4

Ecological Literacy

David Orr

Literacy is the ability to read. Numeracy is the ability to count. Ecological literacy, according to Garrett Hardin, is the ability to ask 'What then?' Considerable attention is properly being given to our shortcomings in teaching the young to read, count and compute, but not nearly enough to ecological literacy. Reading, after all, is an ancient skill. And for most of the 20th century we have been busy adding, subtracting, multiplying, dividing, and now computing. But 'What then?' questions have not come easy for us despite all of our formidable advances in other areas. Napoleon did not ask the question, I gather, until he had reached the outskirts of Moscow, by which time no one could give a good answer except 'Let's go back home'. If Custer asked the question, we have no record of it. His last known words at Little Big Horn were, 'Hurrah, boys, now we have them', a stirring if dubious pronouncement. And economists, who are certainly both numerate and numerous, have not asked the question often enough. Asking 'What then?' on the west side of the Niemeh River, or at Fort Laramie, would have saved a lot of trouble. For the same reason, 'What then?' is also an appropriate question to ask before the last rain forests disappear, before the growth economy consumes itself into oblivion, and before we have warmed the planet intolerably.

The failure to develop ecological literacy is a sin of omission and of commission. Not only are we failing to teach the basics about the earth and how it works, but we are in fact teaching a large amount of stuff that is simply wrong. By failing to include ecological perspectives in any number of subjects, students are taught that ecology is unimportant for history, politics, economics, society, and so forth. And through television they learn that the Earth is theirs for the taking. The result is a generation of ecological yahoos without a clue why the colour of the water in their rivers is related to their food supply, or why storms are becoming more severe as the planet warms. The same persons as adults will create businesses, vote, have families and, above all, consume. If they come to reflect on the discrepancy between the splendour of their private lives in a hotter, more toxic and violent world, as ecological illiterates they will have roughly the same success as one trying to balance a chequebook without knowing arithmatic.

Formation of attitudes

To become ecologically literate one must certainly be able to read and, I think, even like to read. Ecological literacy also presumes an ability to use numbers, and the ability to know what is countable and what is not, which is to say the limits of numbers. But these are indoor skills. Ecological literacy also requires the more demanding capacity to observe nature with insight, a merger of landscape and mindscape. 'The interior landscape', in Barry Lopez's words, 'responds to the character and subtlety of an exterior landscape; the shape of the individual mind is affected by land as it is by genes' (Lopez, 1989). The quality of thought is related to the ability to relate to 'where on this earth one goes, what one touches, the patterns one observes in nature – the intricate history of one's life in the land, even a life in the city, where wind, the chirp of birds, the line of a falling leaf, are known'. The fact that this kind of intimate knowledge of our landscapes is rapidly disappearing can only impoverish our mental landscapes as well. People who do not know the ground on which they stand miss one of the elements of good thinking which is the capacity to distinguish between health and disease in natural systems and their relation to health and disease in human ones.

If literacy is driven by the search for knowledge, ecological literacy is driven by the sense of wonder, the sheer delight in being alive in a beautiful, mysterious, bountiful world. The darkness and disorder that we have brought to that world give ecological literacy an urgency it lacked a century ago. We can now look over the abyss and see the end of it all. Ecological literacy begins in childhood. 'To keep alive his inborn sense of wonder', a child, in Rachel Carson's words, needs the 'companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in' (Carson, 1984). The sense of wonder is rooted in the emotions or what E. O. Wilson has called 'biophilia', which is simply the affinity for the living world (Wilson, 1984). The nourishment of that affinity is the beginning point for the sense of kinship with life, without which literacy of any sort will not help much. This is to say that even a thorough knowledge of the facts of life and of the threats to it will not save us in the absence of the feeling of kinship with life of the sort that cannot entirely be put into words.

There are, I think, several reasons why ecological literacy has been so difficult for western culture. First, it implies the ability to think broadly, to know something of what is hitched to what. This ability is being lost in an age of specialization. Scientists of the quality of Rachel Carson or Aldo Leopold are rarities who must buck the pressures toward narrowness and also endure a great deal of professional rejection and hostility. By inquiring into the relationship between chlorinated hydrocarbon pesticides and bird populations, Rachel Carson was asking an ecolate question. Many others failed to ask, not because they did not like birds, but because they had not, for whatever reasons, thought beyond the conventional categories. To do so would have required that they relate their food system to the decline in the number of birds in their neighbourhood. This means that they would have had some direct knowledge of farms and farming practices, as well as a comprehension of ornithology. To think in ecolate fashion presumes a breadth of experience with healthy natural systems, both of which are increasingly rare. It also presumes that the persons be willing and able to 'think at right angles' to their particular specializations, as Leopold put it.

Ecological literacy is difficult, second, because we have come to believe that education is solely an indoor activity. A good part of it, of necessity, must be, but there is a price. William Morton Wheeler once compared the naturalist with the professional biologist in these words: '[The naturalist] is primarily an observer and fond of outdoor life, a collector, a classifier, a describer, deeply impressed by the overwhelming intricacy of natural phenomena and revelling in their very complexity.' The biologist, on the other hand, 'is oriented toward and dominated by ideas, and rather terrified or oppressed by the intricate hurly-burly of concrete, sensuous reality ... he is a denizen of the laboratory. His besetting sin is oversimplification and the tendency to undue isolation of the organisms he studies from their natural environment' (Curtis and Greenslet, 1962). Since, Wheeler wrote, ecology has become increasingly specialized 'and, one suspects, remote from its subject matter. Ecology, like most learning worthy of the effort, is an applied subject. Its goal is not just a comprehension of how the world works, but, in the light of that knowledge, a life lived accordingly. The same is true of theology, sociology, political science, and most other subjects that grace the conventional curriculum.

The decline in the capacity for aesthetic appreciation is a third factor working against ecological literacy. We have become comfortable with all kinds of ugliness and seem incapable of effective protest against its purveyors: urban developers, businessmen, government officials, television executives, timber and mining companies, utilities and advertisers. Rene Dubos once stated that our greatest disservice to our children was to give them the belief that ugliness was somehow normal. But disordered landscapes are not just an aesthetic problem. Ugliness signifies a more fundamental disharmony between people and between people and the land. Ugliness is, I think, the surest sign of disease, or what is now being called 'unsustainability'. Show me the hamburger stands, neon ticky-tacky strips leading toward every city in America, and the shopping malls, and I'll show you devastated rain forests, a decaying countryside, a politically dependent population and toxic waste dumps. It is all of a fabric.

And this is the heart of the matter. To see things in their wholeness is politically threatening. To understand that our manner of living, so comfortable for some, is linked to cancer rates in migrant labourers in California, the disappearance of tropical rain forests, 50,000 toxic dumps across the US, and the depletion of the ozone layer is to see the need for a change in our way of life. To see things whole is to see both the wounds we have inflicted on the natural world in the name of mastery and those we have inflicted on ourselves and on our children for no good reason, whatever our stated intentions. Real ecological literacy is radicalizing in that it forces us to reckon with the roots of our ailments, not just with their symptoms. For this reason, I think it leads to a revitalization and broadening of the concept of citizenship to include membership in a planetwide community of humans and living things.

And how does this striving for community come into being? I doubt that there is a single path, but there are certain common elements. First, in the lives of most if not all people who define themselves as environmentalists, there is experience in the natural world at an early age. Leopold came to know birds and wildlife in the marshes and fields around his home in Burlington, Iowa before his teens. David Brower, as a young boy on long walks over the Berkeley hills, learned to describe the flora to his nearly blind mother. Second, and not surprisingly, there is often an older teacher or mentor as a role model: a grandfather, a neighbour, an older brother, a parent, or teacher. Third, there are semi-

nal books that explain, heighten, and say what we have felt deeply, but not said so well. In my own life, Rene Dubos and Loren Eiseley served this function of helping to bring feelings to articulate consciousness.

Ecological literacy is becoming more difficult, I believe, not because there are fewer books about nature, but because there is less opportunity for the direct experience of it. Fewer people grow up on farms or in rural areas where access is easy and where it is easy to learn a degree of competence and self-confidence toward the natural world. Where the ratio between the human created environment to the purely natural world exceeds some point, the sense of place can only be a sense of habitat. One finds the habitat familiar and/or likeable but without any real sense of belonging in the natural world. A sense of place requires more direct contact with the natural aspects of a place, with soils, landscape, and wildlife. This sense is lost as we move down the continuum toward the totalized urban environment where nature exists in tiny, isolated fragments by permission only. Said differently, this is an argument for more urban parks, summer camps, green belts, wilderness areas, public seashores. If we must live in an increasingly urban world, let's make it one of well designed compact green cities that include trees, river parks, meandering green belts, and urban farms where people can see, touch, and experience nature in a variety of ways. In fact, no other cities will be sustainable in a greenhouse world.

Ecological literacy and formal education

The goal of ecological literacy as I have described it has striking implications for that part of education that must occur in classrooms, libraries and laboratories. To the extent that most educators have noticed the environment, they have regarded it as a set of problems which are: (1) solvable (unlike dilemmas, which are not) by (2) the analytic tools and methods of reductionist science which (3) create value-neutral, technological remedies that will not create even worse side effects. Solutions, therefore, originate at the top of society, from governments and corporations, and are passed down to a passive citizenry in the form of laws, policies and technologies. The results, it is assumed, will be socially, ethically, politically and humanly desirable, and the will to live and to sustain a humane culture can be preserved in a technocratic society. In other words, business can go on as usual. Since there is no particular need for an ecologically literate and ecologically competent public, environmental education is most often regarded as an extra in the curriculum, not as a core requirement or as an aspect pervading the entire educational process.

Clearly, some parts of the crisis can be accurately described as problems. Some of these can be solved by technology, particularly those that require increased resource efficiency. It is a mistake, however, to think that all we need is better technology, not an ecologically literate and caring public willing to help reduce the scale of problems by reducing its demands on the environment and to accept (even demand) public policies that require sacrifices. It all comes down to whether the public understands the relation between its well being and the health of the natural systems.

For this to occur, we must rethink both the substance and the process of education at all levels. What does it mean to educate people to live sustainably, going, in Aldo Leopold's words, from 'conqueror of the land community to plain member and citizen

of it'? (Leopold, 1966) However it is applied in practice, the answer will rest on six foundations.

The first is the recognition that *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. Conventional education, by and large, has been a celebration of all that is human to the exclusion of our dependence on nature. As a result, students frequently resemble what Wendell Berry has called 'itinerant professional vandals', persons devoid of any sense of place or stewardship, or inkling of why these are important (Berry, 1987).

Second, *environmental issues are complex and cannot be understood through a single discipline or department*. Despite a decade or more of discussion and experimentation, interdisciplinary education remains an unfulfilled promise. The failure occurred, I submit, because it was tried within discipline-centric institutions. A more promising approach is to reshape institutions to function as transdisciplinary laboratories that include components such as agriculture, solar technologies, forestry, land management, wildlife, waste cycling, architectural design and economics (Caldwell, 1983). Part of the task, then, of Earth-centred education is the study of interactions across the boundaries of conventional knowledge and experience.

Third, *for inhabitants*, *education occurs in part as a dialogue with a place and has the characteristics of good conversation*. Formal education happens mostly as a monologue of human interest, desires and accomplishments that drowns out all other sounds. It is the logical outcome of the belief that we are alone in a dead world of inanimate matter, energy flows and biogeochemical cycles. But true conversation can occur only if we acknowledge the existence and interests of the other. In conversation, we define ourselves, but in relation to another. The quality of conversation does not rest on the brilliance of one or the other person. It is more like a dance in which the artistry is mutual.

In good conversation, words represent reality faithfully. And words have power. They can enliven or deaden, elevate or degrade, but they are never neutral, because they affect our perception and ultimately our behavior. The use of words such as 'resources', 'manage', 'channelizes', 'engineer' and 'produce' makes our relation to nature a monologue rather than a conversation. The language of nature includes the sounds of animals, whales, birds, insects, wind and water – a language more ancient and basic than human speech. Its books are the etchings of life on the face of the land. To hear this language requires patient, disciplined study of the natural world. But it is a language for which we have an affinity.

Good conversation is unhurried. It has its own rhythm and pace. Dialogue with nature cannot be rushed. It will be governed by cycles of day and night, the seasons, the pace of procreation, and by the larger rhythm of evolutionary and geologic time. Human sense of time is increasingly frenetic, driven by clocks, computers, and revolutions in transportation and communication.

Good conversation has form, structure, and purpose. Conversation with nature has the purpose of establishing, in Wendell Berry's words: 'What is here? What will nature permit here? What will nature help us do here?' (Berry, 1987). The form and structure of any conversation with the natural world is that of the discipline of ecology as a restorative process and healing art.

Fourth, it follows that *the way education occurs is as important as its content*. Students taught environmental awareness in a setting that does not alter their relationship to basic life support systems learn that it is sufficient to intellectualize, emote, or posture about such things without having to live differently. Environmental education ought to change the way people live, not just how they talk. This understanding of education is drawn from the writings of John Dewey, Alfred North Whitehead, J. Glenn Gray, Paulo Friere, Ivan Illich and Eliot Wigginton. Learning in this view best occurs in response to real needs and the life situation of the learner. The radical distinctions typically drawn between teacher and student, between the school and the community, and those between areas of knowledge, are dissolved. Real learning is participatory and experiential, not just didactic. The flow can be two ways between teachers, who best function as facilitators, and students who are expected to be active agents in defining what is learned and how.

Fifth, *experience in the natural world is both an essential part of understanding the environment, and conducive to good thinking*. Experience, properly conceived, trains the intellect to observe the land carefully and to distinguish between health and its opposite. Direct experience is an antidote to indoor, abstract learning. It is also a well-spring of good thinking. Understanding nature demands a disciplined and observant intellect. But nature, in Emerson's words, is also 'the vehicle of thought' as a source of language, metaphor and symbol. Natural diversity may well be the source of much of human creativity and intelligence. If so, the simplification and homogenization of ecosystems can only result in a lowering of human intelligence.

Sixth, *education relevant to the challenge of building a sustainable society will enhance the learner's competence with natural systems*. For reasons once explained by Whitehead and Dewey, practical competence is an indispensable source of good thinking. Good thinking proceeds from the friction between reflective thought and real problems. Aside from its effects on thinking, practical competence will be essential if sustainability requires, as I think it does, that people must take an active part in rebuilding their homes, businesses, neighbourhoods, communities and towns. Shortening supply lines for food, energy, water and materials – while recycling waste locally – implies a high degree of competence not necessary in a society dependent on central vendors and experts.

The aim: Ecological literacy

If these can be taken as the foundations of Earth-centred education, what can be said of its larger purpose? In a phrase, it is that quality of mind that seeks out connections. It is the opposite of the specialization and narrowness characteristic of most education. The ecologically literate person has the knowledge necessary to comprehend interrelatedness, and an attitude of care or stewardship. Such a person would also have the practical competence required to act on the basis of knowledge and feeling. Competence can only be derived from the experience of doing and the mastery of what Alasdair MacIntyre describes as a 'practice' (MacIntyre, 1981). Knowing, caring, and practical competence constitute the basis of ecological literacy.

Ecological literacy, further, implies a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably. It

presumes both an awareness of the interrelatedness of life and knowledge of how the world works as a physical system. To ask, let alone answer, 'What then?' questions presumes an understanding of concepts such as carrying capacity, overshoot, Liebig's Law of the minimum, thermodynamics, trophic levels, energetics and succession. Ecological literacy presumes that we understand our place in the story of evolution. It is to know that our health, well being, and ultimately our survival depend on working with, not against, natural forces. The basis for ecological literacy, then, is the comprehension of the interrelatedness of life grounded in the study of natural history, ecology and thermodynamics. It is to understand that: '"There ain't no such thing as a free lunch'; 'You can never throw anything away'; and 'The first law of intelligent tinkering is to keep all of the pieces.' It is also to understand, with Leopold, that we live in a world of wounds senselessly inflicted on nature and on ourselves.

A second stage in ecological literacy is to know something of the speed of the crisis that is upon us. It is to know magnitudes, rates, and trends of population growth, species extinction, soil loss, deforestation, desertification, climate change, ozone depletion, resource exhaustion, air and water pollution, toxic and radioactive contamination, resource and energy use – in short, the vital signs of the planet and its ecosystems. Becoming ecologically literate is to understand the human enterprise for what it is: a sudden eruption in the enormity of evolutionary time.

Ecological literacy requires a comprehension of the dynamics of the modern world. The best starting place is to read the original rationale for the domination of nature found in the writings of Bacon, Descartes and Galileo. Here one finds the justification for the union of science with power and the case for separating ourselves from nature in order to control it more fully. To comprehend the idea of controlling nature, one must fathom the sources of the urge to power and the paradox of rational means harnessed to insane ends portrayed in Marlowe's *Doctor Faustus*, Mary Shelley's *Frankenstein*, Melville's *Moby Dick*, and Dostoevsky's 'Legend of the Grand Inquisitor'.

Ecological literacy, then, requires a thorough understanding of the ways in which people and whole societies have become destructive. The ecologically literate person will appreciate something of how social structures, religion, science, politics, technology, patriarchy, culture, agriculture and human cussedness combine as causes of our predicament.

The diagnosis of the causes of our plight is only half of the issue. But before we can address solutions there are several issues that demand clarification, 'Nature', for example, is variously portrayed as 'red in tooth and claw', or, like the film 'Bambi', full of sweet little critters. Economists see nature as natural resources to be used; the backpacker as a wellspring of transcendent values. We are no longer clear about our own nature, whether we are made in the image of God, or are merely a machine or computer, or animal. These are not trivial, academic issues. Unless we can make reasonable distinctions between what is natural and what is not, and why that difference is important, we are liable to be at the mercy of the engineers who want to remake all of nature, including our own.

Environmental literacy also requires a broad familiarity with the development of ecological consciousness. The best history of the concept of ecology is Donald Worster's *Nature's Economy* (Worster, 1985). It is unclear whether the science of ecology will be 'the last of the old sciences, or the first of the new'. As the former, ecology is the science of efficient resource management. As the first of the new sciences, ecology is the basis

for a broader search for pattern and meaning. As such it cannot avoid issues of values, and the ethical questions raised most succinctly in Leopold's 'The Land Ethic'.

The study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design and implementation of solutions. The concept of sustainability implies a radical change in the institutions and patterns that we have come to accept as normal. It begins with ecology as the basis for the redesign of technology, cities, farms, and educational institutions, and with a change in metaphors from mechanical to organic, industrial to biological. As part of the change we will need alternative measures of well being such as those proposed by Amory Lovins (least-cost end-use analysis) (Lovins, 1977), H. T. Odum (energy accounting) (Hall et al, 1986) and John Cobb (index of sustainable welfare) (Daly and Cobb, 1990). Sustainability also implies a different approach to technology. One that gives greater priority to those that are smaller in scale, less environmentally destructive, and rely on the free services of natural systems. Not infrequently, technologies with these characteristics are also highly cost-effective, especially when subsidies for competing technologies are leveled out.

If sustainability represents a minority tradition, it is nonetheless a long one dating back at least to Jefferson. Students should not be considered ecologically literate until they have read Thoreau, Kropotkin, Muir, Albert Howard, Alfred North Whitehead, Gandhi, Schweitzer, Aldo Leopold, Lewis Mumford, Rachel Carson, E. F. Schumacher and Wendell Berry. There are alternatives to the present patterns that have remained dormant or isolated, not because they did not work, were poorly thought out, or were impractical, but because they were not tried. In contrast to the directions of modern society, this tradition emphasizes democratic participation, the extension of ethical obligations to the land community, careful ecological design, simplicity, widespread competence with natural systems, the sense of place, holism, decentralization of whatever can best be decentralized, and human scaled technologies and communities. It is a tradition dedicated to the search for patterns, unity, connections between people of all ages, races, nationalities and generations, and between people and the natural world. This is a tradition grounded in the belief that life is sacred and not to be carelessly expended on the ephemeral. It is a tradition that challenges militarism, injustice, ecological destruction and authoritarianism, while supporting all of those actions that lead to real peace, fairness, sustainability and people's right to participate in those decisions that affect their lives. Ultimately, it is a tradition built on a view of ourselves as finite and fallible creatures living in a world limited by natural laws. The contrasting Promethean view, given force by the success of technology, holds that we should remove all limits, whether imposed by nature, human nature or morality. Its slogan is found emblazoned on the advertisements of the age: 'You can have it all' (Michelob Beer), or 'Your world should know no limits' (Merrill Lynch). The ecologically literate citizen will recognize these immediately for what they are: the stuff of epitaphs. Ecological literacy leads in other, and more durable, directions toward prudence, stewardship and the celebration of the Creation.

References

Berry, W. (1987) *Home Economics*, North Point Press, San Francisco

Caldwell, L. K. (1983) 'Environmental studies: Discipline or metadiscipline?' *The Environmental Professional*, pp247–259

Carson, R. (1984) *The Sense of Wonder*, Harper and Row, New York, p45
Curtis, C. P., Jr and Greenslet, F. (eds) (1962) *The Practical Cogitator*, 3rd edition, Houghton Mifflin Co, Boston, pp226–229
Daly, H. and Cobb, J. (1990) For *the Common Good*, Beacon Press, Boston, pp401–455
Hall, C. et al (1986) *Energy and Resource Quality*, Wiley and Sons, New York, pp3–151
Leopold, A. (1966) *A Sand County Almanac*, Ballantine, New York, p240
Lopez, B. (1989) *Crossing Open Ground*, Vintage, New York, p65
Lovins, A. (1977) *Soft Energy Paths*, Ballinger, Cambridge
MacIntyre, A. (1981) *After Virtue*, Notre Dame University Press, South Bend, p168–189
Wilson, E. O. (1984) *Biophilia*, Harvard University Press, Harvard
Worster, D. (1985) *Nature's Economy*, Sierra Club Books, San Francisco (1977); reissued by Cambridge University Press, Cambridge