

# History & Ecological Education

## *Understanding Ecology In Secondary School Education*

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Science educators have already recognized the value of historical material in fostering an accurate understanding of science and in achieving desirable, positive and realistic attitudes toward science (Klopfer 1957, 1969; Russel 1981; Wandersee 1981, 1985). Many ecologists and environmentalists also have recognized the importance of achieving an accurate understanding of ecology and developing positive attitudes and behaviors toward the environment (Keller 1979). Moreover, because the roots of our present ecological problems are found in the ancient world (Hughes 1975; Bilsky 1980), ecohistory, too, can contribute to these goals by developing an accurate understanding of the causes and consequences of past and present ecocrises and by encouraging effective behavior in dealing with them. While the historical roots of environmental crisis are not a pretty picture, Keller (1979) believes they are "full of lessons to be learned."

Since the target population we need to educate is the general public, desired attitudes and behaviors are not likely to be achieved unless ecohistory is learned and appreciated by all young citizens. Or as Russell (1981) puts it, "The consequences of distorted historical content are particularly significant for that majority of students who do not become scientists." In general, historical awareness of environmental changes can be an essential element in developing ecologically aware citizens.\* There is a need for ecology and biology educators to involve, investigate and explore the application of historical ecology to

modern science education in general, and biology and ecology education in particular.

By the "history of ecology" or "ecohistory," I do not mean the evolution of ecology, as it is only recently (during the last half of the 19th century) that a few concerned biologists laid down the foundations for its study. I also do not intend to suggest using history as the structuring principle for school ecology, as this approach could unintentionally result in changes in the content of school ecology classes without emphasizing real ecological processes and an understanding of ecology. Nor do I suggest that a primary concern should be for developing good ecological historians. What I do suggest is that it is important to give students some kind of historical material for its content and ideas in such a way as "... to promote awareness of differences and possibilities, and understanding of how things have come to be as they are and that they might have been otherwise. It must be used to enlarge horizons, to shake complacency, to stir the imagination." (Barrow 1980)

This will help to produce citizens who are well informed about their society, understand the roots of the ethics and moral philosophies that guide human behavior, know their natural position in the living community and understand the human impact on the ecosystem. Producing such citizens is not, however, an easy task. The successful teaching of ecohistorical information requires a particular instructional approach. Such instruction should advocate understanding, reason and evidence. While a

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\* In general, historical awareness in terms of our place and the place of our civilization in the environmental sphere is believed to be one of four necessary awareness conditions that should be achieved in order to be an educated man or woman (Barrow 1981). According to Barrow's theory of education, the four conditions that have to be approached before someone becomes educated are: first, historical awareness—broad awareness of our place, the

place of our civilizations, in the totality; second, awareness of individuality—the unique quality and the power of every individual; third, awareness of logical distinctions—the ability to understand and to distinguish logically distinct kinds of questions such as empirical, aesthetic, moral and so on; finally, awareness of one's capacity for discriminations—the great capacity to discriminate precisely and in detail as much as possible (Barrow 1981).

familiarity with actual historical facts and events is obviously important in developing ecological awareness, an analysis of those facts is equally important to derive the knowledge of circumstances and consequences that might affect the future of world ecology. While I strongly advocate using historical material to this end, I recognize that, as both Klopfer (1969) and Russell (1981) point out, it may be a difficult challenge.

One might argue that historical information related to the environment should be included in history books and that agricultural and geographical historians should have a better knowledge of documentary sources. But first, as Sheail (1971) pointed out

Unfortunately, the historian and geographer, in their turns, have frequently ignored wildlife in the past, and wild animals have received scant attention in their writings. In the fifteenth and early sixteenth centuries, larger tracts of arable land were turned into sheep pasture, and the grazing grounds of our 2000 villages were extended. This change in land use has been closely studied by historians, but no one has mentioned its likely impact on wild life.

Second, even if historians paid attention to the impact on past wildlife, it is ecologists who can reconstruct the landscape of the past more realistically by using ecological knowledge to understand the relationship of plants and animals to their habitat. (Sheail 1971)

### The Main Objectives of Ecohistory

The broad goal of ecology education to which ecohistory seems most relevant is to contribute toward the potential development of scientific and ecological literacy. That includes stimulating and encouraging student interest and appreciation for ecology and developing an accurate understanding of the behavior of ecological systems and the impact of human behavior on these systems.

The main objectives of ecohistory proposed in ecology-school-curricula (ESC) are:

- 1) to stimulate students to move from being passive observers to becoming positive, appreciative participants in ecological and environmental issues.
- 2) to inform students' views of ecology.
- 3) to influence students' understanding of ecology by developing accurate images of past ecology.
- 4) to stimulate the desired increase in students' interest in ecology.
- 5) to avoid perpetuating present destructive behaviors and attitudes toward the environment.

It seems, however, that the significance of ecohistory in achieving the broad goal of ecological education has been ignored by both scientists and educators.

### Resources for the Study of the History of Ecology

Sheail (1971) suggests that the most important source of information on past environments, especially wildlife populations, is contained in old books and documents, such as letters and notes left by naturalists, landowners, farmers and topographers. Information on past environments and the history of living things can also be generated from field studies and geological records. Plant and animal remains can be used to determine the vegetation cover of a given period of time and can help students see how changes in climate and vegetation over time can alter the distribution of plant and animal species. For example, by using special techniques (such as pollen frequency, type and characteristics), paleobotanists and archeologists are today able to analyze pollen remains to predict the involvement of prehistoric men and women in the modification of their environment (Flannery 1986; Moore 1986). Teachers should be advised to communicate with university and museum archeological departments to use such information and throw light on the subject. There are also current books and publications of historical ecology such as *Historical Ecology* edited by L.J. Bilsky (1980) and *Ecology in Ancient Civilizations* by D.J. Hughes (1975).

Sources can also be generated by studying the social behavior of hunter-gatherer societies such as the Kung Bushmen of Botswana in the Kalahari Desert, the Netsilik Eskimo, or any of the native American Indian groups (such as the Kogi Indians of Sierra Nevada de Santa Marta). The social behavior exhibited in these societies reflects the struggle for survival within the specific environmental circumstances of each group. From them we can learn of the earlier history of modern societies and how the environment was viewed during those times. For instance, it is believed that those societies have a high aspiration to live in balance with nature and to treat the earth as a mother (Sitton 1980; Sessions 1983).

In ancient times, as well as in some present primitive human societies, the realm of humanity and nature were intertwined in the human consciousness. Human beings did not separate themselves from nature. They believed that nature was populated by beings like themselves—the spirits of water, fire, air, land, etc. (Kirilenko and Korshunova 1984). Because of this, nature and its forces were treated as living beings; “he was angry with them if there was a storm, a hail or drought, and thanked the land for a rich harvest and sky for long-awaited rain” (Kirilenko and Korshunova 1984). The behavior of birds, animals, insects and even plants was observed in order to forecast the weather. As time went by, humans learned to use their hands to create tools and to develop the means and techniques to manipu-

late the environment and be independent from nature. As a consequence, nature began to lose its concrete impact in the consciousness of humankind.

Today, in the 20th century, it is evident that human beings in Western society have lost their unity with nature as a result of adopting new philosophies in their quest for knowledge, practical activities, lifestyles, etc. Philosophies enable them to be above the natural world they consider there for them to exploit and control. It is important for students to know and understand why these changes took place in Western society and the circumstances that led to such change through the course of human history.

When looked at from an ecological viewpoint, the ruins of human civilizations and desert environments created by human beings can be good educational resources for ecohistory. Studying the ruins of human civilizations and phenomena such as desertification and deforestation brings insight into how human beings have not developed a full awareness of their need for a protective as well as a productive environment.

The explosions of nuclear power plants such as the one near Chernobyl in the Soviet Union in 1986, the Three Mile Island nuclear disaster in the U.S. in 1979, or the mass gassing of Indians living near Union Carbide's Bhopal plant in 1984 would all be excellent sources of historical materials to inform students about the environment and the ecology of the world. We should also include historical events such as mass hunting which died out as a result of man's invasion of North America and caused destruction of the basic food resource for many people at that time (Bouhey 1980). The global nature of these disasters can be seen in the radiation from the nuclear calamity at Chernobyl having spread not just across northern Europe beyond Scandinavia into the North Atlantic, but also south into Paris and Rome (*Science Digest* July 1986).

The history and development of environmental legislation and laws also can be used as a source of information in the teaching of ecohistory. Teachers can discuss certain environmental legislation and laws and identify key issues, then try to relate these issues to the moral and ethical values of society toward the natural world. For example, "It is emphasized that the English Nuisance Law of 1536 involved a type of common law still used in the United States, the main principle of which is that if other people suffer equally from a particular pollution, an individual can not bring suit against the polluter." (Keller 1979). The Refuse Act of 1899 demonstrated that "... it is against the law to pollute any stream in the United States. However, the Secretary of the Army can allow the discharge of refuse into a stream if a permit is first applied for" (Keller 1979). The National Environmental Act of 1969 is another example,

but it is different. According to Keller (1979), "The act requires that before any environment-affecting activity that is directly or indirectly involved with the federal government can begin, a statement evaluating the environmental impact must be completed." These examples show the possibility of using the history and development of environmental legislation as a source of information in ecohistory because they reflect whether society considers the possible long-range injury caused by human activities. These laws and legislation reflect the strength of the public's concern not only for our survival and welfare, but also for our children and our children's children.

### Ecohistory Themes that Are Important for Attaining Ecologically Educated Minds

With respect to the history of ecology, it is worthwhile for students to know something about:

- 1). the history of the planet on which we live; theories of its origin and development.
- 2). the history of local fauna and flora; their origin, evolution and distribution.
- 3). the history of our species; its origin and evolution.
- 4). the history of human civilizations; their origin, distribution and decline.
- 5). the historically documented changes in the human environment (our own historically documented modifications of the environment), including the impact of the industrial revolution; new technological energy from coal, to oil, to nuclear power; the growing of world populations; the pollution of air, ocean and land; etc.

#### *The history of the planet Earth*

Although there are no eyewitnesses to the origin of this planet, there is a widely accepted astronomical theory explaining the phenomenon. This theory, which can be taught to students, proposes simply that the physical earth could have been formed as a result of purely random and natural physical and chemical reactions about 4 billion to 5 billion years ago. Today, of course, the planet has changed. Therefore, the planet's origin might be interesting, but even more interesting are the mechanisms that developed billions of years ago.

One of the justifications for including the history of the planet in school-ecology curricula is that, according to our present very limited knowledge, it is only on this planet that life has developed (Emmel 1977). The earth is unique, not only because of its mild environment, but also because 70 percent of its surface is covered with water. Similar vast oceans are not found on any other planet that we know of.

Without this amount of water, it would be difficult to imagine how life could have come into existence in the first place. Another justification is that, as Christman, et al. (1973) explain, "To gain a proper perspective of the human activity on 'nature,' one must first understand the mechanics of an environment that was formed and shaped in the absence of man by a variety of complex natural forces."

#### *The history of fauna and flora*

The similarities and differences in the fauna and flora of large areas, such as major continents and oceans, are important for every ecologist. I am primarily concerned with the smaller scale distribution of plants and animals, how they originated, how they evolved, why they live in a certain place, etc. To answer questions such as these requires a great deal of historical as well as ecological biogeography. Indeed, many of the regional patterns of distribution of flora and fauna can be better explained by historical factors than ecological ones (Emmel 1977).

A basic understanding of the local flora and fauna in the past and present is an important prerequisite for effective ecological education. It is, in fact, a necessary element in achieving this goal. Lin Jun-Yi (1980) asks, "How can a country that does not have a sufficient ecological understanding of its flora and fauna find solutions for environmental deterioration and for continuing utilization of its natural resources?" He answers by saying, "In short, environmental education programs will not be effective and relevant when animals, plants and the nature of their habitats are mostly unknown." Sufficient ecological understanding of the present natural habitats of plants and animals depends on the ecological understanding of their origin, evolution, biogeographical distribution and natural habitats in a given area. The relevant history of modern flora and fauna goes approximately to the end of the last ice ages.

#### *The history of the human species in terms of origin and evolution*

There is no doubt that human beings are responsible for most of the recent environmental deterioration on this planet. Understanding this responsibility demands going beyond the social order to consider how humans have evolved and how they are sustained by interaction with the natural world. Learning something about the origin and evolution of this species is of utmost importance in understanding the attitudes and behavior of modern human beings toward the environment.

Human history, in terms of origin and evolution, is a complex story (Emmel 1977). Any available scientific knowledge and theories, especially those reasonably well documented by cultural and fossil evi-

dence, must be used as a resource for the history of the human species.

It appears from archaeological and geological evidence that human beings similar in structure to ourselves originated several million years ago. The emergence of social aggregations in communities goes back about 500,000 to 100,000 years ago. This means our appearance on the evolutionary scene is a relatively recent development within the context of planetary history.

The appearance of human beings immediately had a profound impact on the environment and its living organisms, especially mammals, birds and terrestrial plants. However, the behavior of human beings is also profoundly affected by the natural world (Boughey 1980; Cole 1966; Hoffiman 1980). A greater understanding of human origin and development hopefully will help us to better prevent our destruction of the environment.

The history of the human species can also be looked at from the viewpoint of human behavior. The ethics and moral philosophies in which human behavior is rooted have evolved from the belief that humankind is the dominant species over all other living as well as non-living components of nature. Consequently, humankind claims the right to use nature solely for its own survival. According to this anthropocentric value system, it has been human self-interest and not nature that has been the focus of human ethics and morality. However, the human species has a mutual relationship with the natural web of life, with no special claim to the resources of the earth, no special claim to control or exploit and with no right to threaten its very continuation. Knowledge of nature and the interrelationships between organisms and their environments should be considered as one of the elements upon which an ethical system (regarding the natural world) should be based. Therefore, including in current school curricula knowledge about how members of previous civilizations interacted with their environments could help individuals make ecologically sound decisions toward their interaction with the environment.

#### *History of human civilization*

Broad historical awareness of human civilizations is one of many conditions necessary for developing the educated mind (Barrow 1981). Familiarity with ancient history gives us insights into ecology, especially the history of areas where current modern civilization found its roots.

Young citizens need to be aware of the cultural ancestors of today's technological society (Hughes 1975). They should be aware of how agriculture and animal husbandry changed lifestyles from that of roving collectors of wild foods to that of settled farmers, and how early farmers began to add the

technological characteristics of civilization-town life, markets, army, government, business corporations, associations, etc. They should be aware that those changes posed problems never before encountered by a hunter-gatherer in the natural environment (Coleman 1982).

They should learn how little villages became towns and then cities, and how those changes affected the set of the human mind; how humankind looked at nature before and after the rise of cities; how the human value dealt with relatively rapid change, especially in technology, and with far-reaching results in the old world. Such curriculum is already being taught in social studies classes in the Northwest, a great boon to ecology education and ecohistory. An ecological view of ancient civilizations and their relationship to modern times is a necessary condition for understanding the development of human relationships with nature as well as present-day attitudes toward the natural environment (Hughes 1975).

Since humankind is a part of changing nature, the successes and failures of any civilization depend in part on the human attitudes and beliefs which help to direct and shape human activities and the impact those activities have on interrelationships in the natural world. The ruins of human civilization, for example, are linked at least in part to a lack of awareness that we need a protective as well as productive environment (Keller 1979; Odum 1975). It is important to understand that the natural environment and the course of human civilizations are interrelated. According to Hughes (1975), there are three themes that are most basic and central to environmental history. These are "... first, the influence of the environment on the development of civilizations; second, human attitudes toward nature; and third, the impact of civilizations upon the natural environment." Furthermore, there is a moral and ethical consideration to the relationship between civilization and its physical environment (Keller 1979). Hughes (1975) states clearly, however, that environmental history is a new and challenging field. He advises researchers to read deeply and widely and combine insights from several areas of inquiry.

#### *The historically documented changes in human environment*

Our own historically documented modifications of the environment include the impact of the industrial revolution; new technological energy from coal to oil to nuclear power; the growing world population; and the pollution of air, ocean and land. These can be studied and understood by providing students with real case histories of environmental deterioration from the present and recent past. The following themes might be helpful in developing ecological awareness and understanding among students:

- ecological shifts caused by over cultivation and grazing (Desertification).
- ecological shifts caused by logging (Deforestation).
- ecological shifts caused by mining (Erosion).
- ecological shifts caused by contaminating (Pollution).
- ecological shifts caused by hunting and fishing (Extinction or De-diversification).
- ecological shifts caused by cultivating (Salt depletion, Erosion and Pollution of water).
- ecological shifts caused by the conflicts between the environment and political, economic, or social benefits (Ecological crisis/Resource conflicts).

The interrelationships of the above themes, set against the background of ever-increasing human population, are the key issues in developing human attitudes and behavior toward the environment. It is the conflict between environmental problems and economic, political and social benefits that becomes the critical factor in environmental deterioration, solutions which first demand an understanding of all these dimensions of the problem. Therefore, each of the themes mentioned above is important in the development of an ecological awareness and understanding among students, but only when they are studied and examined within the context of eco-biology, socio-economic and political parameters.

If one could argue that present morality is actually based on short sighted ecological ignorance and self-interest, then it would reasonably follow that an understanding of ecological damages might lead to an understanding of human values and morality. Aldous Huxley, one of the first to warn of the impending environmental crisis, wrote in his novel *Island* (1962) that

Confronted by [examples of ecological damage], it's easy for the child to see the need for conservation and then go on from conservation to morality—easy for him to go on from the Golden Rule in relation to plants and animals and the earth that supports them to the Golden Rule in relation to human beings . . . The morality to which a child goes on from the facts of ecology and the parables of erosion is a universal ethic . . . Conservation morality gives nobody an excuse for feeling superior, or claiming special privileges. (Cited in Sessions 1983, p.35)

For a more graphic demonstration of the relevance of studying the history of ecological developments in the recent past, consider the following experiences.

An understanding of the problem of desertification in North Africa may help Canadian students understand the problems of deforestation in Canada. Students may be surprised to learn that not long ago North African flora and fauna had a rich variety of species. Students today might not believe that North Africa once supported large populations and exported wheat, olive oil and other agricultural products to the whole Roman Empire and later to many cities during the Islamic civilization (Bagi 1983). Today, this same area

possesses the largest human-made desert, the Sahara. Students need to know that this happened through the introduction of foreign animals such as goats and sheep and through different human behaviors such as wood-gathering. The massive deforestation presently occurring in some parts of Canada due to over-logging, and without any concerted efforts at replanting, represents a similar situation. By teaching Canadian students about desertification in North Africa and the over-logging of cedar forests in Lebanon and Greece in early times, they may realize the danger of over-logging that is taking place in their own land. They might also realize the need for humankind to be fully aware of the conditions necessary for a protective and productive environment, an environment that is mandatory for human survival.

Science history testifies that scientific methodology alone might not guarantee a true explanation of given biological or ecological questions and phenomena. Therefore, and as Hill (1986) convincingly argues, greater use of historical and philosophical aspects of biology should be made in teaching to give a full account of the scientific processes. In addition to this, the contributors in *Historical Ecology*, edited by Bilsky (1980), believe that human understanding of current ecological problems can be enhanced by studying similar problems in the past, and/or by examining the relationship between social changes and the shifting relationships within the environment in any given society.

However, the question remaining in the minds of most of us is: how much historical material do we need to gain an accurate understanding and positive attitude and appreciation of ecology? Russell (1981) answers this question regarding science education by saying that, "If we wish to use the history of science to influence students' understanding of science, we must include significant amounts of historical material and treat that material in ways which illuminate particular characteristics of science." The question of how much a "significant amount" is might remain a moot point for years to come. In the meantime, it is crucial that we get started.

## Acknowledgments

I would like to formally acknowledge the help of many friends and colleagues in a variety of ways. Specifically, I would like to express my gratitude to Dr. Robin Barrow (philosophical educator), Dr. Fulton Fisher (biologist), Dr. Marvin Wideen (science educator), Dr. Milton McClaren (environmental educator) and Sue Staniforth (graduate student) at Simon Fraser University, Burnaby, B.C. Canada.

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