Environmental education and ecological rehabilitation: a synthesis

Andrea Gardiner Stephens

The University of Montana

Let us know how access to this document benefits you.

Follow this and additional works at: https://scholarworks.umt.edu/etd

Recommended Citation
https://scholarworks.umt.edu/etd/7338

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.
Environmental Education and Ecological Rehabilitation: A Synthesis

by

Andrea Gardiner Stephens
B.S., University of Puget Sound, 1986

Presented in partial fulfillment of the requirements for the degree of Master of Science University of Montana 1991

Approved by

Chairman, Board of Examiners

Dean, Graduate School

Date

May 26, 1992
Acknowledgments

I wish to thank the following people for their unflagging support of my work: Dr. Ron Erickson for participating in this project from its conception (with the Restoration Ecology course), and for encouraging this oft' diffident student along the way; Dr. David Bilderback for helping me crystallize initial ideas; and Dr. Ralph Allen for his excellent advice and aid.

My appreciation goes to Tom Roy for lending an empathetic ear; and to Dr. Lee Metzgar for thoughtful dialogue, and for shaping the direction of my work and thought.

To David McEvoy: my love and gratitude, for his encouragement, understanding, and patience over the past two years, and especially during the writing of this paper.

And finally, to my parents, for their support and prodding: my love and thanks!

Dedicated to the powerful landscape of northern Minnesota, where I was changed by a "significant life experience."
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acknowledgments</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td>Chapter 1. Introduction: Current Directions in the Field of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental Education</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Chapter 2. The Educational System and Environmental Education:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Problems and Prospects</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Chapter 3. The Values Issue in Environmental Education</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Chapter 4. From Knowledge to Action: The Potential of Ecological</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rehabilitation</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Chapter 5. Curriculum Applications</td>
<td>77</td>
</tr>
</tbody>
</table>
Chapter 1

INTRODUCTION: Current Directions in the Field of Environmental Education

Environmental education (EE) is a response by educators and others to the perception that the Earth is plagued by serious problems. These are not, as some argue, simply matters of changing climate or increasing population or income (Simon, 1989). Our environmental problems cannot be overcome solely through increases in the strength of economic and social systems, nor can they be solved entirely through technological advances.

This paper rests on the belief that most environmental problems result from our environmentally destructive attitudes and values, and from the behaviors they engender; from a lack of ecological understanding, including the effects of our behavior on the environment; from a lack of a bond with the natural world; from a lack of knowledge about, and motivation to engage in, environmentally responsible behaviors; as well as from the overpopulation of the human species.

These beliefs are common to most environmental educators; the guiding assumption behind EE is that our environmental problems require, in part, education and personal action. My specific interest in the following chapters is in the practice of environmental education in individual classrooms. I shall first review current directions in the field of EE; second, discuss problems of our
educational system in general, which I believe can be addressed through a sound program of environmental education; third, explore the issue of the lack of values education in EE programs; and fourth, propose ecological rehabilitation as one process which can help correct some of the deficiencies in both general educational practice and in environmental education. Moving from the abstract to the specific, I will conclude the paper with a practical application of my ideas: an outline of several units on ecological rehabilitation which could be integrated in a traditional curriculum.

The methods we choose for addressing problems depend largely on the way in which we define those problems. Similarly, the creation of curricular objectives in environmental education depends on how we define the solutions to environmental problems.

Practitioners have perhaps always believed that human behavior is an important key to solving environmental problems. However, strategies for behavioral change, manifested in curricular objectives, have changed over the years as educators refine their notions of how to influence behavior.

Typically, most environmental education programs have operated on the assumption that if we could either reconnect people with the wonder of nature, or inform them about environmental problems, they would eventually act in environmentally positive ways because of a deeply felt response to beauty or threats to that sense of beauty (Hungerford & Volk, 1990).
In a national survey, Childress (1978) found that the primary objectives of most public school (formal) EE programs were awareness of environmental problems, knowledge of natural history and science, and appreciation of the natural environment.

Most formal environmental education efforts either focus on specific environmental problems or general topics in natural history. At the elementary level, the vast majority of formal EE programs take the form of outdoor and conservation education, nature study, and energy education. Most secondary programs consist of science, technology, and society (STS), energy, and conservation education (Disinger, 1989).

A primary emphasis on nature study and appreciation is prevalent among the nonformal environmental education centers with which I am most familiar. These facilities offer an array of ecology courses, almost entirely outdoors, as well as a variety of group bonding exercises, initiative courses, and traditional recreational activities. Many teachers use the week spent with their students at these centers as the major EE experience they offer students.

In a typical ecology course, dealing with streams, for example, instructors spend perhaps fifteen minutes indoors with a group, covering introductory issues concerning the water cycle, types of measuring equipment, and their use. The group then walks to a field site, collects aquatic insects, and measures dissolved oxygen, pH, flow rates, and temperature. Back inside at the conclusion of the two hour class, students key out insects to order, and discuss
effects of water temperature on dissolved oxygen, and the implications for various species of fish and insects. The courses deal almost entirely in knowledge of natural environments and simple field research methods. Rarely do instructors address environmental problems or associated social issues.

In the past ten years, however, researchers and educators have come to believe that the majority of EE programs aren't sufficient in their scope or focus. Conservation education, for instance, with its emphasis on game management, agricultural land use, and conservation of soil and water resources, doesn't sufficiently address global or urban environmental problems, or widespread cultural attitudes.

Experiences such as Van Matre's Acclimitization exercises (1972), designed to put students in touch, literally, with the natural world, and awareness-based education programs are likewise limited. They haven't necessarily prepared students to DO anything with their new awareness. Environmental education seems to have created "emotionally charged...ecologically concerned citizens," who have not yet made the crucial step to action (Gigliotti, 1990). As Van Matre writes (1990):

you wouldn't claim you had a satisfactory reading program if most of your learners couldn't read at the end...but many leaders will say they have a complete EE program even though most of their learners don't end up doing anything specifically to live more lightly on the earth.
Thus, the new trend in EE is to discard the old model of behavioral change in which knowledge, or awareness, leads linearly to improved attitudes, and ultimately to responsible action. Educators are becoming more aware, in Matthiessen's words (1978), of "that aching gap between what I know and what I am." Consensus has been reached, at least in the literature, on the aims of environmental education: "support has grown among environmental educators for the importance of developing individuals who behave responsibly...it can now be said that the development of environmentally responsible and active citizens has become the ultimate goal of environmental education" (Hines, et al, 1987). With this newly realized, or reinforced, statement of purpose comes a concurrent realization that we need to reassess our beliefs about how to influence behavior.

In a seminal article, Hines, et al (1987) review the behavioral literature and describe a model integrating the many components of behavior (fig. 1). The model synthesizes the findings of a number of studies on environmental behavior (for instance, see Asch & Shore, 1975; Ramsey, et al., 1982; Sia, et al., 1985/86; and Jordan, et al., 1986).

Most of the studies the authors surveyed conclude that knowledge of and skill in applying action strategies is a critical component in environmental behavior. Obviously, this is an important finding since most energy in the past has been directed at the awareness level.
Attitudes are defined as an individual's feelings toward the environment or particular aspects of it. Locus of control refers to an individual's sense of his or her own ability to bring about change. Individuals with an external locus of control attribute change to chance or to powerful others. An internal locus of control gives an individual the sense that his or her own actions will be effective.

The model synthesizes the findings of a number of studies on environmental behavior (for instance, see Asch & Shore, 1975; Ramsey, et al., 1982; Sia, et al., 1985/86; and Jordan, et al., 1986). Most of the studies the authors surveyed conclude that knowledge of and skill in applying action strategies is a critical component in environmental behavior. Obviously, this is an important finding since most energy in the past has been directed at the awareness level.

We ought to be careful, however, that the emerging emphasis on behavior does not come entirely to define the goals of environmental
education. For example, Hungerford, et al. (1980) have outlined a set of EE objectives, the four levels of which are as follows: ecological foundations, conceptual awareness, investigation and evaluation of environmental issues, and action skills.

From these goals, the authors have developed curricular materials aimed at investigating and evaluating environmental issues. These materials have been created in response to the lack of EE materials which actually focus on environmental problem solving. Synthesis of various alternative solutions into a comprehensive plan, evaluating value systems and their effect on human behavior, learning to identify and define environmental problems, and actually solving environmental problems are typically not objectives at all of formal EE programs, (Childress, 1978).

Providing opportunities for students to apply knowledge, to develop ownership for problems, and to be given responsibility for "real-world" solutions is obviously an important goal not only for effective environmental education, but for good general education as well.

However, for several reasons, we ought to be concerned with the strong emphasis in the literature and in curricular projects on achieving behavioral change solely through teaching action skills. Current behavioral research seek to isolate particular variables most associated with environmentally responsible behavior. This reductionist approach is simply not always appropriate; to the degree that practitioners, in an attempt to be efficient, cling to the "most parsimonious set of the variables" (Sia, et al., 1985) and
direct educational efforts solely towards them, a holistic approach may be lost.

A problematic aspect of most of the action strategies called for in the environmental education literature is that they deal with examination of relatively large scale social/environmental issues and their resolution. The skills called for, termed citizenship skills, have been categorized as follows by Ramsey, et al., (1982): persuasion, consumerism, political action, legal action, and ecomanagement (e.g., tree planting). Certainly environmental educators would like to develop active citizenship in their students, to motivate students to be informed and participate in the political process on some level. Yet it seems equally important, if not more so, to help students develop environmentally responsible habits and lifestyles. As Gigliotti (1990) points out, "environmental education has produced...citizens who, armed with ecological myths, are willing to fight against environmental misdeeds of others but lack the knowledge and conviction of their own role in the environmental problems."

A strict focus on action skills may lead to the notion of students as objects to be manipulated toward a specific desired end. In addition, we may not be preparing students for the long term. We may teach students how to analyze environmental problems, collect data, influence policy, work cooperatively, but their actions in the classroom and in the future need to be informed by a strong set of environmentally healthy values and attitudes. The love of nature, the bond with a place, and a strong sense of values concerning the
environment will surely sustain students throughout their lives, even when their actions are unsuccessful or when they must decide on new actions in an unfamiliar arena.

Sia, et al. (1985) recognize that attitude, or sensitivity to the natural environment is a critical component of EE and argue that curriculum developers must not neglect this variable. Perhaps one way to maintain an integral emphasis on attitude is for environmental educators to "join forces with values/moral educators" as Newhouse (1990) suggests. However, it may be the case that formal educational programs have little influence over long-term personality factors such as attitude (Hines, et al, 1987). In this case, comprehensive EE programs must rely to some extent on nontraditional or nonformal programs to supplement their structured, cognitive efforts. Nature centers, student outing clubs, summer programs, etc., can all play an important role in shaping student attitudes by providing them with emotional experiences outdoors.

Keeping in mind the breadth of variables which influence environmentally positive behavior, the following are broadly defined environmental education goals:

Knowledge - to provide students with sufficient ecological knowledge to permit them to eventually make ecologically sound decisions with respect to environmental issues.

Awareness - to help students acquire an awareness of environmental problems and issues, and of the ways varying individual and group values, beliefs, and behaviors impact the
environment; to introduce them to a variety of value systems; to make students aware of the alternatives available to them in solving or preventing environmental problems.

Sensitivity - to provide students opportunities for positive outdoor experience in both natural and degraded environments, with emphasis on the affective, or emotional, realm.

Attitudes-to help students acquire feelings of empathy, personal responsibility, and dedication to acting positively on behalf of the environment; develop a sense of empowerment both collectively and as individuals; and develop motivation to actively participate in solving and preventing environmental problems.

Skills-to help students acquire skills in the following arenas: identifying and investigating environmental problems, and a variety of alternative solutions to those problems; actually solving or preventing community environmental problems; and developing skills in their personal lives for living with less impact on the Earth.

Participation-to provide students with opportunities to be actively involved at all levels in working toward resolution of environmental problems (adapted from Tbilisi conference declaration, 1977; Hungerford, et al., 1980; Tanner, 1980; Hines, et al., 1987).

It would be fair to call this statement of goals a definitional standard for environmental education. In this sense, EE programs may be evaluated for their quality, and their effectiveness in implementing these objectives.
Obviously, each individual effort in EE cannot begin to address all these objectives. But a comprehensive (e.g., school district-wide, or state-wide) plan can seek to incorporate the whole set of goals in a number of different efforts, including formal elementary and secondary curricula, and nonformal programs. Individual educators need to understand the role of their program in a larger scheme. Thus, while conservation education programs are necessary, they are not sufficient. Likewise, nature centers which deal strictly with nature study and appreciation aren't sufficient on their own to function as the sole EE experience of students.

Educational approaches to environmental problem solving need to be defined broadly to include knowledge, behavior, values, attitudes, and motivation. We come closer to teaching quality environmental education the more we can address all of these variables.
Chapter 1
Reference List


Chapter 2
The Educational System and Environmental Education: Problems and Prospects

Reports of American educational failure, declining test scores, and the poor rankings of our students on international standardized tests seem to surface every week in the newspapers and major periodicals. Science and math education, in particular, are receiving great attention and funding from such sources as the National Science Foundation and the American Academy for the Advancement of Science to try to reverse these apparent trends. At risk seems to be the country's global economic position and our status in the fields of science and technology. Fears of losing our ranking provide the catalyst for innovation and energy in curriculum development.

Yet as far as the field of environmental education is concerned, our national capacity to compete with Japan or our high schoolers' ability to outscore their Asian or European peers is rather low on the list of reasons to reexamine the American educational structure. We need to push for educational reform because the poor state of our environment demands, at least in part, an educated and motivated public.

The field of EE, with its agenda of interdisciplinary, experiential education, can make an important contribution to educational reform. It can do this partly by integrating "knowing, caring, and
practical competence" (Orr, 1989) in a comprehensive educational program. In this chapter, I will explore some of the problems I see in our educational structure, and ways in which environmental education can contribute to improvements.

It seems important that we begin to break down some of the arbitrary barriers students come to take for granted. For instance, by avoiding environmental issues, schools teach students that the natural and social sciences are academic affairs, with little application to the everyday world of students or their community.

Students learn the classroom is a distinct environment from the community; much of the science curriculum, for example, is based on generic textbooks written not for any one place, but for a general discussion of concepts. Textbook examples are as likely to come from another continent as from one's own state. While it is critically important to expose students to the biological wealth found around the world, and to general concepts of which no local examples may be found, we almost never turn the focus of student examination toward their own familiar regions. The community rarely is a place for study, and almost never the focus of personal responsibility. Even if teachers are daring enough to take students outdoors for a field trip or field work, the majority of these lessons rarely go beyond natural history or environmental science to address related political or social issues.

I would like to see the local community become a place for study for a variety of reasons. First, the concreteness and imminence of local issues may stimulate interest and motivation to learn and act.
In the pragmatic tradition of Dewey, Rogers' experience in therapy lead him to the conclusion that "significant learning occurs more readily in relation to situations perceived as problems...[we ought to] permit the student, at any level, to be in real contact with the relevant problems of his existence, so that he perceives problems and issues which he wishes to resolve" (Rogers, 1961). While local issues may not be inherently more captivating than global ones, it seems likely that students' motivation will be increased by focusing on problems which directly affect them and their families daily, and over which they may have some direct effect.

This is not to say we should ignore global problems or that we shouldn't try to apply concrete examples to broader issues. But continuous focus on problems elsewhere can be an escape tactic, so that neither teacher nor students has to face controversial issues or the very real fact of personal accountability. I hope not to teach students that "it is sufficient to intellectualize, emote, or posture about [environmental problems] without having to live differently" (Orr, 1989).

Focusing on their community also helps students become familiar with their own place on Earth. Part of the basis for an environmental ethic is a sense that our own landscape is unique, and as worthy of care, respect, and protection as any national park. As students become more invested in their own environment, they may become more committed to acting positively in its behalf.

One excellent model for the integration of school and community is the Foxfire project, initiated by English teacher Eliot Wigginton in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Rabun Gap, Georgia. Wigginton's high school students research and write articles on local cultural heritage for the journal they publish, named *Foxfire*. One of the most motivational aspects of the Foxfire project for students is that they have directed their energy back into the community. As a few examples of their many projects, Wigginton and his students have built, on land acquired with book profits\(^1\), a community museum of local artifacts; helped a local man edit and publish his journals, begun in 1934; and helped another local start a mail order business for his handmade wagon wheel rims (Wigginton, 1975).

Spin-off programs in other parts of the country are having similar effects. State Offices of Historic Preservation are grateful for the research data students are collecting. In an article in *Historic Preservation*, the director of the American Folklife Center at the Library of Congress comments, "Foxfire has been a wonderful major development in cultural conservation" (Graham, 1989).

Wigginton feels strongly about the potential of students in their own communities:

> I'm afraid we've become a nation of nomads with no sense of that security or serenity that comes from being able to say, 'Here is where I belong. Here is my place, my time, my home, my birthright, my community. Here I am loved and known, and here I love in turn'...The only way I can see to get our kids committed to our neighborhoods and our communities is to get them so involved in their surroundings that they become determined that the

\(^{1}\) The *Foxfire* journals have been compiled and published as a series of books, titled *Foxfire 1*, *Foxfire 2*, etc.
community's destiny will be in their hands, not in the hands of commercial rapists. They must feel that they are essential to the future of their homes (1975).

Environmental educators would do well to consider some of the thinking evolving in the bioregional movement, which focuses on the particulars of place rather than on abstract or faraway environmental problems. "Bioregionalism specifically values the local and the regional, seeing the revitalization of local places, peoples, and cultures as perhaps the only sure way of healing our planet," (Plant, 1988). While we certainly need groups watchdogging the federal government, big business, and large scale environmental problems, at the middle and high school level we may need to scale down to a much smaller, more manageable level.

As Berry argues, the environmental movement itself, with its focus on the planetary, may be describing the "problem in such a way that it cannot be solved:"

The word 'planetary' refers to an abstract anxiety or an abstract passion that is desperate and useless exactly to the extent that it is abstract. How, after all, can anybody - any particular body - do anything to heal a planet?...The question that must be addressed, therefore, is not how to care for the planet, but how to care for each of the planet's millions of human and natural neighborhoods, each of its millions of small pieces and parcels of land, each one of which is in some precious and exciting way different from all the others (Berry, 1990).
By emphasizing the local community, environmental education at the individual classroom level can begin to teach students the necessity of caring for their specific environment, and provide them the skills for doing so.

It is likely that an initial bond with a particular place later leads to a more global environmental concern (see Tanner, 1980). If this is true, then in the quest for developing environmentally affirmative citizens, we ought to be helping students develop ties, both emotionally and intellectually, to their community.

One may say that we should care for trees and plants, rocks and waters, animals and people because all things are both fundamentally related to each other and are manifestations of the same life principle. This compassion would be made concrete by reference to one's own particular geographical context and social history (Zimmerman, 1990).

Not only would this general concern be made concrete, it might in fact develop, and radiate, from the initial, concrete love of a specific environment.

In addition to breaking down barriers between school and community, it also seems useful to eliminate some of the arbitrary walls between school subjects. The very structure of schools teaches students that the different courses have little relation to one another, and that one shouldn't try to apply in a class what one has learned in another (except, perhaps, for basic reading and math skills). Schools typically teach us that:
English is not History and History is not Science and Science is not Art and Art is not Music, and Art and Music are minor subjects and English, History, and Science major subjects, and a subject is something you "take" and when you have taken it, you have "had" it, and if you have "had" it you are immune and need not take it again (Postman & Weingartner, 1969).

Problems humans encounter, and the skills needed to solve those problems, or adapt to them, are rarely restricted to the content of a school "subject." If solutions and skills transcend discipline boundaries, how can we expect students to become adept at solving problems when we teach the components of knowledge, but not the synthesis of many areas of knowledge?

Most schools continue to treat subjects as discrete, independent courses of study, rather than to emphasize the problems to which those subjects, in concert, naturally apply. Part of the problem, Disinger (1990) points out, is that:

in school settings, interdisciplinary content has no clearly identified curricular home, and is not seen to 'fit' in settings which place a premium on disciplinary rigor. Also, educational leaders, curriculum planners, and textbook publishers have not placed priority on interdisciplinary topics.

Environmental education, with its roots in the study of ecology, ideally promotes the concepts of interdependency and of the necessity of addressing problems from a variety of perspectives, integrating and synthesizing knowledge from diverse fields. Yet, Orr (1989) contends, "despite a decade or more of discussion and experimentation, interdisciplinary environmental education remains
an unfulfilled promise. The failure occurred...because it was tried within discipline-centric institutions."

Environmental education hasn't been a particularly effective tool for promoting interdisciplinary study because we have tried to force it into an existing framework. Instruction usually comes in the form of units included in the flow of an otherwise traditional course (Engelson, 1989). This method probably has an impact similar to the historical practice of designating "Women in Science Week", or "Native American Appreciation Day": students learn implicitly that these are out-of-the-ordinary topics. ("For 35 weeks out of the year, we study history; for one week, we study the exceptions.")

Engelson (1989) calls this type of teaching "insertion," and considers it equivalent to teaching a wholly separate course. He prefers, as do many other educators, the "infusion" of environmental subject material, such that environmental education is built into every subject area at every grade level: everything taught will somehow be related to the environment. Of course, some subjects will be more applicable to environmental topics, but "all have a role to play" (1990). The assumption is that if teachers of diverse disciplines infuse environmental topics into their courses, students will come to realize the environment is related to everything else they study, hence they'll be receiving an interdisciplinary education.

The infusion process is problematic for several reasons, however. Environmental material is typically inserted, or infused, into a single topic: science (mostly biology). In a survey of all 50 state education agencies, Disinger (1989) found that, of 40 returns, 36
reported that infusion was the chosen method of inclusion of environmental education. 57% of these reported environmental education was infused in only science or biology courses. 72% reported science/biology and social studies as the only subject areas of inclusion. Only 25% reported social studies as a target subject; none listed social studies exclusively. One state each listed language arts, agriculture, and Science, Technology, and Society study. None listed math. Studies of teachers in western and midwestern states revealed similar findings (Ham & Sewing, 1987; Simmons, 1989). Students are clearly being taught that environmental issues, if they are addressed at all, are scientific issues.

Even if environmental education were infused equally throughout disciplines, and if teacher training and curriculum materials were exceptional, interdisciplinary study wouldn't necessarily be the result. A high school offering literature courses which address nature writing, social studies courses which delve into socially-related environmental problems, and science courses which focus on environmental science may be exposing students to environmental topics, but unless teachers actively integrate material and methods from other disciplines, students may not make the conceptual leap to synthesize those ideas themselves.

Furthermore, the EE program will still "be limited by the theoretical structures and presuppositions of existing educational practices" (Rejeski, 1982). Environmental education must maintain its own set of goals and priorities. It shouldn't simply serve as a
means toward the end of other subjects, or as a "subliminal bonus" (Van Matre, 1990).

This may imply we need to create separate, environmental education courses, perhaps centered around issues, which offer students the chance to look at whole problems from the perspective of a variety of disciplines. Van Matre (1990) suggests adding separate EE courses at the 5th, 8th, and 11th grades, to round out an EE program dedicated to the infusion model. Individual EE courses are being offered as electives in some schools, but in most cases, financial and administrative constraints overwhelm teachers who might initiate extra EE courses (R. Hanbey, G. Bisbee, pers. communications, spring, summer, 1991).

We may need to develop, and advertise, model EE courses to help sell the notion to administrators. For example, science teacher Gina Long has introduced an environmental education class this year at Two Eagle River School in Ronan. She is teaching two sections of the course, which is centered around the theme of the four aspects of a traditional medicine wheel: earth, air, fire, and water. Students spend a great deal of time in the field, taking trips to such places as a mining site on the Clark Fork, an organic farm, a fish hatchery, and a sewage treatment plant. She has received a great deal of administrative support for this course, but runs them on an almost nonexistent budget (Long, pers. comm., fall, 1991).

Russ Hanbey, a special education teacher in Seattle, is also offering for the first time two sections of a separate course in environmental education. The course explores current environmental
issues, wilderness management, ecological restoration, waste reduction, environmental occupations; all students complete independent projects of service to the community or to the environment (Hanbey, pers. comm., fall, 1991). While separate courses are not the norm, a number of schools now offer them, providing excellent opportunities for students to engage in active, interdisciplinary experiences.

In addition to entertaining ideas of separate EE courses, we need to try to improve the current infusion system already in place. Preservice and inservice training for teachers is imperative in helping teachers who may have no background in environmental studies or have been given no guidelines on how to infuse environmental topics into their specific courses. Ham & Sewing (1987) point out that pre-service teacher education typically places environmental education into science methods courses, preconditioning teachers to assume EE belongs only in science classes.

One radical way of improving the current infusion process would be the dissolution of a compartmentalized educational structure in favor of large blocks of time devoted to an "interdisciplinary laboratory." (Orr, 1989). A middle school in Georgia is experimenting with this idea: students take one single course, taught by the science, math, social studies, and reading teachers together. Three hours and 20 minutes long, the course integrates all four subject areas in an effort to make the point that "real life problems rarely come labeled as 'chemistry' or 'math,'" (Culotta, 1990).
In Montana, middle schools come closest to accomplishing this interdisciplinary ideal, as opposed to high schools and junior high schools, which steadfastly remain wedded to the ideal of disciplinary compartmentalization. In addition to their normal planning period, core teachers (English, math, social studies, and science) at the middle schools are given one joint planning period for the purpose of synchronizing their efforts in the classroom.

Other steps toward interdisciplinary study are being taken by some of the leaders in the current science education reform movement. For example, the Scope, Sequence, and Coordination project, initiated by the National Science Teacher's Association, aims to break down some of the barriers between subjects through implementation of a "horizontal" curriculum. Instead of offering earth science, biology, chemistry, and physics in a 9-12 sequence, SSC director Aldridge suggests schools integrate all four topics in each of the four high school grades (Aldridge, 1989).

The second, and more difficult, task of SSC, is accomplishing integration of the sciences in a thematic model. For instance, the topic Light might be approached from physical, chemical, biological, and geological angles in a single unit. Discussion of successes and failures of model school programs should be published by NSTA in the next few months.

Project 2061, a program of The American Academy for the Advancement of Science, is also currently piloting projects in schools around the country. 2061's motto is "Science for All Americans," and the approach is similar to Scope, Sequence, and
Coordination: integration of the sciences, as well as technology and communication, for the purpose of promoting scientific literacy (see Rutherford & Ahlgren, 1990).

Science reform may help validate the novel interdisciplinary approaches to education that EE proposes. The move toward teaching science and social studies thematically, with environmental issues at the core, is an excellent step toward integrating environmental topics into the curriculum as well as offering interdisciplinary study opportunities.

Interdisciplinary systems are not impossible. We need, among other things, more model programs, more flexibility and support from administrators, and more motivation on the part of teachers to initiate such efforts, but the idea is not beyond reach.

Much of the success of these programs probably depends on the extent to which students are involved actively in their own learning. Environmental education specifically encourages teachers to move away from a traditional lecture format. In our daily lesson planning, rather than focusing mostly on what information will be covered (i.e. what we will say) we need to think in terms of the activities we will arrange for students (i.e. what students will do). "Active learning" should be both mentally and physically active, getting students out of their desks, out of the classroom, and out of the standard practice of memorization of facts.

Student motivation is increased as we replace lectures with student-directed activities, but this practice also encourages responsibility. In my experience, students want to be given
responsibility and a voice. Certainly the ability to take responsibility needs to be refined in most young people, but responsibility often engenders responsible behavior. Responsibility, active learning, and motivation are probably inextricably related; any time we can encourage one of these it seems the others will follow.

If we want to develop active, motivated citizens, we not only need to allow students to be active, we need to provide opportunities for students to take action. Simply talking about action won't do. Local environmental problems provide excellent opportunities for students to become involved and practice their citizenship skills. Hammond, advocating curricula which emphasize opportunities for community action, writes:

thinking skills programs are part of a widespread educational 'bandwagon' currently travelling throughout North America. Most focus on 'meta thinking' (thinking about thinking) with few programs that engage students in acting on thinking or thinking while acting. Environmental education programs provide a rich opportunity for practicing thinking in context while acting on community problems of worth.

Since skill in solving environmental problems appears to be an important factor leading to action, (see Hines, et al, 1987; Asch & Shore, 1965; Jordan, et al, 1986) we need to involve students in actively investigating environmental problems and resolutions, and to teach them the skills involved in doing so. Ramsey, et al (1982) break citizenship skills down into the following categories: persuasion (e.g., letter writing, debate); consumerism (e.g.,
boycotting, discriminating use); political action (e.g., lobbying, voting); legal action (e.g., injunction); and ecomanagement (e.g., reforestation, urban landscaping).

Because I believe we ought to help students focus on personal action, as well as on civic action, I would add the following, more basic, behavioral traits: skills in group conflict resolution and cooperative action; in active listening (clarifying the position of another, empathising, remaining non-judgmental); in values clarification (stating one's own position or opinion, being able to provide the value position associated with one's own as well as others' opinions); and in information acquisition (ability to formulate or refine questions; ability to find sources of information; interviewing skills). Perhaps we also ought to emphasize skills in living with less: decreasing our dependency on the products of industry, etc.

Unfortunately, teachers often shy away from teaching advocacy, or from allowing students the opportunity to act on community problems. One of the most commonly cited reasons why teachers don't address environmental issues is their controversial nature (Gunderson, 1988). Also, the open-ended nature of student action projects is uncomfortable for many teachers. Evaluation is difficult, no textbook is necessarily available, and this approach "involves the handing over of some control of the classroom process - sometimes obtained after a long struggle - to the students" (Wals, et al. 1990).
While many schools hope to create citizens capable of acting responsibly in our democratic society, rarely is the school structure organized to prepare students specifically for this possibility. Given the lack of energy most citizens exhibit for the political process, or for taking personal responsibility for environmental problems, citizenship skills shouldn't be left to chance.
Chapter 2

Reference List


Education, 60(3), 126-136.


Chapter 3
The Values Issue in Environmental Education

...education exists to further the world view and values of a particular social paradigm, but it can also serve to provide a critique of that paradigm and possibly to suggest new paradigms, values, and ways of life when the old social paradigm has been shown to be out of touch with reality... Sessions, 1983

In order to solve and prevent environmental problems, environmental education needs to address values. We cannot sidestep values issues in EE because our lifestyles, which contribute heavily to environmental degradation, are partially a product of our values. In addition, most environmental problems don't have clear-cut solutions: they evolve into values conflict issues. As far as the deep ecology movement is concerned, Naess (1989) declares that its "strength...depends upon the willingness and ability of its supporters to force fact-dependent experts who underpin environmental decisions into discussions in terms of values and priorities." However, because values questions are potentially controversial, and entering the arena of values education becomes a sensitive subject itself, some parents, community members, and even teachers believe it is not the place of public school teachers to deal with values. I believe instead of asking whether it is right for teachers to teach environmental values, we ought to try to answer the question, "how best can we as environmental educators address values in the classroom, keeping in mind our responsibilities to the environment, to our students, and to our communities?"
To begin to answer this question, we need to focus on two issues: first, the notion that if we don't explicitly address values, then values education isn't occurring; and second, what is implied by the term "teach."

To be pointed, the question of whether values education belongs in the school is relatively moot. As Purpel and Ryan (1976b) have noted, "it comes with the territory." Teachers convey moral and non-moral value messages in everything they do, as well as in everything they have students do. The way a teacher treats students, and allows students to treat others; how teachers handle questions; the content of assignments; the classroom atmosphere; behavior with other teachers; level of enthusiasm in class all transmit messages to students.

In particular, lack of attention to environmental problems and issues in school carries a powerful, though tacit, message to students; for, as Orr (1989) argues, "all education is environmental education. By what is included or excluded, emphasized or ignored, students learn that they are a part of or apart from the natural world. Through all education we inculcate the ideas of careful stewardship or carelessness."

Clearly, in addition to the explicitly defined curriculum, a "hidden curriculum" exists through which values are taught, whether we are aware of it or not (see Giroux & Purpel, 1983). We are foolish to imagine any education is values free. When the values transmitted are those of the mainstream culture, the process of values education may become transparent; we may even believe it is non-existent. We
may believe, for instance, the sciences are objective and free of value when in fact the cultural paradigm underlying the "scientific method" carries strong, though implicit, values messages itself.

Each institution of education, whether devoted to the instruction of religion, civics, music, business, etc., assumes its own values; environmental education should be no different. Values cannot, as Orr suggests, and should not, be separated from the content or methods of EE, or from any other form of education. Instilling positive environmental values in students is simply an integral part of the process of environmental education. While this may be an offensive perspective to some, insofar as it poses a threat to our culture's dominant world view of exploitation and resource extraction, our responsibilities to the environment mandate nothing less. The degraded state of our environment may be justification enough for trying to reorient students' values toward environmental health. For as Roth (1988) admonishes, "we have to become more radical. Radical, not in the sense of wild-eyed, crazy viewpoints, but in the sense of returning to roots, which is what the word truly means. We are rooted in the system of life, all of us, and whatever else we may be or do, we had best take care of that system first and foremost."

If some would question the right of educators to teach values, we may turn to the issue of what is meant by "teaching values" or "values education." Presumably, ambivalence surrounding values education lies partially in a misunderstanding of its goals. While part of the task of environmental education appears to be
developing positive values about the environment, this is not the only desired outcome. Ideally, EE also helps students in the following ways: developing an understanding of the important relationship between values and behavior, as well as disparities between the two; helping students clarify the value systems which underlie personal opinions, laws, proposed solutions to environmental problems, and differing positions on environmental issues; and giving students the tools for resolving personal and social values conflicts.

We still cannot, however, avoid the issue of what is implied by "developing in students positive environmental values." Can we strike a balance between indoctrination in its most negative sense, and a complete avoidance of values issues, borne of the belief that it isn't our place to teach values?

Duties to students and community, and to our own sense of ourselves as good teachers, dictate that we be as responsible as possible in the manner in which we address values. We could imagine a continuum of possibilities, with indoctrination and a laissez-faire approach (i.e., explicitly ignoring questions of values altogether) at opposite ends. These seem equally poor alternatives. Indoctrination is simply not an appropriate teaching method, insofar as the indoctrinator wishes to control and close the minds of students, to prevent rather than stimulate critical questioning (Watkins, 1976). Indoctrination also implies the view that students are objects to be manipulated toward a desired end, and as a method fails to provide students with the thinking skills necessary for
making future decisions (Kauchak, et al, 1978). Teachers who shirk the responsibility of facing values issues in class rob students of the practice and guidance they need in making autonomous decisions.

Considering responsibilities to students, a more nurturing and empowering place on the continuum would be marked by "careful and sensitive inquiry into moral questions" (Purpel & Ryan, 1976c). Methods would encourage and demand debate, critical thinking, and questions such as "Why?" "What is the basis for this belief?" "How do we know this statement is true?" and "What is the source of the disagreement?" Here also teachers would help students become aware of both the consequences involved in particular choices and actions, and of the variety of alternatives to, or options for, solutions to problems.

Where values education falls in this spectrum is in large part relative to the attitudes of teacher and students, to the atmosphere of the classroom, and to the relationships established there: the relationship between teacher and students, and among students themselves.

A safe environment, free of outright condemnation and rejection, is imperative for discussion and exploration of values. Teachers who actively foster nurturing relationships with students will probably be more likely than others to establish this secure environment. Students at the middle school and high school levels are so painfully aware of peer pressure and social norms that often no public environment is safe for discussing personal matters or opinions. Fear of being different, or peer rejection often leads to
put-downs, sarcasm, competition, and domination by popular students or troublemakers. Teachers need to solicit advice and behavioral goals for safe discussions from students, in order that students can take more responsibility for their behavior and teachers can relax their role as police.

Simply acknowledging the existence of a hidden curriculum through which values are inculcated, and accepting that we as teachers are implicated in the process, doesn't close the chapter, however. We also need to grapple with the question of which values shall EE define and promote as positive environmental values? The field of environmental ethics may shed some light on this search. One of the directions of the thinking in this field asks whether we can extend our sphere of moral concern beyond human welfare to the environment, including other living beings, as well as nonliving entities and abstract concepts such as ecosystems and nutrient cycles.

Most discussions of moral/values education center on human relationships. For example, moral education has been described as “helping people to deal with questions of right and wrong in the interpersonal realm (Purpel & Ryan, 1976a). Part of the process of EE is to broaden students' moral reasoning to also include questions of right and wrong in the human-environment realm.

In wrestling with the question, "which broad moral principles should we agree to teach?" Caduto (1983b) believes we ought to focus on the "ideal values of American society." He writes that these values, including "honesty, generosity, tolerance, equality, and
respect for the environment are founded in the moral evolution stretching from early Biblical times, through the thinking of the Greek, Roman, and Renaissance philosophers, and on into the present day.” As regard the environment, these values include, respectively, ecologically wise behavior and love for earth; a world of beauty, and a balanced global ecosystem.

Caduto seems to want to appease critics of values education by claiming that EE is, after all, only teaching good American values. Yet if American values had been consistent with environmental health, why then would we need environmental education so desperately at this time? While honesty, generosity, tolerance, and equality are all certainly ideals, many of our problems stem from the fact that our behavior is often not aligned with these ideals. Unfortunately, ecological integrity has never even been an ideal of mainstream American society. Additionally, the history of scientific thought, so influential in the development of western culture, has been one of domination over, not of reverence for, the environment (Merchant, 1986).

Berman (1981) argues that both Jewish and Greek cultures were initially responsible, as long as 4000 years ago, for the gulf which progressively opened between humans and non-human nature:

The Old Testament is the story of the triumph of monotheism over...the nature gods of neighboring 'pagan' peoples...Ecstatic merger with nature is judged not merely as ignorance, but as idolatry. The Divinity is to be experienced within the human heart; He is definitely not immanent in nature. The rejection of participating consciousness...was the crux of the covenant between the Jews and
Yahweh...[While] the Greek case is less easily summarized...the separation of mind and body, subject and object, is discernible as a historical trend by the sixth century before Christ; and the poetic, or Homeric, mentality in which the individual is immersed in a sea of contradictory experiences and learns about the world through emotional identification with it (original participation) is precisely what Socrates and Plato intended to destroy.

Rather than promoting the "ideal" American values, environmental education should serve, among other things, to critique them. If "values are not things but indications of one's deeper conceptual systems about the world and life..." (Stewart, 1975), EE must probe beyond values to world views. It can serve to initiate a paradigm shift away from our predominantly anthropocentric cosmology to an ecocentric one, analogous in impact to the geocentric/heliocentric paradigm shift which occurred during the Copernican Revolution. The specific value orientation EE ideally espouses is one in which the environment ceases to be simply a means to the end of human satisfaction or welfare or need, and becomes an end in itself.

This ethical position doesn't imply that in all environmental dilemmas, the environment is given top priority, but that the health of the environment will at least be considered equally along with human welfare. Values aren't direct guides to behavior; environmental values education shouldn't try to provide explicit directions for action in every circumstance. The point is not to show students how to act in given situations, for this doesn't supply them the tools needed for solving problems in the future. Exploring
"value conflict or value tension is a more realistic approach to social controversy than searching for some overriding principle that will tell us the correct solution to any particular problem" (Oliver & Bane, 1976).

The possibility exists that this "paradigm shift" may be an impossible one for most students at their level of reasoning and cognitive development. We may have to be content with more egocentric, or anthropocentric, reasoning at this age. In the lower grades, environmental educators may need to explain the value of the environment in terms of its direct value to humans; later we may attempt to move on to a conception of value based on human notions of beauty and integrity (eg, this ecosystem doesn't need to provide me with economic benefit, its beauty alone is enough). Ultimately we hope to present the notion of environmental integrity as being an end in itself, regardless of whether humans might find value in an environment, aesthetic or otherwise. Some students may grasp this notion; others may only do so on an intellectual, abstract level. In any event, environmental educators ought to be aware of the limits of reasoning, and of the potential inherent in the shift from an egocentric to a more universal mode of thinking.

It may not be the case that "a strong system of general moral values is the basis on which environmental values must be founded" (Caduto, 1983b). Perhaps the strong inclination of children toward an emotional association with nature in general and animals in particular is the root of future systems of morality, as regards both human relationships and human-environment relationships.
The sum of a teacher's beliefs about values education is manifested in the creation of curricula and in the day-to-day interactions with students. In the following pages I will present a few of the ways teachers can incorporate environmental values education into their courses.

Perhaps the most fundamental way in which educators teach values is by being role models. In fact, teachers' positive behavior in the environmental realm may speak more strongly to students than any amount or type of lecturing. Tanner (1980), in researching significant experiences for environmentally active people, concluded that teachers were most often remembered for their attitudes, or as enthusiastic, concerned people "rather than as purveyors of school programs."

As far as defining the behaviors a good role model should exhibit, it becomes fundamentally irrelevant, and impossible, to distinguish between process and content, or between what teachers have students do and what students learn. Taking their cues from McLuhan, Postman and Weingart (1969) argue that, in fact:

the medium is the message...[This] implies that the invention of a dichotomy between content and method is both naive and dangerous. It implies that the critical content of any learning experience is the method or process through which the learning occurs...It is not what you say to people that counts; it is what you have them do...What students do in the classroom is what they learn (as Dewey would say) and what they learn to do in the classroom is the classroom's message (as McLuhan would say) (emphasis mine).
Thus, a teacher's role as a model for environmentally responsible behavior is effected both through personal behavior, in and out of school, as well as through the learning experiences s/he creates for students. In terms of the remainder of the activities listed, as well as of attempts to "environmentalize" the content of any course, teachers are responsible models by virtue of incorporating these into their classes. The message becomes clear: the environment is important enough, and integral enough, that our class will devote a significant amount of energy to its study.

As far as personal behavior is concerned, it seems important for teachers to try to be models of people who live their values. Additionally, in the task of helping students develop the capacity for independent judgment, teachers can model the habit of having thought critically about those values and being able and willing to express the justification, the emotions, and the world view behind values and opinions.

While teachers ought not be in the business of trying to form students' opinions for them, they can share their views when appropriate or when asked by students, "but even then full of humility in relation to truth. Admit confusion, but insist that even the confused has to act..." (Naess, 1989). Naess here refers to the importance of public debate with opponents over values, but his ideas are fully valid in the classroom as well: [your students] "have mostly high regard for the combination of personal honesty and integrity with attitudinal admission of frailty and fallibility."
Teachers often remark that when students ask their opinion on controversial subjects, they reply, "my opinion isn't what's important; yours is." In the Wisconsin State Guide to Curriculum Planning in Environmental Education, (1990), Engelson writes, "teachers should...resist the temptation to let their own positions on issues be known and thus bias the conclusions reached by students." However, it is often the case that students already know the opinions of their teachers because actions and personality do speak so loudly. In any event, I suspect students resent this approach, and view it as either hypocritical or dishonest.

Hug, quoted in the Wisconsin curriculum guide argues the same point: "strong advocacies are all around us, each using the techniques of persuasion and propaganda to build their constituencies... Environmental educators must scrupulously strive to get all the facts, examine and illuminate all the viewpoints, and keep from letting their own particular position (as an environmentalist) from mixing with their educator role." Yet what is the point of withholding one opinion in a sea of differing ones? It makes no sense to acknowledge the powerful influence of the "strong advocacies all around us," while silencing ourselves on the basis we might bias students.

Those strong advocacies often give no hint of the underlying reasoning or world view behind their position. As teachers, we can help students sort through the myriad influences of peers, media, sports and music idols, advertising, etc. by modelling thoughtful behavior and helping students evaluate their own attitudes and
opinions, which often come directly from parents and others, with little or no understanding behind them. Instead of saying "my opinion doesn't matter," a teacher can show how very much their opinions do matter to them, and why.

One clearly important way teachers shape students' values is through the study of ecology. As Callicott (1982) points out:

prior to the emergence of the science of ecology...nature was perceived more as a mere collection of objects, like a room full of furniture, the parts of which were incidentally and externally related. Natural things, thus, had either an indifferent value, a positive utilitarian resource value, or a negative value (as pests, weeds, vermin, and so on). Ecology has changed all this. It has brought into being a new natural paradigm. The natural world is now perceived as a living whole...Ecology has transformed the value of nature.

Studying ecology changes our values by fundamentally changing our view of the world and our place in it.

Another important activity in values education is exploration of environmental issues. In most science courses, environmental issues are avoided, yet they provide fertile ground for discussion of values since they are, basically, matters of values controversy. Issues are often introduced for many of the following reasons: drawing connections between academia and the "real world;" creating enthusiasm and motivation for a school subject; helping students clarify their own values and opinions through juxtaposition and comparison with others'; and helping stimulate moral development.
Widely criticized for its subjective approach to values, values clarification methodology can, to its credit, be useful in issues discussions if teachers can avoid the trap of dwelling largely on trivial or non-moral matters. It can help expose students to inconsistencies between stated beliefs and behaviors. Additionally, it "can help to direct student attention to elements of the environment that are prized, those that are important but taken for granted, and those that students may previously not have felt important" (Harshman, 1978).

Issue exploration also can provide the forum for moral development as conceived hierarchically by Kohlberg. According to this model (1976), important conditions for moral development include:

"1. Exposure to the next higher stage of reasoning.
2. Exposure to situations posing problems and contradictions for the child's current moral structure, leading to dissatisfaction with his current level.
3. An atmosphere of interchange and dialogue combining the first two conditions, in which conflicting moral views are compared in an open manner."

As an example, Kohlberg uses in his moral discussions the dilemma of Heinz, a man who steals an expensive drug in order to save the life of his dying wife. An ironically analogous dilemma is the critical issue of whether pharmaceutical companies ought to be allowed to "mine" yew trees, which can be taken most profitably from old growth forests of the Pacific Northwest, in order to
produce the drug taxol, shown to be effective against a certain form of ovarian cancer. Environmental issues, whether hypothetical or real seem to be nice examples of Kohlbergian moral dilemmas, especially when it is considered that EE hopes to broaden students' conceptions of morality to include the environment.

The implication for teachers is that group discussions can provide the forum for moral growth, provided there exists a range of students at different levels in Kohlberg's hierarchy. Fraenkel (1976) reiterates the possibility that some people don't grow morally simply because they haven't been exposed to other, better alternatives to their own thinking. The exploration is a chance to become aware of others' opinions and to clarify or solidify one's own.

While there appear to be numerous problems with Kohlberg's theory of moral development, (for example, see Gilligan, 1983; Peters, 1976; and Fraenkel, 1976) the notion of using issues to explore values considerations, and to stimulate development of positive environmental values certainly seems useful.

Part of the learning in issues education, as suggested previously, is an awareness that our environmental ills are strongly affected by our values, and as such are not "discrete problems that are solvable...(but are) dilemmas which, though avoidable, are not solvable," (Orr, 1989). Students analyzing or discussing environmental issues come to see first hand the complexity involved as the impact of values controversy becomes apparent. Because an understanding of this complexity is crucial to real-world conflict...
resolution, teachers guiding students through exploration of values involved in environmental issues should seek a balance between editing superfluous information and becoming sidetracked by definitional squabbling among students.

Kohlberg proposes that dilemmas should be simple to avoid confusing students "who are then forced to spend time clarifying facts and circumstances rather than discussing reasons for suggested actions." Yet, part of the educational importance of this activity is the clarification itself of the positions, the values, the facts involved (Fraenkel, 1976). This process elucidates the context of the issue and draws attention to the idea that circumstances need to be considered in values conflicts.

In fact, the cognitive moral educational curriculum developed by Oliver (1976) deliberately focuses on in-depth analyses of prescriptive, descriptive, and analytic issues. Respectively, these involve "what should or ought to have been done, given the information available; problems of fact - describing people's behavior, interpreting what the world is actually like, or explaining why certain circumstances presumably occur; and what is the most useful meaning or interpretation of a word, phrase, or problem." The point of categorizing these is to help guide productive discussions, not to emphasize the concreteness of each. Oliver and Bane (1976) conclude, however, that even at this level of analysis or complexity, the "political-process component, factional in-fighting and...semi-coercive methods and power plays" are absent.
While it obviously has application for environmental values education, Oliver's curriculum is intended for the social studies discipline, and deals entirely in moral values as they relate to human interactions. Hungerford et al (1988) have developed a similar curriculum for investigating environmental issues, two components of which are the conceptual awareness level, and the investigation and evaluation level. At both stages, learners are provided opportunities, respectively, "to conceptualize the roles played by differing human values in issues and the need for personal values clarification as an integral part of environmental decision making; to develop the ability to analyze environmental issues and the associated value perspectives with respect to their ecological cultural implications" and to identify and evaluate "alternative solutions and associated value perspectives."

While these curricula are to be commended for including values as part of the discussion of environmental issues, they ought not comprise the entirety of one's values education effort. Probably in order to maintain some perceived semblance of objectivity, these curricula leave the affective realm of values untouched, or at least offer no avenues for addressing this area. Part of this lack may be due to the overwhelming impact of the fact/value split in our culture. As Naess (1989) writes "...the activism of the ecological movement is often interpreted as irrational, as a 'mere' emotional reaction to the rationality of a modern Western society. It is ignored that reality as spontaneously experienced binds the emotional and the rational into indivisible whole, the gestalts."
Environmental educators would like to foster emotional ties with the environment. Passion is an end in itself, but it also is important insofar as it leads to motivation and the desire to act on behalf of the environment. Soule (1988) argues that conservationists must become concerned with motivating people, and increasing knowledge alone isn't the answer. Lecturing students on the economic or biological values of diversity may stimulate the intellect, but conservationists probably need to make a greater appeal to the "sensory, physical experience of nature:

The most direct and powerful pathways to pleasurable emotions are not via the thought centers of the neocortex but through the sensory-motor centers of the brain stem and cerebellum, and from there into the emotional centers of the limbic system. This is also the region that houses the playful, nurturing, and social behaviors that we find so pleasurable and that must be evoked in the people we wish to involve in the cause of biodiversity.

He suggests that while educators are responsible for "the organ of learning," conservationists ought to direct their efforts towards the "organ of doing." Environmental educators can connect the two, but this will occur most effectively if teachers, as Oliver suggests in a critique of his own work, "move to a level deeper than that suggested by such phrases as 'justification strategies' or 'moral reasoning.'"

Instead of asking that students "become engaged in abstract social and political issues in a somewhat impersonal way without such a deep investment of [their] own psyches that it will warp
[their] perceptions" (Oliver & Bane), we need to show students that strong feelings are as important as critical thinking, and that one need not preclude the other:

Our emotional life...is not something which paralyses thought or any of our faculties. It is the power-house which keeps the whole lot going. In this wide sense there is nothing objectionable about emotion at all; quite the contrary. Accordingly, anyone accused of being emotional about injustice or oppression or war or bad science or anything else can quite properly reply, 'Of course I feel strongly about this, and with good reason. It is a serious matter. Anyone who has no feeling about it, who does not mind about it, has got something wrong with him.' The real fault must lie, not in the presence of feeling, but in the absence of thought (Midgley, 1983).

We ought to help students refine the ability to deal critically with emotional issues rather than teach them that emotions ought to be set aside in values considerations. As Caduto (1983a) comments, "values analysis methodologies leave little room for emotional and intuitive responses which could lead learners to think that these aspects of values are...invalid." (Also, we ought to be in the business of helping students see that all our perceptions are simply that: social/cultural constructions. Deep investment of our emotions hardly "warps" our perceptions any more than does years of training in our educational or religious institutions.)

Wigginton (1975) makes a strong case for the importance of integrating the cognitive with the affective domain:
in most cases the most rewarding and significant things that happen to a kid happen outside the classroom: falling in love, climbing a mountain, rapping for hours with an adult who is loved or respected...or genuinely understanding some serious community or national problem. These are all things that may later give him the motivation necessary to want to be able to write correctly and forcefully, or want to know history, or want to understand the complexities of nature and man through biology, botany, psychology...But we too often ignore these events, seeing them as "irrelevant" or "froth"...The walls of those buildings we imprison kids in must come crashing down, and the world must be their classroom, the classroom a reflection of their world.

Soule's and Wigginton's admonitions, as well as Oliver's argument that "only in powerful, emotionally laden environments has research uncovered significant reorientation of values," bear important implications for environmental values education.

One of the most important facets of environmental values education may not be discussing values in the classroom, but may be providing opportunities for students to become emotionally involved - in experiencing the beauty and wonder of nature, the frustration of politics, the shock and disgust of pollution and degradation. Perhaps we need to create experiences for students which involve long term, unstructured time spent outdoors in a relatively pristine setting with a few close friends (Tanner, 1980).

While this is nearly impossible in a traditional school setting, summer programs and alternative, school-year field courses can be a significant factor in values education. Ecological restoration, for
example, is a potentially valuable experience into which teachers could incorporate values education, as well as some of the components of a comprehensive EE plan discussed in the previous chapter. We ought not limit students' outdoor experiences to ones of beauty and pleasure. We ought to, as Newhouse (1990) points out, juxtapose experiences in natural settings with experiences in degraded areas to stimulate a "sense of loss and longing [which may] be the motivational driving force" behind conservationists' actions. By helping students see what is, and what can be, ecological restoration can be a powerful part of a values education process.
Chapter 3
Reference List


Chapter 4

From Knowledge to Action: The Potential of Ecological Rehabilitation

In this chapter I will argue the educational value of ecological rehabilitation. Prior to doing that, however, it is necessary to discuss briefly its scientific and technical significance.

Ecological restoration implies the process of re-creating from degraded land an ecosystem complete with its original diversity, structure, function, productivity, and species composition. Most formal restoration work has been conducted from either a technical perspective (e.g., reclamation of strip mines or roadcuts) or from an ecological one (e.g., returning biodiversity to degraded lands.) Thus, the field of restoration has been primarily defined by ecologists and engineers.

For example, Jordan, et al (1987) have coined the term "restoration ecology" to describe the usefulness of restoration in "raising basic questions and testing fundamental ideas" in the field of ecology. Harper (1987) provides examples of such questions:

- Does increasing the species diversity of a synthesized community increase its stability and resilience?
- Can succession be bypassed?
- What is the role of mutualists?
- How does the age structure of component species influence an ecological community?
Land reclamation engineers must focus primarily on technical problems, such as slope stabilization or determining which species can survive depleted or toxic soils. Their concerns also include the following: intended uses of the ecosystem by the general public (which would influence planning); legal requirements (e.g., meeting EPA regulations); financial cost to the public or to the industry being held responsible for the reclamation; and level of sensitivity of monitoring programs (i.e., regulatory agencies' need to avoid situations where measurements indicate a false recovery and industries' need to avoid situations where projects mistakenly appear to have failed) (Cairns, 1986).

Many conservation biologists are concerned with both the technical and theoretical aspects of restoring tracts of land in order to link existing wildlands (Wilson, 1988; Janzen, 1988).

While these issues are fundamentally important to ecologists and engineers, I see an enormous value in restoration work quite apart from, though complementary to, its function in increasing biodiversity. My primary goal is not to solve a technical or ecological problem; it is to solve an educational one. Restoration can serve to educate students about ecology and environmental issues; it also provides a forum for discussion of environmental values issues, and questions about human relationships with nature. Ultimately, I see restoration as a process for empowering students, by integrating knowledge, compassion, and action.

In the context of education, I prefer the term rehabilitation to restoration partly because true restoration is such an improbable
task. It seems naive, or arrogant, for us to assume we can accomplish restoration given all we don't know and perhaps can't know about something as complex and dynamic as an ecosystem. If restoration is defined as actively returning "a displaced ecosystem to its original condition," the restorationist must be able to describe that "original condition;" have available for reintroduction the many species which were "originally" present; be able to stop the processes which presumably lead to the degradation, and reverse their effect; and possess the knowledge, finances, and physical ability to create a sustainable system capable of retaining nutrients and resisting invasions by alien species (Ewel, 1987; Cairns, 1986).

In many instances, lack of these resources, both intellectual and biological, will impede progress toward true restoration. For instance, Jordan et al., (1987) point out that even 50 years after Aldo Leopold pioneered several restoration projects at the University of Wisconsin Arboretum, none of the sites had become anything precisely resembling a natural prairie.

I also prefer the idea of rehabilitation because I want to maintain enough flexibility to pursue a number of agendas outside the traditional discipline of restoration or restoration ecology.

For example, teachers may consider a number of possible options in addition to restoration, when working with degraded lands for educational purposes. Funnell (1989) suggests that, given the impossibility of exposing students to all the habitats in one's geographic location, teachers may want to create habitats on school
grounds specifically designed for teaching about the environment, not necessarily for the purpose of establishing sound ecosystems. In this instance, he advocates planting a variety of species, in natural associations, but not restricted to their natural environments, to facilitate learning about diverse habitats. Valuing "play as an essential part of learning and development," Funnell also specifically includes in habitat designs hearty plants able to withstand use.

Baines (1989) stresses the necessity of "political", in addition to "ecological," habitat creation. He defines political habitats as those created in urban settings specifically for human use and enjoyment, in order to stimulate public interest in conservation of wilderness lands and ecologically recreated habitats. "The best time to sell the difficult idea of the need for dead trees in woodland is when the 'public' are enjoying the sight of a feeding woodpecker, and in a [political habitat] the bird-table and bags of peanuts are as important as the trees themselves." In these educational areas Baines doesn't see the need for precisely defined natural communities, and would include non-aggressive aliens "to court public interest."

Creation of purely educational sites could also include the formation of experimental plots, perhaps for propagation of rare or endangered species.

I point out these examples as an indication of the possibilities available to teachers. Rather than rigidly prescribing some particular scheme for habitat creation, the important guideline to
follow is to allow students a major role in determining the focus of the project. In the end, the ecological success of a vegetation project, of whatever type, will depend in part on the care given the area by students. Likelihood of an educational success will be increased if instead of taking on projects themselves and involving students only peripherally, teachers incorporate projects into the grain of their regular classes, since the learning and motivation derived when students plan and produce their own work is one of our primary interests.

The concept of rehabilitation, as opposed to restoration, tends to steer me away from a preconceived result, leaving the possibilities open for students to create something of their own desire rather than something I originally had in mind. Bradshaw (1987) defines "rehabilitation" as a process leading necessarily toward complete restoration; he uses the term "replacement" to describe land reclamation for any purpose other than restoration. Cairns (1986) considers rehabilitation as restoration of "some of the most desirable original features." I will define rehabilitation broadly to encompass a variety of goals: the possibility of restoration, but also of replacement or guided neglect, while acknowledging the limits of human capability. In education, as perhaps opposed to restoration, the process seems more important than the product.

As an educational tool, rehabilitation is clearly an excellent process for teaching ecological concepts. Intensely studying ecosystems or habitats for the specific purpose of mimicking them
can teach students a great deal about ecology, both as a holistic method of inquiry and as a body of knowledge. Jordan et al., (1987) using the common mechanistic analogy, agree that "one of the most valuable and powerful ways of studying something is to attempt to reassemble it, to repair it, and to adjust it so that it works properly."

While I see problems, as do Jordan et al., with the watch-repair analogy, students can learn valuable lessons by defining an ecosystem through the process of trying to determine what a restoration project would replace, or what any habitat needs to function.

Students can learn ecological concepts quite powerfully in this process because they are in direct contact with the objects of their study rather than reading about them in a textbook. If education leads to changed behavior, we need to try to impact students, to move them from their present position. Direct experience seems the most effective means of accomplishing this. While we often begin teaching a subject, especially the sciences, through memorization of basic concepts, opportunities to work outdoors can provide the concrete experience necessary to internalize more abstract ideas.

Hawkins (1970) points to the "need for sheer acquaintance with the variety of things and phenomena...before one can embark on any of the roads toward the big generalizations or the big open questions of biology." This becomes more important the more we see students spending less time outdoors in rural or undeveloped
areas. Particular insights in the field can be related to broader, more abstract concepts of ecology, and through those guided discussions we can "harvest the crop of insights that had been sown and cultivated."

Rehabilitation is also a powerful teaching process because of the inherent motivation involved. Student interest is probably increased when learning has a particular purpose behind it. Instead of studying soils, nutrient cycling, plant adaptations, etc. for their own sake, it sounds infinitely more interesting to learn as much as we possibly can about a particular environment because we are going to try to recreate it back at school. In this process, we can also weave together a variety of subjects which ordinarily might not merge in a traditional class.

Not only can we integrate various scientific disciplines, we can relate scientific aspects of rehabilitation to environmental issues and the values questions inherent in those issues. For instance, I would incorporate the following types of questions into class discussion: since ecosystems, when described over a period of time, are in a state of flux rather than stasis, to which "original condition" do we return our site? Isn't any point chosen in the history of a landscape fundamentally arbitrary, since the decision is based on our human conception of what "ought" to be? Do we have particular responsibilities to particular types of landscapes?

What are appropriate uses of technology, and acceptable levels and methods of intervention by humans in rehabilitation work?
What types of behaviors or attitudes correspond to what types of relationships with our environment? What ethical responsibilities do we have to endangered or locally extinct species in returning them to their habitat? Through the process of rehabilitation, we can teach students about the scientific method, but also about its limits. There exist important, valid ways of relating to our environment, other than through scientific inquiry; I hope students learn through the process of rehabilitation that nature is more than an object of scientific experiments, and they themselves, more than observers.

Part of the heuristic value of rehabilitation may be the growing awareness of what a healthy ecosystem looks like, how it functions, and what we need to do to care for it adequately. As we "reconstruct what was, we learn how to sustain the system's processes," (Maser, 1988), moving from an entirely consumptive relationship to a more constructive one with nature.

To the extent that studying ecology changes our values by exposing us to such concepts as interdependence, rehabilitation is necessarily part of a values education program. Yet rehabilitation work also stimulates the empathetic component of environmental affirmation in other, distinct ways.

The exploration of land use history, and thus of cultural history as well, which marks the initial stages of any rehabilitation project, places the community at the heart of the curriculum. Historical research integrates academia with the "real world" by helping to weave students into the fabric of their community.
Students may come to see their surroundings not as a disembodied, isolated event in time, but as one link in a story with a rich past and a tangible future (Lutts, 1985). The positive feelings arising as students become "experts" about their community, and as they come to believe they are capable of having some positive effect there, can stimulate an interest in the well being of that particular place.

Current writing on the subject of rehabilitation recognizes the power of the act of rehabilitation to heal not only land but also the gulf between us and nature, and to help return the integrity of community livelihood (see Jordan, 1985; Maser, 1988; and Lopez, 1991.)

For example, Sayen (1989) writes "grassroots restorationists...believe that a restoration ethic should be connected with lifestyles (that is, restore the human culture of the watershed at the same time the watershed is being restored so that the two restoration projects merge into one)...They feel restorationists need to become a significant part of the local economy."

Janzen, working in Costa Rica, agrees that "the single most critical resource for tropical restoration (and for conservation as well) is social desire to build the wildlands back into the agroecosystem's mind, heart, and pocketbook" (1988). He hopes the local people will "come to view [their ecosystem] exactly as they now view their schools, their churches, their libraries, and their democratic government" (Jordan, 1987).

While it would be naive to assume that the work of several groups of students at a single school could accomplish the
rejuvenation of an entire community's cultural and ecological heritage, the energy generated by students' work can significantly impact a community's culture and stimulate a broad-based interest in conservation, as evidenced by the Foxfire project.

In addition, students can be part of a larger, community-based rehabilitation effort. Examples of this include the Mattole Restoration Council's salmon release program. The Council began as a "salmon support" group, to help restore dwindling native Mattole king salmon populations. Their projects include stream enhancement or repair; erosion control; reforestation; and trapping, collecting eggs and milt from, incubating, and eventually releasing salmon. Petrolia High School students and "a whole generation of elementary school kids" have helped raise salmon in a hatchbox program, and have released yearling salmon into tributaries of the Mattole River (House, 1990). This project underscores the notion that rehabilitation is more than tree planting.

A related program exists in Japan. The "Come Back Salmon" society, which has member organizations on every river north of Tokyo, involves students as part of its program to reestablish salmon in all the major rivers of the north. Students at 60 Tokyo schools have raised and released salmon into rivers in their communities. To compare notes, Japanese school students have visited Washington state students who are involved in salmon release projects of their own. Another 240 Japanese elementary and high schools have developed environmental education programs centered around the salmon project (Murdoch, 1991).
Seattle special education teacher Russ Hanbey involves students in community rehabilitation work in another way. In three greenhouses, five cold frames and a "hoop house," for cuttings, Hanbey and his students propagate native plants for use in rehabilitation projects initiated by King County's Surface Water Management and Solid Waste agencies, Metrowaste, the Forest Service and others. Students help care for a couple thousand plants, mostly species such as ferns, in which nurseries typically won't invest time. Operating costs are covered by profits made from the contracts (Hanbey, pers. comm., spring, 1991).

Teachers may need to make explicit the point that the rehabilitation work of students at their school is of community benefit. To make the work a truly mutual affair, I advocate getting members of the community involved in students' work, including parents, city politicians, the media, city planners or landscape designers, etc. This may help students sense the importance of their work and, at the same time, gain community support for the idea.

While I am suspicious of the tendency to romanticize the act of rehabilitation, I would argue that working with a particular place, with specific local inhabitants and particular species, can stimulate "personally meaningful relationships with personally significant environments" (Lutts, 1985). This in turn is an important part of environmentally positive values, and environmentally responsible behavior.
The actual planting and site preparation work can give students the experience of doing something positive for the environment in the face of overwhelming bad news and demands for personal responsibility. Wigginton (1975) believes "before kids can act effectively, they have to know they can act." Rehabilitation work can give students the opportunity to "try on the hat" of supporting the environment, or of working cooperatively: something they may never have had the chance to do before. Much more than contributing to a body of biologically healthy lands, rehabilitation with students may lead to a sense of empowerment which, throughout the lives of those students, may carry greater potential and generate more positive energy than the sum biological effect of their school rehabilitation work.

Helping students become proactive instead of reactive is important work. Yet I am wary of sending the message that since government and corporations which may contribute heavily to our environmental problems, making rehabilitation necessary, will not take part of the responsibility, the people must instead take all the responsibility. Lopez (1991) argues:

our answer must be, if we are to find hope in the face of this hopelessness, to turn our backs on the institutions. A person turns her back by putting a seedling in the earth with her two hands...We turn our backs by accepting the responsibility that government and industry reject. At some point their opposition becomes so willfully ignorant, so wedded to catastrophe, so deranged by a sense of destiny that it becomes irrelevant.
I would not advocate forsaking the political process, or absolving government and industry of their accountability, in favor of taking matters entirely into our own hands. The process of rehabilitation with students should necessarily take into account, among other things, the local land use policy and community power structure which may have helped create or perpetuate the problems which rehabilitation must now try to correct. Research into local history needs to include exposure to the political system, its importance in land use, and ways in which citizens can influence policy and can hold accountable those institutions which are partly responsible.

In the best sense of the term, educational rehabilitation carries a full hidden curriculum. What students learn isn't separate from the way in which they learn it, and the many things they learn aren't separate from one another. Direct environmental action and experience teaches students they are capable of action while at the same time teaching them that the environment is worthy of, even demands, their study, care, and efforts. In the process, students learn ecological principles in a specific context, and learn that those principles are directly linked to questions of environmental values and community responsibility.
Chapter 4

Reference List


75


Chapter 5:
Curriculum Applications

Since the bulk of this paper thus far has been theoretical, and abstract, I would like to crystallize some of the ideas discussed previously in a plan of action: a project which could be taught as a series of units at the middle school level. In this chapter, I will outline a site rehabilitation project which addresses not only the ecological imperative of rehabilitation but also values, community action and responsibility, and interdisciplinary study.

For the sake of specificity, I have tried to envision this unit as an integral part of an earth science or general science course, since that is my area of certification. The activities presented here, while oriented towards earth science, are certainly applicable to other grades and subjects as well. I can imagine this type of rehabilitation project forming an integral part of a nontraditional course devoted solely to environmental education.

A great deal of potential exists to work cooperatively with other teachers on a project of this sort. Instructors of art, social studies, English, math, and most of the sciences could clearly find opportunities to involve their students, however peripherally, in a rehabilitation project.

Ideally, a core of teachers would work on the project together, each finding optimal ways of addressing their subject matter in the context of the project. I see value in teaching students content matter in the course of a project or activity, rather than beforehand.
Students feel a great sense of ownership for knowledge and skills acquired as a necessity in working through a problem.

Any environmental education project works best when material can be addressed by a number of teachers; no one single course can, or ought to, carry the full weight of implementing an environmental education program. Yet, as has been suggested before, interdisciplinary education is far from being realized in most schools.

This project is comprised of a series of units which I intend will be carried out over the time period of a semester course. (The work certainly could be expanded over a year's time, depending on individual circumstances.) The project forms a cohesive whole not by being completed in a discrete, several-week period, but by progressing through a series of activities which build upon one another, and by asking a number of related questions: what can we tell about the natural history of this area (including geology, climate, hydrology, and soils)? How have human cultures adapted to, or taken advantage of, this unique combination of features? How have climate and other factors resulted in a particular biota? What toll have human cultures taken on the environment? How can we return some of the native biodiversity to our community? To our own school grounds?

Little distinction exists between some of the activities involved in preparing for a rehabilitation project and those involved in a traditional course in biology or earth science: students must sample soil and vegetation, study the life cycles and needs of plants,
understand soil chemistry and genesis, etc. It was difficult to
decide where the rehabilitation project ended and general course
topics began. Where does one draw the line? I have tried to limit
discussion of activities to those relatively directly related to the
rehabilitation project itself, but obviously a great deal of overlap
exists; this is, after all, the point of infusion.

Some of the proposed outcomes of this project were even less
straightforward to prepare for. Much of the values component is not
easily described as discrete activities. Discussions forming the
platform for values inquiry tend to be informal, spontaneous
conversations between teacher and students. While I have detailed a
number of specific values activities in this project, a good deal of
the values education occurs implicitly as a result of the outdoor,
community- and student-centered nature of the project, and during
unstructured discussions.

As part of the description of each unit, I have included the
following: a qualitative list of suggested student activities; a list
of "extension" activities for further study, by the class or by
individual students; a discussion of evaluation methods; and a
summary of specific resources available for the instructor. I have
also included at the end of the unit sequence a list of long-term
activities which should be carried out throughout the entire project,
or preferably throughout the entire course.
Goals: To put students in direct, constructive contact with nature.

To empower students by giving them responsibility, and the experience of being active and effective.

To instill in students positive environmental values.

To develop in students a sense of responsibility towards their community.

To give students a discovery-based, open-ended educational experience, where answers aren't already known, where there is no specific textbook, and where they help to decide the course of their own education.

To initiate students on the path towards becoming self-educated.

---Unit Sequence---

1. "The Land Remembers" - Local Land Use History

In this unit, students will become familiar with the geography and cultural history of their community. The unit prepares students for the actual rehabilitation work by putting the current landscape in a historical perspective. To discover how they might want to reconstruct a particular habitat, it is useful for students to study what the landscape has looked like in the past, what uses have been
made of vegetation, soils, etc., and what changes the land has gone through. In this way, students can get a sense of what has been lost and why.

Students will learn how various "resources" have been used by humans; the importance of the history behind various resource-extraction professions; and different perspectives about the value of land.

Students will gain specific skills in map reading, interviewing, writing, and will be able to explain the major uses of the area's natural resources.

**Time:** 8-10 total class periods.

**Activities:**

Create a "mental" map of the community: students draw from memory a map of their surroundings, including personally important landmarks.

Take a neighborhood field trip, esp. to cultural and natural landmarks near the school; also visit a vantage point, such as the "M" or the Mansion, to get a large-scale perspective on the city.

Redraw "mental" map to take into account new information or perspectives. Discuss how a map might look if it were drawn by something other than a person (the Clark Fork, Blue Mountain, etc.).

Learn and practice, indoors and outdoors, map reading skills, esp. for topographic maps. Draw own topo maps of simple, familiar object (shoe, pop bottle, etc.).
Invite speakers into class for a panel/debate on values of natural resources, and historical perspective on resource use in past 25 years (e.g., Keith Hammer [Swan View Coalition], Jim Freeman [Grass Roots for Multiple Use], etc.)

Practice interviewing skills - choose another student in the class to interview about favorite childhood places, worst outdoor experiences, favorite outdoor recreation, etc. Briefly report back to class on interviews.

Working in small groups, interview local residents who can talk about Missoula's history (e.g., grandparents, Mr. Prescott, museum employees, etc.). Students may want to use some of the same interview questions as in the last activity.

Present oral reports on interviews to whole class.

Study old maps, "plat" books, museum archives, photos, etc. Visit Historical Museum.

Draw timeline of past 100 years: including population changes in 10-25 yr. intervals; major industries in existence, etc.

Write autobiographical essay from perspective of some non-human entity (e.g., a particular creek, a valley, the wind).

Evaluation:

Students will be evaluated on the quality of their maps, oral reports, group timelines, essays, and weekly journals (see Long-Term Activities). Students will be tested
on map-reading skills, and will be given an essay exam over historical information covered in class.

**Extension Activities:**

Consider setting up a database which can be accessed and turned into maps, graphics, and pictures by Geographic Information System software and hardware. Both cultural and natural landscape features can be compiled - making the GIS tools applicable to this entire unit, as well as to other units and courses. Information about GIS and other computer programs can be found in "What's Underfoot? Computer tools for restoration," by Hank Roberts, in the spring, 1990 issue of Whole Earth Review (No. 66).

**Resources:**

"Plat" books are located in the UM archives.

D. Walter has compiled a list of sources useful to teachers of local history. This bibliography, titled, "A Teacher's Guide to Montana Local-History Materials," can be found in *Montana Historian*, (1978), Vol.8, #2.

A powerful, graphic simulation of human population growth from 1 A.D. to present is available on video from Zero Population Growth. Six minutes long, the video displays a world map with dots, each representing 1 million people, added through time. The video can be ordered from ZPG Publications, 1400 16th St, N.W., Wash., D.C 20036 for $29.95 plus $3.00 shipping.
"Earth Watch" - Local Ecology Study

In this unit, students will make in-depth studies of two contrasting sites: a future rehabilitation site on or near the school grounds, and a complementary "natural" site, comparable in habitat to the pre-development school site. In preparation for rehabilitation work, students will compare and contrast the sites from an ecological perspective in order to get a feel for how they might mimic a natural environment.

Students will work in the field and in the classroom, learning basic concepts of soil science, hydrology, botany, and plant ecology, (many other earth science topics can be addressed in this unit as well) in the context of their own familiar surroundings.

Students will also be exposed to a variety of local environmental problems and associated issues involving land use. Scientific concepts will be placed in a specific context in the process of examining local issues. Also, connections will be drawn for students between an academic study of science and environmental problems about which science may provide a particular understanding, and between environmental problems and related sociopolitical issues.

Time: 10-15 total class periods.

Activities:

At both sites, dig and examine soil pits; identify horizons.

Describe soil profile, qualitatively describe differences. Measure depth of feeder root zone.
Perform field infiltration tests; try tests in lab with a variety of media: sand, humus, gravel, mixtures, etc. Graph results.

Examine layers which settle out when soil is liquefied and shaken in sealed jars. Qualitatively determine soil class.

Have soil samples chemically analyzed (eg. through Camas Labs at the Univ.). Compare both sites with “average” soils data.

Discuss soil genesis. Obviously many topics could be worked in here, including soil chemistry, physics, and biology; geomorphology, including erosion, weathering, glaciation, etc.

Analyze local environmental issue: choose issue specifically related to soils and collect up-to-date information from radio, t.v., newspaper, etc. Discuss the ecology of the issue: relate to current site studies. Explore issue from social perspective: what people have a stake in this issue? what is the power structure? what are the positions taken by the various groups in disagreement? what types of values do these groups hold? how does this affect their opinions? Time should be set aside for issue analysis several times throughout this unit, so that a variety of land use issues are addressed, and their ecological roots related back to the topic being studied.

Learn to identify several of each: major tree, shrub, and forb species on natural site. Help students mentally place
species in their particular habitat. Use slides for in-class review.

Read and discuss Rick Bass' essay, "On camp robbers, rock swifts, and other things wild to the heart," (discusses the different feeling of wild and urban places).

At natural site, collect individual samples of a variety of species for plant collection; research geographic ranges.

At school and natural sites, sample vegetation on random plots: Measure grids, perform simple measurements of species diversity, community structure, ratio of grasses to forbs, forbs to shrubs, etc.; graph results. Document existing species (with or without common names) - attempt to identify one unknown sp. on each plot. Try to determine vegetation patterns (e.g., which species grow in clumps? which are ubiquitous?).

Collect seeds at natural site for possible, long-term propagation projects, or for sowing: have students devise seed-collection methods (e.g., tying sections of nylon stocking around flowers to catch seeds after they ripen but before they are dispersed or destroyed).

Prepare group reports on soil, vegetation, presence of animal species, plant diseases, etc. at both sites.

Finish the unit with analysis of a current issue, and as a culminating activity, role play a public forum. All groups involved in the issue should be represented, including the
ecosystem and/or non-human species (e.g., soil, river, salmon, etc.) A pair or group of students should take on the role of one species or human group, and all will have a chance to speak their positions and explain how they will be affected or how they feel about other groups' actions or opinions. End the role play with each group telling what others may learn from them. This activity is modelled after the "Council of All Beings." (see Resources). Students may want to create masks or costumes for the role play.

**Evaluation:**

Students will be evaluated on the quality of the final group site report, including lab work results; on thoroughness of plant collections, and on their participation in group discussions and in the public forum. Students will be quizzed several times on plant identification; will be given an essay exam over recent geologic history of the Msia. valley and over ecological concepts covered in the site studies.

**Extensions:**

Experiment with a stream table; with Mountain Water Company's model aquifer; with sediment settling rates in a class-constructed replica of Glacial Lake Missoula.

Experiment with different seed stratification techniques; research simple concepts of plant physiology, flower and fruit biology.

The Investigating and Evaluating Environmental Issues and Actions curriculum, (listed under resources), has been

87

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
designed specifically for teachers who want to turn study of environmental issues into a long-term project. The point of studying environmental problems as part of the rehabilitation project is to reinforce the awareness of threats to the environment, particularly the environment the students are studying, and to point out possible citizen action strategies, rehabilitation being one. As with all the units described here, this one could be expanded greatly, if desired. Doug Knapp, project coordinator with IEEIA, told me trained teachers have taught the IEEIA curriculum anywhere from one to nine months.

**Resources:**

Slide show of local native plants, and weeds; include slides of students doing field work to prepare students for outdoor work.

Driller's logs can be obtained from DNRC (Water Rights Division) in Helena or the MT. Bureau of Mines and Geology in Butte. These contain information noted by the company or person who drilled a well, including exact location of the well, and notes on the "character, color, thickness of strata such as soil, clay, sand, gravel, etc...[They also] show depth at which water is found and height to which water rises in well." If logs on wells near the school site can be obtained, they may add a great deal of information to soil pit data.

*Thinking Like a Mountain: Toward a Council of All Beings,* (Seed, Macy, Fleming, & Naess, 1988).


III. "UNLESS" - Rehabilitation Planning and Design.

In this unit, students will work cooperatively to determine a rehabilitation plan for a site on or near the school grounds. As a whole class, students will determine the overall goal of the project, specifying the type of planting they will initiate, intended uses of the site, etc. They will also solicit opinions from school staff and faculty in helping define the final project's outcome.

In smaller groups, students will plan detailed planting schemes for individual plots based on their knowledge and experience with a comparable natural site. Community experts in landscape design and site rehabilitation will be invited to give advice and ideas. Students will prepare final plans for approval by school administration.

Time: 8-10 total class periods.

Activities:

Read The Lorax, (Dr. Seuss). Discuss the significance of the "Truffula seed" and the Onceler's request at the end of
the story. Discuss rehabilitation as an important citizen action strategy.

Draw or create something which expresses an environmental utopia - an ideal environmental future. Discuss ways in which we as individuals could make these a reality.

Define group goal for rehabilitation site (considering uses by other classes, the public, maintenance staff, etc.).

Draw up small-group action plans (class divided into several working groups). Invite landscape designers, botanists, etc. to help with planning (e.g., Billie Gray from Caras Nursery, John Pierce, etc.).

Produce list of species which will be planted on the site, (don't necessarily need to use even common names - pictures, descriptions, etc. are fine); also groups will create detailed site sketch. Students may also arrange flags on plots to mark planting or landscaping sites.

Create and distribute opinionaire, including proposed plan, to solicit suggestions and criticisms from school administration, faculty, and neighboring residences, if applicable.

Read and compile responses: calculate % returned, % of responses favoring/opposing all or part of project.

Brainstorm ways to incorporate suggestions into final plan.
Try to form parent network; also solicit help and donations from local nurseries, Dep't of State Lands, private timber companies, etc.

**Evaluation:**

Students will be evaluated on the quality of their group plan, and on how well knowledge of natural communities was applied in the creation of the plan.

**Resources:**

The Soil Conservation Districts award $500 grants to school "conservation" projects. Teachers Gene Solomon and Don Felton at Bonner School won an SCD grant, with which they bought and planted seedlings along the south and west sides of the school ground to form a windbreak. Yukiko Tanaka, a UM graduate student, and Bente Winston, principle at Sussex School, were also awarded an SCD grant. They have begun a site rehabilitation project at Sussex to form an educational "nature area." Sadie McDonald, at the Missoula Conservation District, is eager to assist schools in planning conservation-type projects. Gary Botchek, School District One's Grounds Supervisor, is an important contact person for any major activities on school grounds.

V. **From Knowledge to Action - Beginning the Rehabilitation Project**

As a culminating activity, students will begin the physical work of planting, landscaping, transplanting, watering, etc., the
rehabilitation site. They will apply their knowledge of, and experience with, natural communities in creating some new habitat on or near the school grounds.

Students will learn the physical skills involved in rehabilitation work, and will practice their communication skills while teaching other students about their project. Students will be asked to keep clear notes about their work for future students who will follow up on the project.

Time: May extend over a period of up to several months.

Activities:

Measure project area.* Each group is responsible for at least one square meter (start small!). Calculate number of plants needed of each species. Plan a groundbreaking ceremony: create and mail invitations to parents, media, neighbors, community leaders, etc.

Prepare the site physically. [For example, students may want to "un-grade" the ground so it isn't perfectly flat; if existing vegetation wasn't removed beforehand, students may need to pull aggressive weeds (or experiment to see which methods work best) or scalp the lawn down to bare soil.]*

Bring in necessary materials (e.g., small snags, downed logs, rocks, etc.) and do preliminary landscaping.

During, and outside of, class time, learn and apply techniques of transplanting vegetation from natural area(s) to school site; sow certain species of collected seed; plant containerized nursery stock, if available.

92
Take a field trip to a large clearcut slated for reforestation, or to a Superfund site (e.g., the Warm Springs settling ponds or the Opportunity ponds, or to Silver Bow Creek area) to discuss large scale rehabilitation projects.

Prepare an educational lesson for younger students (elementary students, if possible) describing the project (e.g., lecture, slide show, guided tour).

Teach planting techniques to younger students. Consider having students serve as advisors to other classes or schools wanting to start similar projects...the Domino effect.

Extensions: The sky's the limit!

Evaluation:

Students will be evaluated on the thoroughness of the work performed at the rehabilitation site. Students will also be evaluated on the physical portion of (the write-up or slide show or poster presentation, etc.), and on the presentation of, their educational programs for younger students. Students will be awarded grades based on the quality of their work and on their participation and cooperation with other students.

Resources:

Bitterroot Native Growers is a native plant nursery in Corvallis which specializes in restoration work. They will be able to provide containerized stock, as well as advice, for rehabilitation projects (for a price...). A field trip to their greenhouses would be worthwhile.
Remarks:

* Ideally, it would help if the teacher started (before the students) at the beginning of school, or even earlier in the summer, to prepare for this project. Receiving permission from the school administration and the school district's grounds staff at the beginning of the year would obviously speed up the process later on. Additionally, as an alternative to herbicides, one or two layers of black plastic may be used to kill off existing, above-ground vegetation. Summer is the best time to begin this process, although depending on the weather, the beginning of the school year may not be too late.

** Rehabilitation is one big, long-term experiment! Any project begun won't be "finished" in a year, or probably even within five or ten years! Students should be encouraged to think of this as an experiment, and to "mess about" with different techniques. To ensure future students can benefit from past work, make sure students keep careful notes. This would be another important use for a database and GIS program.

Long Term Activities:

1. Documentation: Photography can be approached as a useful academic and scientific tool for purposes of documentation. Students should be encouraged to work with the journalism department, or use their own cameras, to help document the activities described in this unit. At the end of
the course, students could then prepare a slide show or poster exhibit of prints for the class, the school, or for younger students. Photographs would be useful documentation for later classes as well. Students may also be encouraged to videotape some or all of the activities. The school may have cameras available for student use, or Missoula Community Access Television will train students to use their cameras, and will also train them in the use of the editing equipment necessary to create a finished product.

2. Phenology monitoring: Students should collect data on weather, including daily temperature, precipitation type and amount, wind speed and direction, dates of first and last frost, etc. and perhaps try to correlate these with natural events. The class should keep track of specific events, such as dates when particular species bud, flower, go to seed, and ripen. Data can be compiled over years' time and can help in creating informational files on topics such as dates you will be likely to find ripe seeds from particular species for collection. Activities like this help students connect with, and pay more attention to, natural cycles.

3. Journals: Throughout the project, students will spend ten minutes in class twice a week writing in their journals. Sometimes, students will be assigned a specific topic; occasionally they will be left to write on their own. In either case, they will be asked to express their feelings or thoughts about the week's activities. Students will also be
asked to spend one fifteen to twenty minute period out of class a week, in a quiet outdoor setting, writing about that place and their experiences there.