Stankey, et al., 1975).

Stankey, et al. (1975) lay out in detail numerous research questions, answers to which could guide the development of citizen participation. Their questions concern each of the five processes inherent in public participation in decision-making: issue identification, collection, analysis, evaluation, and decision implementation. Reviewing their work, Erickson and Davis (1976) raise specific research questions relating to techniques for facilitating the two-way flow of information and dialogue between decision-makers and public which are necessary for citizen participation:

1. Amount of Public Involvement. Empirically founded criteria need to be developed to guide decisions on "when" and "how much" is needed.

2. Techniques of Collecting and Analyzing Public Input. What alternative collection techniques are possible and what are the benefits and costs of these techniques? What are the advantages and disadvantages of these techniques at each stage in the decision-making process? How does the quality of opinion vary with collection techniques? What techniques can be used to analyze information?

3. Participant Characteristics and Motivation. What kinds of people are participating in resource decisions? Does involvement reduce anomie and powerlessness? Why and how do people get involved? What techniques are effective at obtaining representation of all interests affected by a decision?

4. Group Interactive Mechanisms. What are the costs and benefits of various interactive mechanisms between managers and the public? What mechanisms are most effective for exchanging information between managers and the public? What mechanisms tend to reduce conflict?

5. Information Dissemination Techniques. What techniques can be used to communicate issues to the public? How does the definition of the issue affect the kinds of participants that become interested in the issue? What techniques are effective at displaying the consequences of alternative courses of action?

6. Decision-Making Procedures of Resource Agencies. To what extent are state and local agencies utilizing public involvement procedures in decision-making? What techniques are being utilized? (Erickson and Davis, 1976).

Visual Preference

Wengert (1976a), calling citizen participation "a practice in search of theory," points out the importance of developing a theortical model for any techniques used for facilitating citizen input. While most citizen participation techniques or tools are not based on theoretical models, visual preference is based on a sound theoretical model proposed by S. Kaplan and R. Kaplan (1978). Their approach considers the environment in terms of the information qualities that make human functioning possible, and recognizes that humans are profoundly influenced by the conditions of their evolutionary history. They contend that humans prefer environments where they can use the cognitive abilities which they have evolved. Deviations from preferred environments produce stress. Such stress can cause people to become unpleasant, irritable, aggressive, and destructive, and to withdraw, become uninvolved, and drop out, resulting in a break-down in community. When humans find themselves in non-preferred environments, they seek to manage such stress by developing coping strategies which either modify conditions or adapt to them. Strategies to keep the information generated by the environment manageable include: (1) choosing to gravitate toward preferred environments; (2) managing such environments so as to enhance their preference values; (3) imposing patterns on environment and experience through shared cultural interpretations; and (4) participating, or taking an active role in what happens in the environment.

S. Kaplan's and R. Kaplan's (1978) theoretical model recognizes that humans are dynamic organisms, actively striving to cope with their environment. They can be difficult and potentially very dangerous, yet are highly capable of problem-solving, cooperation, and creativity when effectively informed. Humans do not want to have things done to them or for them. Rather, they want to be involved, to have a piece of the action, to influence the course of events.

Visual Preference as a Tool in Visual Resource Management

A significant part of the increased environmental awareness in the past two decades has been manifested as a greater appreciation of aesthetics, the visual landscape, and scenic resources. Formerly, people used to say that some issue involved "mere aesthetics," implying that aesthetic judgments are idiosyncratic ("beauty is in the eye of the beholder"), arbitrary, personal, and quite unimportant as far as public policy is concerned. They considered the visual landscape as an amenity, an insignificant and peripheral backdrop to what they deemed the more important parts of life. However, people have increasingly come to recognize that aesthetic judgments or preferences for visual landscapes constitute an integral part of the total environment in which we live, and help shape our character as individuals and as a society.

So important is the issue of aesthetics, in fact, that it has begun to be incorporated into legislation and to play a role in various other public contexts. Most federal environmental legislation passed in the past two decades makes at least some mention of the importance of aesthetics and the need to consider peoples' preferences for visual landscapes in natural resource management projects. Many states have passed laws dealing with aesthetic conerns as well. Historically, landscape and scenery have not been a primary concern of planners. Only recently have landscape and scenic parameters become controlling elements in litigation. But, increasingly, aesthetic considerations are included in land use case law (American Bar Association, 1967; Broughton, 1972: Bufford, 1973; New York University Law Review, 1970).

Environmental designers, planners, managers, and decision-makers responsible for implementing such federal and state laws and carrying out decisions of the courts are often at a loss as to where to begin in dealing with aesthetics. In recent years, the field of visual resource management has arisen to assist them in providing technology to address challenges in landscape planning. The assessment systems employed in this field are derived from a variety of academic and professional desciplines, such as psychology, architecture, landscape architecture, geography, economics, engineering, natural sciences, natural resource management, and interdisciplinary approaches. They make use of descriptive, computerized and quantitative, and psychometric and social science approaches. They lend themselves to evaluating any human intervention in natural and built environments.

While most visual resource management systems rely on expert or professional judgment to evaluate landscape qualities, there is a growing literature on public preferences derived from empirical investigations. Visual preference utilizes public preferences derived from empirical investigations. Environmental settings in visual preference studies have been presented to participants either directly, through on-site visitation, or indirectly, by means of simulation techniques. Among the numerous simulation techniques are photographs, films, videotape, computer graphics, models, line drawings, art pictures, and tachistoscopic projections.

Shafer, Hamilton, and Schmidt (1969), Shafer and Mietz (1970), Shafer and Richards (1974), Cerny (1974), Zube, Pitt, and Anderson (1975), Daniel and Boster (1976), and Levin (1977) have all found no significant differences between preference ratings for actual scenes and photographs of those scenes. Photos are certainly less expensive and easier to deal with than transporting participants to actual landscape settings. Furthermore, the use of photographs allows for evaluation of many more aspects of the environment than field trips.

R. Kaplan and S. Kaplan and their graduate students have used black and white photographs for visual preference assessments with a high degree of success. The results from use of the photos in a number of different settings and with a wide variety of participant groups have been reliable and valid. Just as important, the results have been intuitively meaningful. The settings studied have included scenic roadsides (R. Kaplan, 1977), storm drains, (R. Kaplan, 1978), parks (R. Kaplan, 1980), naturalized prairie landscapes (Gallagher, 1977), a river corridor (Levin, 1977), roadside environments (Ulrich, 1977), a bog environment (Hammitt, 1978), forest practices (Anderson, 1978), rivers (Weber, 1980) and urban neighborhoods (Frey, 1981). In each case, questionnaires included photographs conveying information about the environment under study. Participants were asked to rate each of the photos on a five-point scale reflecting their preference for the scene. Verbal questions were asked as well.

Advantages of Visual Preference for Facilitating Citizen Participation

R. Kaplan (1979a, 1979b) points out the value of visual preference assessments for citizen participation. Not only does this simple, straightforward approach yield useful and enlightening results, but it is also interesting and meaningful for the participants. The procedure is inexpensive and manageable, and the participant's task is simple and presents no difficulties. Participants can readily determine their preferences for various environmental situations from viewing black and white photographs. They need no technical expertise, and are not baffled by having to try to make sense of maps, birds' eye perspectives, artists' conceptions, complex graphics, sections and elevations, and other potentially frustrating media. And with printed photo questionnaires rather than projected images, participants can complete the task at their

own pace. Most people find looking at photographs to be a positive experience. They are happy to participate, and need no encouragement to complete their questionnaires. Not only do they respond willingly, but also they are enthusiastic that their involvement is sought. It gives them a sense of ownership for the environment in question which, in turn, stimulates cooperation and goodwill when the project is completed (R. Kaplan, 1980).

Visual preference offers a means of simultaneously obtaining and sharing information. As with all surveys, interviews, and questionnaires, this methodology collects reactions by asking people to respond to questions. But, in addition, it also serves the function of providing information as well. Visual imagery brings with it so much other information. In reacting to photographs, participants experience the space depicted and the process of locomoting within the space. Such rapid and unconscious assessment provides important information to human functioning (S. Kaplan, 1979).

Presenting participants with visuals of both existing places or situations and a variety of feasible alternative solutions gives participants a sense of the range of possibilities and increases the possibility of their meaningful participation. And including verbal analogies to the photos provides a useful check on the responses to each.

Managers like visual preference assessments, too, because they generate information that is both useful and useable. Citizens give insights and opinions that can be important elements of decision-making. Decision-makers have a way of finding out what people care about, what they notice, how they might view changes; and they can reflect these concerns in management decisions. The preference ratings tell not only peoples' likes and dislikes, but their patterns of perceiving the environment. Decision-makers can find out what the important dimensions from the public's point of view are and whether different people perceive the environment differently. And the approach is readily adapted to many problems of environmental assessment.

Claiming that "the key to useful exchange with the general public is the provision of information in a way that is comprehensive," R. Kaplan (1979a) concludes that visual preference is a relatively straightforward mechanism for incorporating public input into decisions. She believes it increases the likelihood of avoiding the unpleasantness and frustration that so often characterize the manager/citizen interface. The characteristics of visual preference mentioned overcome many of the problems with citizen participation techniques cited in the literature (Heberlein, 1976b), and provide an opportunity for informed and meaningful participation in the planning process. There is every reason to believe the technique is valid for facilitating citizen participation in a wide variety of environmental and natural resource projects.

Summary

In the past two decades, citizens have demanded a more active role at every level of government. A number of interrelated factors have contributed to these pressures for increased participation in a wide range of issues. Certainly the alienation of people from government decision-making and their distrust of government agencies which have grown in size and power are among the most important reasons for the public's insistence upon greater power sharing.

Governments have responded to these pressures by more effectively making use of existing institutions, enacting new legislation and even establishing new agencies, and expanding research and experimentation to discover more effective ways of involving the public. While much has been written about techniques for facilitating citizen participation, little is based on empirical work. Practitioners and researchers have identified important research questions relating to techniques and have raised the importance of developing a theoretical model for any technique used.

Visual preference is a technique undergirded by a model proposed by S. Kaplan and R. Kaplan which provides a theoretical understanding of citizen participation and its significance in human behavior. Visual preference assessments using black and white photographs have proven valuable for facilitating citizen participation in a variety of settings and have many advantages over techniques traditionally employed. Visual preference offers promise as a tool for facilitating citizen participation in a wide variety of environmental and natural resource projects.

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Photovoltaics in the Soft Energy Path

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Abstract: *Large terrestrial PV systems have been dramatically demonstrated in the last four years, and DOE's R & D program has aimed at making PV cost-competitive for such applications within this decade. However, recent federal budget cuts and/or oil-company ownership of the larger PV firms could retard the development of the domestic PV industry, while other nations accelerate their programs.*

Introduction

This paper is meant to provide current information to environmental educators, to whom photovoltaics may be of interest because it is a potentially significant source of energy, it is environmentally benign, and it employs an essentially inexhaustible natural resource. As will be shown, part of its appeal lies in the fact that it is compatible with conventional homes, life-styles, and energy delivery systems; its use need not be limited to the ardently self-sufficient.

Today's typical solar cell is a circular wafer of silicon about 3" in diameter and .01" thick, encapsulated behind glass. When struck by sunlight it produces an electric current, about one-half to one watt under peak solar conditions. (Thus PV cells are rated in peak watts, or Wp). A module is a flat panel of, usually, several dozen connected cells. An array of one or two hundred modules on the roof of a house, their current directed through a DC-to-AC inverter, may produce as much electricity as the home consumes in a year.

The first solar cells powered instruments in satellites, in the late 1950's. Today they also provide electrical power for signal buoys at sea, electric fences on rangelands, corrosion control systems on pipelines, seismographic monitoring units, and other remote devices with small power demands. Although solar cells are very expensive, they are often less so than the operation of generators, periodic replacement of batteries, or extension of transmission lines which such uses would otherwise require.

However, if photovoltaic cells are ever to contribute significantly to the U.S. energy mix, they must become cost-competitive with utility power. Then, PV can find widespread use in residential, commercial, and industrial sectors. Recognizing the potential for this, Congress in 1978 passed the Solar Photovoltaic Energy Research, Development, and Demonstration Act, providing the U.S. Department of Energy with a rather sudden infusion of funds. Some of this money has been devoted to advanced R & D aimed at

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raising the efficiency and lowering the cost of PV cells, while some has been used to test or demonstrate the technical feasibility of state-of-the-art equipment in house-sized or larger applications. Some of these are described in the next section. Note that industries, utilities, and state governments as well as DOE contributed significantly to these projects.

Larger Terrestrial Demonstrations, 1978-1982

A. Grid-Connected Systems

In 1980 and 1981, a number of houses or house-like structures were completed which were "grid-connected" or "utility-interactive." At times their roof-mounted PV arrays produce excess electricity which flows into the utility lines; at other times, including night, they must draw upon the utility to meet their electrical demands. They have no battery storage, and their PV systems meet a significant fraction of a home's electricity demand. They have been and are being used to test different brands of cells, inverters, and related equipment, array tilt, climatic realm, the combining of PV with passive solar and conservation features, and other variables.

A typical example is a Florida house having a 640 ft^2 array rated at 5000 Wp, which produced nearly 8000 kWh in its first year, as compared to the 9000 used by the average American home. Occupation of the house was simulated by timers and thermostats (Litka, et al., 1981; Florida Solar Energy Center, 1981: 4-5; telephone inquiry.)[2]

A rather similar home in Phoenix has 7,200 cells which produced 5,463 kWh in nine months, or about 7,100 annualized (McNeill and Solman, 1981; telephone inquiry). A Massachusetts house is noteworthy because it combines PV with passive solar design and exceptional insulation in order to meet the challenges of a northerly climate, a very large living area, and an electric heating system. The house was expected to produce about 9,500 kWh/year, which would be 85% of its anticipated annual load (Nichols, 1981: telephone inquiry). The six monthly reports reviewed to date suggest that this goal will be met.

DOE funds have also helped to construct thirteen house-like structures at experimental stations in the Northeast and Southwest; a third climatic realm will be represented at the Southeast station. The thirteen arrays

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[2]Many individuals have responded promptly to telephone requests for recent technical reports and other sources of information. Some who have been especially generous in providing very new info directly by phone include Ed Burgess, Sandia Laboratories; Bob Campbell, Westinghouse Semiconductor Lab; Andy Glassberg, House Subcommittee on Energy Conservation and Power; Ed Kern and Burt Nichols, MIT Lincoln Lab; Barry McNeill, Arizona State University; Vincent Rice, DOE.

range from 500 ft^2 and 4,200 Wp to 950 ft^2 and 7,400 Wp (Kern, 1981: 3-5; Shaefer, et al., 1981). To date, the stations' monthly reports suggest that the fully operational systems will produce about 4,000 to 9,000 kWh/year.

The technical reports reviewed for this paper describe a number of monitored or simulated homes which use electricity for space heating, water heating, and air conditioning; these homes demand 6,000 to 22,500 kWh/year. Therefore, the experimental rooftop arrays might meet about 20% to 150% of the energy loads of these "all-electric" houses. (4,000/22,500 = 18%; 9,000/6,000 = 150%.)

The utility-interactive systems described above simulate conditions as they might be in a mature American market.

B. Stand-Alone Systems

Economists have noted the difficulty of leaping directly to such a market from that of today's small, remote applications. They have suggested that as PV costs are lowered, an intermediate market will develop for large but remote systems with battery storage and no utility connections -- so-called "stand-alone" systems. They believe this most likely to happen in developing nations where government purchases of community-scale facilities will occur (Costello, et al., 1979; Costello and Rappaport, 1980:346-347). This market is simulated more or less in the following three DOE-supported projects.

Natural Bridges National Monument in SE Utah is thirty-seven miles from the nearest power lines. In 1980 it became the site of what was then the world's largest photovoltaic power plant, a one-acre array of a quarter-million cells, rated 100,000 Wp. These are connected to a battery bank having two days of useable storage; a diesel generator charges the batteries when necessary. DC current from the batteries is inverted to AC to power the facility, consisting of six staff residences, visitor center, maintenance buildings, and water and sanitation systems. To date, the PV array has produced 80% and the generator 20% of the electricity used at the site, a total of about 60,000 kWh/year (Solman, et al., 1982; staff report, Sun Times, 1980; information obtained on site).

The Papago Indian village of Schuchuli, Arizona, is seventeen miles from the nearest power line. In December 1978, PV cells began powering a limited number of appliances -- two fluorescent lights and one small refrigerator per family plus a community water pump, washing machine, and sewing machine. The system uses battery storage, DC appliances, and only 3,500 Wp of PV cells. It has been noted that due to its imposition by an outside agency (the Indian Health Service of HEW), this project has not been a model of self-reliance, local initiative, and community acceptance (Adelman and Logan, 1980-1981:9-10; McKirchy & Baldwin, 1981:105-107).

With DOE funding, the University of Nebraska used PV at an agriculture research station. Their array was rated at 25,000 Wp, had a surface area of about 5,400 ft^2, and produced 36,000 kWh/year in the three years 1978–1980. Battery storage and DC-AC inverters were employed. Twenty-one percent of the PV output provided all power for irrigating eighty acres; the other end uses included grain drying and production of nitrogen fertilizer; utility power was also used for these purposes (Rullwinkel & Hopkinson, 1981).

C. Very Large Systems

Foregoing figures suggest that a 100,000 Wp array may meet the electrical demands of anywhere from six to sixteen homes. Table 1 summarizes the operating and scheduled U.S. systems of 100,000 Wp or greater (Burgess, et al. 1982; telephone inquiries). They are listed in chronological order, and are rated in peak kilowatts. (1 Wp x 1000 = 1 kWp.) A concentrator system uses lenses or mirrors to focus light on the cells; these concentrators "track" the sun, i.e. they turn with it each day. A range of numbers in the kWp column usually indicates a difference between rated and actual performance to date, or -- in Oklahoma city -- between flat plate performance and seasonal augmentation from fixed banks of mirrors. All of these projects were or are supported by DOE funds.

Table 1.

U.S. Photovoltaic Facilities, Operational or Scheduled, 100 kWp or Larger

Facility	Operational Date	kWp	Flat Plate or Concentrator	Stand-Alone or Utility-Interactive
Natural Bridges Nat'l Monument, Utah	Jun, 1980	100	FP	SA
Beverly High School, Massachusetts	Jan, 1981	95-100	FP	UI
Lovington Shopping Center, New Mexico	Mar, 1981	100	FP	UI
Mississippi County Comm. Coll., Arkansas	May, 1981	160-240	Conc	UI
Center for Science & Arts, Oklahoma City	Feb, 1982	100-135	FP	UI
Sky Harbor Airport, Phoenix	May, 1982	225	Conc	UI
Sacramento Municipal Utility District	Jun, 1984	1,000	Conc	Central Station
Georgetown University D.C.	Sep, 1984	300	FP	UI

Costs, and Research to Reduce Them

The retail price for panels, or modules, of cells has dropped from about $200/Wp in 1959 satellites to about $10 or less in terrestrial uses today. When "balance of system" costs are added -- inverters, supporting framework, concentrators, wiring, other associated hardware -- then recent prices range from $14 to more than $50/Wp for installed systems (Burgess, et. al., 1982: Tables 1 and 2). Systems using flat plates tend to be at the low end of this range, those with concentrators at the upper. At prices of $14-18, a homeowner with a flat plate, utility interactive system of 7000 Wp, producing perhaps 60-90% of his own electricity, can expect to pay about $100,000 to $125,000 for an installed system. Using an expected module life of about twenty years (Williams, 1979:14; D'Aiello, 1979:16), the estimated cost of PV power lies in the range of $.50-2.00/kWh, about an order of magnitude higher than the price of utility power today.

In 1978, DOE and Congress established a schedule of price goals which would make PV power competitive with conventional power. The 1986 goals, in 1980 dollars, were $.70/Wp for modules and $1.60 to $2.60 for installed systems. These translate to $.05-.10/kWh, comparable to utility rates. With moneys from the Solar Photovoltaic Energy Act of 1978, DOE has funded a variety of research efforts aimed at achieving the price goals, and the private sector has spent similar amounts of its own funds on such research.

One effort is toward an eight-fold reduction in the price of the high-quality silicon which is used (Stefanides, 1982). Another is to change the way in which the silicon becomes a cell. The conventional procedure is to grow a cylindrical silicon crystal and then slice it into very thin wafers. This is slow, and half the silicon is lost as sawdust. But Westinghouse has learned to grow the crystal as a ribbon, 1" wide and .005" thick (Roberts, 1981). This has two clear advantages. When the ribbon is cut into rectangular cells, there is no significant sawdust loss, and the rectangles can completely "pack" a module, eliminating the space wasted by circular cells. This reduces the cost of glass, metal circuitry, and other materials used. The first Westinghouse module of this type was produced in 1981. The company plans to have a commercial-sized production facility operating by the mid-1980's; two California utilities are partners in the venture.

Another research avenue departs from single-crystal silicon. The idea is to spray or coat a very thin film of PV material on a metal backing. Materials used to date include amorphous (non-crystalline) silicon, gallium arsenide, cadmium sulfide, and other semiconductors. RCA, particularly, has done considerable R & D work with amorphous silicon film.

Other research aims to improve the operation and lower the cost of concentrators, inverters, and other balance of system components. It seems safe to say that tomorrow's PV systems may be rather different from today's.

Toward the Future

Several models for large scale PV use have been envisioned. They are not mutually exclusive. One consists of 60 to 100 cell-covered satellites, placed into orbit in the first quarter of the next century. They would beam power to terrestrial stations in the form of microwaves, and produce about one-fifth of U.S. electricity. The scheme has received much criticism for a number of reasons, including its very high cost and the possible danger of the microwaves (Miller, 1982:336-337).

A less exotic conception is that of central PV power stations operated by utilities; one of these would probably have only about one-tenth the power output of a conventional power plant (Ehrenreich and Martin, 1979:28), but would still be 100 times as large as the pioneer facility planned for Sacramento.

The third model consists of individual homes which are grid-connected, such as the ones described earlier, selling their excess output to the utility at perhaps 50 to 80 percent of the utility's price to them. The potential of this model is very much an unknown; if the output of such homes exceeds ten to twenty percent of the power in a utility grid, technical (McNeill and Solman, 1981) and economic (Redfield, 1981:20-24) problems could be significant. (For example, peak demand and peak production would match only at times of high air conditioning use.)

The fourth model is that of stand-alone systems for individual homes or neighborhoods. At today's high PV prices there are few pure examples, but quite a few hybrids. A modern home outside Santa Barbara uses propane, wood, passive solar, and a 400 Wp photovoltaic array as its energy sources, with no ties to the utility (Lindsley, 1981; Watts, et al., 1981:7.3-7.4). As PV prices drop, we can expect PV to assume a greater role in such systems, as compared to fuels such as wood or propane. Thus, such domestic use could be an important fraction of the intermediate market discussed earlier.

Descriptions in popular magazines of the new demonstration homes and the federal price goals have probably generated great expectations among their readers. But various sources are somewhat pessimistic about the attainment of the DOE price goals, e.g. Smith (1981:1478) and Whitaker (1981:46).

With regard to actual deployment, a study by the American Physical Society concluded that PV systems were unlikely to exceed 1% of U.S. electrical production in the year 2000, and that to produce more than 5% "would be extremely difficult" (Ehrenreich & Martin, 1979:29). Since APS projects a doubling of annual U.S. electrical generation to 50 quadrillion BTU's or Quads (Q) by the year 2000, their figures of 1 to 5% convert to 0.5 to 2.5 Q/year. Others make similar projections for the same year: Union of Concerned Scientists, 1-4 Q; National Audubon Society, 0.7 Q; MITRE Corporation, 0.2 Q (National Audubon Society, 1981:48); DOE, 1 Q (General Accounting Office, 1982: Appendix 1, pages 1,3). Generally, these and other sources anticipate rapid deployment in the first quarter of the next century.

Of course, the energy and environmental policies of each administration will affect PV. The Photovoltaic Energy Act of 1978 authorized DOE to use about $150 million per year for ten years, developing PV. The annual budget proposals of President Carter and appropriations of Congress followed this plan closely. But President Reagan's proposal for Fiscal Year 1982 was only $54 million, and Congress's compromise appropriation of $74 million was less than half that of the preceding year. Mr. Reagan's FY 1983 proposal was a mere $27 million, and the Congressional appropriation $63 million. (Note that the current administration has simultaneously increased funding for nuclear fission, and proposed the elimination of renewable energy tax credits.)

In July 1981, Rep. Richard Ottinger, Chairman of the House Subcommittee on Energy Conservation and Power, asked the General Accounting Office to undertake a thoroughgoing study of the probable effect of such funding cuts on the future of PV. GAO's report of March, 1982, seems to be the definitive reference on the topic at present (General Accounting Office, 1982). Its principal findings and conclusions:

- DOE's funding is now limited to long range, high risk R & D aimed at such possibilities as thin films of new materials; funds even for this area have been much reduced.

- The federal price goals described earlier will now have virtually no chance of being met. They may be delayed only a few years, however.

- After having done virtually all of the pioneering work in PV, the U.S. will now probably relinquish its dominance of the world market, in which it had 85% of the 1979 and 1980 sales. In certain other countries, federal support is increasing while that in the U.S. is being reduced. Japan's support of amorphous silicon thin film research could give it dominance in the world market.

- Small businesses will now be unable to survive in the PV industry. Previously, they had received some protection from the requirement that DOE allocate at least 10% of its total PV budget to small firms. This requirement was included in the Solar Photovoltaic Energy Act because such firms, being high risks, are unable to attract private venture capital, however innovative their ideas or satisfactory their products or research.

Related to this last finding are the issues raised by Stambler and Stambler (1982). They demonstrate that the several largest domestic PV companies were founded independently, but are now owned wholly or in large part by major oil companies. These can afford to underprice potential competitors, and thus are free to retard PV progress until they have profited fully from their prior investments in nuclear and fossil fuels.

Similar criticisms are developed at greater length in other sources (Reece, 1979; Citizens' Energy Project, 1980). Any attempt to evaluate these allegations would be beyond the scope and intent of the present paper.

The Potential of PV

In the literature reviewed to date, the few sources which speculate on PV's potential estimate that it can account for up to 30% of domestic electrical production. This would translate to 10-15% of total U.S. energy consumption in typical scenarios. But these sources seem to limit their predictions to end uses presently driven by electricity. However, as cells become more efficient, and as energy storage materials and devices become more diverse, efficient, and lightweight, might not PV be applied in more diverse ways? At the Phoenix home described earlier, battery-powered commuting cars are charged from the house current and are reported to achieve ranges of over sixty miles (Crozier, 1981). Similar vehicles are delivering fifty miles with a load of four passengers, or seventy-five with two (Behr, 1979). An automobile at Tel Aviv University is reported to get one-third of its daily fifty-mile range from its own rooftop PV cells, the rest from house current. Researchers there plan to double its range while charging it from a stationary PV array (staff report, Mother Earth News, 1980).

Such reports fuel the imagination, prompting it to soar on the wings of the Solar Challenger, which in 1981 carried a man 163 miles from France to England, powered solely by its own cells.

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