FOR MY FATHER AND MOTHER

EARTH IN MIND

On Education, Environment, and the Human Prospect

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CHAPTER ONE

What Is Education For?

If today is a typical day on planet earth, we will lose 116 square miles of rain forest, or about an acre a second. We will lose another 72 square miles to encroaching deserts, the results of human mismanagement and overpopulation. We will lose 40 to 250 species, and no one knows whether the number is 40 or 250. Today the human population will increase by 250,000. And today we will add 2,700 tons of chlorofluorocarbons and 15 million tons of carbon dioxide to the atmosphere. Tonight the earth will be a little hotter, its waters more acidic, and the fabric of life more threadbare. By year’s end the numbers are staggering: The total loss of rain forest will equal an area the size of the state of Washington; expanding deserts will equal an area the size of the state of West Virginia; and the global population will have risen by more than 90,000,000. By the year 2000 perhaps as much as 20% of the life forms extant on the planet in the year 1900 will be extinct.

The truth is that many things on which our future health and prosperity depend are in dire jeopardy: climate stability, the resilience and productivity of natural systems, the beauty of the natural world, and biological diversity.

It is worth noting that this is not the work of ignorant people. Rather, it is largely the results of work by people with BAs, BSs, LLBs, MBAs, and PhDs. Elie Wiesel once made the same point, noting that the designers and perpetrators of Auschwitz, Dachau, and Buchenwald—the Holocaust—were the heirs of Kant and Goethe, widely thought to be the best educated people on earth. But their education did not serve as an adequate barrier to barbarity. What was wrong with their education? In Wiesel’s (1990) words,
It emphasized theories instead of values, concepts rather than human beings, abstraction rather than consciousness, answers instead of questions, ideology and efficiency rather than conscience.

I believe that the same could be said of our education. Toward the natural world it too emphasizes theories, not values; abstraction rather than consciousness; neat answers instead of questions; and technical efficiency over conscience. It is a matter of no small consequence that the only people who have lived sustainably on the planet for any length of time could not read, or like the Amish do not make a fetish of reading. My point is simply that education is no guarantee of decency, prudence, or wisdom. More of the same kind of education will only compound our problems. This is not an argument for ignorance but rather a statement that the worth of education must now be measured against the standards of decency and human survival—the issues now looming so large before us in the twenty-first century. It is not education, but education of a certain kind, that will save us.

Myth

What went wrong with contemporary culture and education? We can find insight in literature, including Christopher Marlowe's portrayal of Faust who trades his soul for knowledge and power, Mary Shelley's Dr. Frankenstein who refuses to take responsibility for his creation, and Herman Melville's Captain Ahab who says "All my means are sane, my motive and my object mad." In these characters we encounter the essence of the modern drive to dominate nature.

Historically, Francis Bacon's proposed union between knowledge and power foreshadowed the contemporary alliance between government, business, and knowledge that has wrought so much mischief. Galileo's separation of the intellect foreshadowed the dominance of the analytical mind over that part given to creativity, humor, and wholeness. And in Descartes's epistemology, one finds the roots of the radical separation of self and object. Together these three laid the foundations for modern education, foundations that now are enshrined in myths that we have come to accept without question. Let me suggest six.

First, there is the myth that ignorance is a solvable problem. Ignorance is not a solvable problem; it is rather an inescapable part of the human condition. We cannot comprehend the world in its entirety. The advance of knowledge always carried with it the advance of some form of ignorance. For example, in 1929 the knowledge of what a substance like chlorofluorocarbons (CFCs) would do to the stratospheric ozone and climate stability was a piece of trivial ignorance as the compound had not yet been invented. But in 1930 after Thomas Midgely, Jr., discovered CFCs, what had been a piece of trivial ignorance became a critical life-threatening gap in human understanding of the biosphere. Not until the early 1970s did anyone think to ask "What does this substance do to what?" In 1986 we discovered that CFCs had created a hole in the ozone over the South Pole the size of the lower 48 U.S. states; by the early 1990s, CFCs had created a worldwide reduction of ozone. With the discovery of CFCs, knowledge increased, but like the circumference of an expanding circle, ignorance grew as well.

A second myth is that with enough knowledge and technology, we can, in the words of Scientific American (1989), "manage planet earth." Higher education has largely been shaped by the drive to extend human domination to its fullest. In this mission, human intelligence may have taken the wrong road. Nonetheless, managing the planet has a nice ring to it. It appeals to our fascination with digital readouts, computers, buttons, and dials. But the complexity of earth and its life systems can never be safely managed. The ecology of the top inch of topsoil is still largely unknown as is its relationship to the larger systems of the biosphere. What might be managed, however, is us: human desires, economies, politics, and communities. But our attention is caught by those things that avoid the hard choices implied by politics, morality, ethics, and common sense. It makes far better sense to reshape ourselves to fit a finite planet than to attempt to reshape the planet to fit our infinite wants.

A third myth is that knowledge, and by implication human goodness, is increasing. An information explosion, by which I mean a rapid increase of data, words, and paper is taking place. But this explosion should not be mistaken for an increase in knowledge and wisdom, which cannot be measured so easily. What can be said truthfully is that some knowledge is increasing while other kinds of knowledge are being lost. For example, David Ehrenfeld has pointed out that biology departments no longer hire faculty in such areas as systematics, taxonomy, or ornithology (personal communication). In other words, important knowledge is being lost because of the recent overemphasis on molecular biology and genetic engineering, which are more lucrative but not more important areas of
inquiry. Despite all of our advances in some areas, we still do not have anything like the science of land health that Aldo Leopold called for a half-century ago.

It is not just knowledge in certain areas that we are losing but also vernacular knowledge, by which I mean the knowledge that people have of their places. According to Barry Lopez (1989),

it is the chilling nature of modern society to find an ignorance of geography, local or national, as excusable as an ignorance of hand tools; and to find the commitment of people to their home places only momentarily entertaining, and finally naive.

[I am] forced to the realization that something strange, if not dangerous, is afoot. Year by year the number of people with firsthand experience in the land dwindles. Rural populations continue to shift to the cities. . . . In the wake of this loss of personal and local knowledge, the knowledge from which a real geography is derived, the knowledge on which a country must ultimately stand, has come something hard to define but I think sinister and unsettling. (p. 55)

The modern university does not consider this kind of knowledge worth knowing except to record it as an oddity “folk culture.” Instead, it conceives its mission as that of adding to what is called “the fund of human knowledge” through research. What can be said of research? Historian Page Smith (1990) has offered one answer:

The vast majority of so-called research turned out in the modern university is essentially worthless. It does not result in any measurable benefit to anything or anybody. It does not push back those omnipresent ‘frontiers of knowledge’ so confidently evoked; it does not in the main result in greater health or happiness among the general populace or any particular segment of it. It is busywork on a vast, almost incomprehensible scale. It is dispiriting; it depresses the whole scholarly enterprise; and most important of all, it deprives the student of what he or she deserves—the thoughtful and considerate attention of a teacher deeply and unequivocally committed to teaching. (p. 7)

In the confusion of data with knowledge is a deeper mistake that learning will make us better people. But learning, as Loren Eiseley (1979) once said, is endless and “in itself . . . will never make us ethical men” (p. 284). Ultimately, it may be the knowledge of the good that is most threatened by all of our other advances. All things considered, it is possible that we are becoming more ignorant of the things we must know to live well and sustainably on the earth.

In thinking about the kinds of knowledge and the kinds of research that we will need to build a sustainable society, a distinction needs to be made between intelligence and cleverness. True intelligence is long range and aims toward wholeness. Cleverness is mostly short range and tends to break reality into bits and pieces. Cleverness is personified by the functionally rational technician armed with know-how and methods but without a clue about the higher ends technique should serve. The goal of education should be to connect intelligence with an emphasis on whole systems and the long range with cleverness, which involves being smart about details.

A fourth myth of higher education is that we can adequately restore that which we have dismantled. I am referring to the modern curriculum. We have fragmented the world into bits and pieces called disciplines and subdisciplines, hermetically sealed from other such disciplines. As a result, after 12 or 16 or 20 years of education, most students graduate without any broad, integrated sense of the unity of things. The consequences for their personhood and for the planet are large. For example, we routinely produce economists who lack the most rudimentary understanding of ecology or thermodynamics. This explains why our national accounting systems do not subtract the costs of biotic impoverishment, soil erosion, poisons in our air and water, and resource depletion from gross national product. We add the price of the sale of a bushel of wheat to the gross national product while forgetting to subtract the three bushels of topsoil lost to grow it. As a result of incomplete education, we have fooled ourselves into thinking that we are much richer than we are. The same point could be made about other disciplines and subdisciplines that have become hermetically sealed from life itself.

Fifth, there is a myth that the purpose of education is to give students the means for upward mobility and success. Thomas Merton (1985) once identified this as the “mass production of people literally unfit for anything except to take part in an elaborate and completely artificial charade” (p. 11). When asked to write about his own success, Merton responded by saying that “if it so happened that I had once written a best seller, this was a pure accident, due to inattention and naivete, and I would take very good care never to do the same again” (p. 11). His advice to students was to “be anything you like, be madmen, drunks, and bastards of every shape and form, but at all costs avoid one thing: success”
I2  THE PROBLEM OF EDUCATION

(p. 11). The plain fact is that the planet does not need more successful people. But it does desperately need more peacemakers, healers, restorers, storytellers, and lovers of every kind. It needs people who live well in their places. It needs people of moral courage willing to join the fight to make the world habitable and humane. And these qualities have little to do with success as our culture has defined it.

Finally, there is a myth that our culture represents the pinnacle of human achievement. This, of course, represents cultural arrogance of the worst sort and a gross misreading of history and anthropology. Recently, this view has taken the form that we won the Cold War. Communism failed because it produced too little at too high a cost. But capitalism has also failed because it produces too much, shares too little, also at too high a cost to our children and grandchildren. Communism failed as an ascetic morality. Capitalism has failed because it destroys morality altogether. This is not the happy world that any number of fickle advertisers and politicians describe. We have built a world of sybaritic wealth for a few and Calcuttan poverty for a growing underclass. At its worst, it is a world of crack on the streets, insensate violence, anomic, and the most desperate kind of poverty. The fact is that we live in a disintegrating culture. Ron Miller (1989) stated it this way:

Our culture does not nourish that which is best or noblest in the human spirit. It does not cultivate vision, imagination, or aesthetic or spiritual sensitivity. It does not encourage gentleness, generosity, caring, or compassion. Increasingly in the late twentieth century, the economic-tecnocratic-statist worldview has become a monstrous destroyer of what is loving and life-affirming in the human soul. (p. 2)

Rethinking Education

Measured against the agenda of human survival, how might we rethink education? Let me suggest six principles.

First, all education is environmental education. By what is included or excluded, students are taught that they are part of or apart from the natural world. To teach economics, for example, without reference to the laws of thermodynamics or ecology is to teach a fundamentally important ecological lesson: that physics and ecology have nothing to do with the economy. It just happens to be dead wrong. The same is true throughout the curriculum.

A second principle comes from the Greek concept of Paideia. The goal of education is not mastery of subject matter but mastery of one's person. Subject matter is simply the tool. Much as one would use a hammer and a chisel to carve a block of marble, one uses ideas and knowledge to forge one's own personhood. For the most part we labor under a confusion of ends and means, thinking that the goal of education is to stuff all kinds of facts, techniques, methods, and information into the student's mind, regardless of how and with what effect it will be used. The Greeks knew better.

Third, I propose that knowledge carries with it the responsibility to see that it is well used in the world. The results of a great deal of contemporary research bear resemblance to those foreshadowed by Mary Shelley: monsters of technology and its byproducts for which no one takes responsibility or is even expected to take responsibility. Whose responsibility is Love Canal? Chernobyl? Ozone depletion? The Exxon Valdez oil spill? Each of these tragedies was possible because of knowledge created for which no one was ultimately responsible. This may finally come to be seen for what I think it is: a problem of scale. Knowledge of how to do vast and risky things has far outrun our ability to use it responsibly. Some of this knowledge cannot be used responsibly, safely, and to consistently good purposes.

Fourth, we cannot say that we know something until we understand the effects of this knowledge on real people and their communities. I grew up near Youngstown, Ohio, which was largely destroyed by corporate decisions to "disinvest" in the economy of the region. In this case MBA graduates, educated in the tools of leveraged buyouts, tax breaks, and capital mobility, have done what no invading army could do: They destroyed an American city with total impunity and did so on behalf of an ideology called the "bottom line." But the bottom line for society includes other costs: those of unemployment, crime, higher divorce rates, alcoholism, child abuse, lost savings, and wrecked lives. In this instance what was taught in the business schools and economics departments did not include the value of good communities or the human costs of a narrow destructive economic rationality that valued efficiency and economic abstractions above people and community (Lynd, 1982).

My fifth principle follows and is drawn from William Blake. It has to do with the importance of "minute particulars" and the power of examples over words. Students hear about global responsibility while being educated in institutions that often spend their budgets and invest their
endowments in the most irresponsible things. The lessons being taught are those of hypocrisy and ultimately despair. Students learn, without anyone ever telling them, that they are helpless to overcome the frightening gap between ideals and reality. What is desperately needed are (a) faculty and administrators who provide role models of integrity, care, and thoughtfulness and (b) institutions capable of embodying ideals wholly and completely in all of their operations.

Finally, I propose that the way in which learning occurs is as important as the content of particular courses. Process is important for learning. Courses taught as lecture courses tend to induce passivity. Indoor classes create the illusion that learning only occurs inside four walls, isolated from what students call, without apparent irony, the "real world." Dissecting frogs in biology classes teaches lessons about nature that no one in polite company would verbally profess. Campus architecture is crystallized pedagogy that often reinforces passivity, monologue, domination, and artificiality. My point is simply that students are being taught in various and subtle ways beyond the overt content of courses.

Reconstruction

What can be done? Lots of things, beginning with the goal that no student should graduate from any educational institution without a basic comprehension of things like the following:

- the laws of thermodynamics,
- the basic principles of ecology,
- carrying capacity,
- energetics,
- least-cost, end-use analysis,
- limits of technology,
- appropriate scale,
- sustainable agriculture and forestry,
- steady-state economics, and
- environmental ethics.

I would add to this list of analytical and academic things, practical things necessary to the art of living well in a place: growing food; building shelter; using solar energy; and a knowledge of local soils, flora, fauna, and the local watershed. Collectively, these are the foundation for the capacity to distinguish between health and disease, development and growth, sufficient and efficient, optimum and maximum, and "should do" from "can do."

In Aldo Leopold's words, does the graduate know that "he is only a cog in an ecological mechanism? That if he will work with that mechanism his mental wealth and his material wealth can expand indefinitely? But that if he refuses to work with it, it will ultimately grind him to dust"? And Leopold asked, "If education does not teach us these things, then what is education for?" (p. 210).

SOURCES


Reflections on Water and Oil

The meaning of water might best be approached in comparison with that other liquid to which we in the twentieth century are beholden: oil. Water as rain, ice, lakes, rivers, and seas has shaped our landscape. But oil has shaped the modern mindscape, with its fascination and addiction to speed and accumulation. The modern world is in some ways a dialogue between oil and water. Water makes life possible, while oil is toxic to most life. Water in its pure state is clear; oil is dark. Water dissolves; oil congeals. Water has inspired great poetry and literature. Our language is full of allusions to springs, depths, currents, rivers, seas, rain, mist, dew, and snowfall. To a great extent our language is about water and people in relation to water. We think of time flowing like a river. We cry oceans of tears. We ponder the wellsprings of thought. Oil, on the contrary, has had no such effect on our language. To my knowledge, it has given rise to no poetry, hymns, or great literature, and probably to no flights of imagination other than those of pecuniary accumulation.

Our relation to water is fundamentally somatic, which is to say it is experienced bodily. The brain literally floats on a cushion of water. The body consists mostly of water. We play in water, fish in it, bathe in it, and drink it. Some of us were baptized in it. We like the feel of salt spray in our faces and the smell of rain that ends a dry summer heat wave. The sound of mountain water heals what hurts. We are mostly water and have an affinity for it that transcends our ability to describe it in mere words.

Oil and water have had contrary effects on our minds. Water, I think, lies at the origin of language. It is certainly a large part of the beauty of language. Water has also given rise to some of our most elegant technologies: water clocks, sailing ships, and waterwheels. The wise use of water is quite possibly the truest indicator of human intelligence, measurable by what we are smart enough to keep out of it, including oil, soil, toxics, and old tires. The most intelligent thing we could have done with oil was to have left it in the ground or to have used it very slowly over many centuries. Oil came to western civilization as a great temptation to binge, devil take the hindmost. Our resistance had already been lowered by the intellectual viruses introduced by the likes of Galileo, Bacon, and Descartes. We were in no condition to fend off those introduced by John D. Rockefeller, Henry Ford, and Alfred P. Sloan that promised speed, mobility, sexual adventure, and personal identity. Oil has undermined intelligence in at least six ways.

First, oil eroded our ability to think intelligently about community and the possibility of cooperation. Its nature is what game theorists call zero-sum: You have it or someone else does; you burn it or they do. Its possession set those who had it against those who did not: states against states; regions against regions; nations against nations; and the interests of one generation against those of generations to follow. Cheap oil and the automobile pitted community against community, suburban commuters against city neighborhoods. Money made from oil and oil-based technologies corrupted our politics, while our growing dependency corrupted our sense of proportion and scale. To guarantee our access to Middle Eastern oil we have declared our willingness to initiate Armageddon. We are now spending billions in fulfillment of this pledge even though a fraction of this annual bill would eliminate the need for oil imports altogether. The characteristics of oil and the way we have used it and have grown overly dependent on it have helped shape a mind-set that cannot rise above competition.

Second, oil has undermined our land intelligence by increasing the speed with which we move on it or fly over it. We no longer experience the landscape as a vital reality. Compare a trip by interstate highway from Pennsylvania to Florida with that taken by William Bartram in the eighteenth century. Where Bartram saw wonders and had the time to observe them carefully and be instructed and moved by them, modern travelers experience only a succession of homogenized images and sounds moving through an engineered landscape all tailored to the requirements of speed and convenience. As a result, our contact with land is increasingly abstract, measured as lapsed time and experienced as the dull exhaustion that accompanies jet lag or close confinement.

Third, oil has made us dumber by making the world more compli-
cated but less complex. An Iowa cornfield is a complicated human contrivance resulting from imported oil, supertankers, pipelines, commodity markets, banks and interest rates, federal agencies, futures markets, machinery, spare parts supply systems, and agribusiness companies that sell seeds, fertilizers, herbicides, and pesticides. In contrast, the forest or prairie that once existed in that place was complex, a highly resilient system consisting of a diversity of life forms, ecological relationships, and energy flows. Complicatedness is the result of high energy use that destroys genetic and cultural information. With complicatedness has come specialization of knowledge and the “expert.” Exit the generalist and the renaissance person. The result is a society and economy that no one comprehends, indeed, one that is beyond human comprehension. Complicatedness gives rise to unending novelty, surprise, and unforeseen consequences. As the possibility of foresight declines, the idea of responsibility also declines. People cannot be held accountable for the effects of actions that cannot be foreseen. Moreover, a high-energy society undermines our sense of meaning and our belief that our own lives can have meaning. It leads us to despair and to disparage the very possibility of intelligence.

Fourth, cheap oil and the automobile are responsible, in large measure, for the urban sprawl that has conditioned us to think that ugliness and disorder are normal or at least economically necessary. Where fossil energy was cheap and abundant the idea of a land ethic based on the “integrity, stability, and beauty of the biotic community” has never taken firm hold. This is not just a problem of ethics; it is a deeper problem that has to do with how poorly we think about economics. Sprawling megalopolitan areas are not only an aesthetic affront; they are sure signs of an unsustainable economy dominated by absentee corporations that vandalize distant places for “resources” and other places to discard wastes. A mind conditioned to think of ecological, aesthetic, and social disorder as normal, which is to say a mind in which the categories of harmony and beauty have atrophied, is to that extent impoverished. It is rather like being able to see only half of the color spectrum. On the other hand, intelligence, I think, grows as the mind is drawn to the possibilities of creating order, harmony, beauty, stability, and permanence.

Fifth, oil has undermined intelligence by devaluing handwork and craftsmanship. To a great extent the history of high-energy civilization can be described by the shift in the ratio between labor and energy. Economic development is the process of substituting energy for labor, moving people from farms into cities and from craft professions into factories and eventually into “the service sector.” This is not simply a matter of economic efficiency as some argue; it is a problem of human intelligence. Thinking, doing, and making exist in a complex symbiotic relationship. The price we pay for the convenience and affluence of a service economy may well be paid in the coin of intelligence. The drift of high-energy civilization is to make the world steadily less amenable to the kind of thought that results from the friction of an alert mind’s grappling with real materials toward the goal of work well done. To the modern mind, with its ghettos of costs and benefits, expertise, efficiency, built-in obsolescence, and celebration of technology that replaces manual skill, any alternative sounds hopelessly naive. However, we may find reason to reconsider, on the grounds of a larger efficiency and higher rationality, the reality that we are in fact “homo faber” whose identity is defined by the close interplay of thought and making.

Finally, oil has undermined intelligence because it requires technologies that we are smart enough to build but not smart enough to use safely. This is the gap between knowing how to do something and knowing what one should do. Cheap oil has divided our capabilities from our sense of obligation, care, and long-term responsibility. Oil used at the rate of millions of barrels each day cannot be used responsibly. The Exxon Valdez oil spill in Prince William Sound, and the dozens of other large oil spills like it, are not accidents but the logical result of a system that operates on a scale that can only produce catastrophes. Our mistake is compounded by the belief that the catastrophe occurred only because oil was spilled. It would have been an equal, if more diffuse catastrophe, had the Exxon Valdez made it safely to port and its cargo burned in car engines, proceeding thence into the atmosphere where its contents would have contributed to air pollution and global warming. Oil has reduced our intelligence by dividing us between what we take to be realistic imperatives of economy and the commands of ethical stewardship. As a result we have become far less adept at thinking and acting ethically and far more adept at rationalizing and denying.

If oil has made us dumber, might water make us smarter about more things over a longer term? I think so. To this end, I suggest several things beginning with an examination of contemporary curriculum to identify those parts that are based on the assumption of the permanence and blessedness of cheap energy. How much of the curriculum would stand if this assumption were removed? Education has generally prepared the
young to live in a high-energy world. We have shaped whole disciplines around such assumptions without stopping to inquire about their validity or their larger effects. The belief in the permanence and felicity of high-energy civilization is found at the heart of most of contemporary economics, with its practice of discounting, development theory, marketing, business, political science, and sociology. The natural sciences have been largely directed toward manipulation of the natural world without any comparable effort to study impacts of doing so or alternative kinds of knowledge that work with natural systems. Behind a great deal of this is the belief that we can make an end run around nature and get away with it.

Second, water should be a part of every school curriculum. I would include, for example, Karl Wittfogel’s (1956) study of the relationship between water management and despotic government, Donald Worster’s (1985) study of the politics of water in the American West, and Charles Bowden’s (1985) study of the relationship between water and the Papago people of Arizona. Water as part of our mythology, history, politics, culture, and society should be woven throughout curriculum, K through PhD.

Third, water should be the keystone in a new science of ecological design. John Todd’s (1991) Living Machines is a working example of ecological design. Education in ecological design would have to be transdisciplinary, aiming to integrate a broad range of disciplines and design principles of resilience, flexibility, appropriate scale, and durability. Todd’s work, as an example, is instructive in part because he has combined good engineering with ecology and vision.

Fourth, water and water purification should be built into the architecture and the landscape of educational institutions. The very institutions that purport to induct the young into responsible adulthood often behave like vandals. This need not be. Institutional waste streams offer a good place to begin to teach applied (as opposed to theoretical) responsibility. Solar aquatic waste systems and similar approaches offer a way to teach the techniques of waste water purification, biology, and closed loop design. There are many reasons to regard resource and waste flows as a useful part of the curriculum, not merely a nuisance.

Finally, I propose that restoration be made a part of the educational agenda. Every public school, college, and university is within easy reach of streams, rivers, and lakes that are in need of restoration. The act of restoration is an opportunity to move education beyond the classroom and laboratory to the outdoors, from theory to application and from indifference to healing. My proposal is for institutions to adopt streams or entire watersheds and make their full health an educational objective as important as, say, capital funds campaigns to build new administration buildings or athletic facilities.

What is the meaning of water? One might as well ask, “What does it mean to be human?” The answer may be found in our relation to water, the mother of life. When the waters again run clear and their life is restored we might see ourselves reflected whole.

**SOURCES**


CHAPTER ELEVEN

ECONOMICS ♦ 75

Economics

Imagine being in the cockpit of a 747 jet in which two pilots were in disagreement about whether the plane faced imminent disaster. Passengers and crew of even modest good sense would deem it a matter of the highest priority to determine which pilot was right. The debate would most likely appear to them as one transcending merely academic interest. Both pilots might be correctly reading different dials. One could be looking, say, at the altimeter, the on-board radar, and the position of the wing flaps, while the other is reading the fuel gauge, air speed indicator, and cabin pressure dial.

The world faces a somewhat analogous situation. To the biologist concerned about conservation, the dials and gauges reporting on the state of the world indicate potentially catastrophic rates of species loss, a sharp decline in major biomes such as coral reefs, wetlands, and rain forests, overpopulation pointing to even greater stresses in the future, high rates of soil loss and land abuse, and perhaps the onset of global warming. Humanity now uses or co-opts 40% of terrestrial net primary productivity, leading many biologists to see a collision ahead between population and economic growth and the carrying capacity of the earth.

The dials and gauges that economists read, in contrast, give them reason for optimism. Gross world product has increased throughout the twentieth century by some 1300% and continues to rise. Per capita wealth among all developed countries continues to grow. Most important, technological innovation continues to improve energy and resource efficiency. Moreover, some believe that technology and higher prices will combine to create substitutes for scarce resources (Dasgupta, 1991, pp. 107–126).

From their perspective, the essential problem is that of getting the price of things right and letting the market and technology do the rest.

Biologists, in other words, are paying attention to the larger economy of life: the biosphere; economists are looking at the subeconomy humans have built by exploiting nature. Both are important, but not equally so. The larger economy is nearly everywhere showing signs of stress and breakdown while the latter is still expanding. The question is not which indicators are more accurate but which is more basic and over what time span. This is a wager of sorts over the extent to which technology can render human economies independent of healthy soils, microbes, plants, animals, forests, ecosystems, and a stable climate. The biologist bets on bugs and biota, the economist on prices and technology. Beneath this, another wager is being played out over the extent to which technology can separate humanity from nature emotionally, spiritually, and intellectually, and whether the person in this Brave New World may regress to some frightful subhuman level.

Those who believe that such wagers cannot be won and should not be made make two basic arguments against mainstream neoclassical economics. The first has to do with the failure of economists to include the price of natural services in their calculations of welfare and income. Harvard biologist E. O. Wilson (1989), for example, argued that neoclassical economics is bankrupt. Its quantitative models of optimization and equilibrium have no realistic measure to place on the value of the environment. Economists cannot factor in opportunity costs, the losses incurred when habitats are destroyed and species go extinct. They are unable to handle multiple margins outside a narrowly defined market economy. (p. 7)

In other words, as biotic stocks, such as forests, soils, and wildlife, are destroyed, their loss should be subtracted from measures such as gross national product in the same manner as capital depreciation is subtracted from corporate profit and loss statements. The result would be a net figure showing the loss of future productivity owing to the loss of natural capital. This is altogether sensible and requires no major disciplinary shift beyond a commitment to full and honest accounting that includes biotic impoverishment. To make such calculations, however, one must first know a great deal about the services that various parts of nature provide directly or indirectly. No prudent ecologist, however, would claim that we
now have or will soon have knowledge this extensive. Moreover, one
must make a simplifying assumption that those parts of nature deemed
useless have no value beyond the arbitrary and fickle public “willingness
to pay.” No worthy philosopher would be so bold without first writing
several volumes of caveats.

World Bank economist Herman Daly has made a second and more
radical critique. Mainstream economists regard the economy, in Daly’s
view, as an isolated, closed system with no exchange of matter or energy
with the environment. As a result, economists working within this fram-
work are unable to deduce any optimal scale for the overall economy.
Daly (1991) proposed instead a model of the macroeconomy as

an open subsystem of the ecosystem . . . dependent upon it, both as
a source for inputs of low-entropy matter-energy and as a sink for
outputs of high-entropy matter-energy. (p. 256)

In other words, physics and ecology are more basic than economic theory.
From the perspective of physics or ecology the idea of an ever expanding
economy within a biosphere of fixed size is, in Lewis Thomas’s (1984)
view, “stupidity on the grandest scale.” But rates of stupidity among econ-
omists fully committed to the ever expanding economy are surely no
higher than those found, say, among members of the U.S. Congress or the
British Parliament. Aside from the power of religious faith disguised as
 technological optimism, how is the paradox of manifestly clever people
believing the truthfulness of physical impossibilities to be explained? Par-
tial answers can be found in assumptions economists bring to their work,
which predispose them not to see the limits of natural systems that are
the daily stuff of biology. Beyond such answers, however, one encounters
a logic that goes like this: (a) Everyone wants what we, the rich, have,
which is to say wealth; (b) who are we to say they should not have it?; (c)
therefore, we cannot deny “progress” and the human desire for material
improvement. Not much is said of the roughly $450 billion spent world-
wide on advertising each year to manufacture wants. But that quibble
aside, the unstated assumption is that we can summon neither the civic
and moral wisdom to create a more equitable distribution of wealth nor
the wit to redefine well-being in a less stuff-oriented and ecologically
destructive manner.

Such logic traps its adherents into accepting potentially catastrophic
risks that sanity and prudence suggest we should avoid. The inherent
risks, for example, in nuclear power, genetic engineering, and nanotech-
nologies appear “necessary” only because we have trapped ourselves in
yet another crisis of carrying capacity. And at each level, the stakes ratchet
upward.

One might dismiss the discrepancy between economists and biolo-
gists were it not for the fact that the assumptions of neoclassical econom-
ics have become widely and often uncritically accepted as faith and
dogma so that the economists’ model of “economic human” serves as
both an adequate description of human behavior, which it is not, and as
a prescription of how rational beings ought to behave, which is to say,
selfishly. Moreover, capitalism and its economists are on the march. After
the fall of communism, armies of economists and business school profes-
sors headed eastward to show former communists how to operate their
fallen economies. As a result the ecological flaws of our economic theories
have taken on added importance in the affairs of more people over a
larger share of the planet.

Those same theories so confidently expounded and exported are a
major cause of the crisis of biodiversity because they assign only short-
term monetary value to species, ecosystems, climate stability, and the
well-being of future generations. The problem in its larger context is what
value should be given to (a) those life forms, landscapes, and ecological
processes whose value cannot or should not be stated in monetary terms
and hence cannot be appropriately regarded merely as resources; (b) those
whose value is unknown and perhaps unknowable; and (c) those, now
ill-considered, that we may yet come to appreciate. Biologists and phi-
losophers can help identify those parts of natural systems and natural
areas that fit Category a. By simply acknowledging their ignorance and
the limits of science, they can also sound a cautionary alarm with regard
to Category b. The third category, however, is more troublesome because
it transcends biology and economics. It has to do with our maturity as a
species, by which I mean our capacity to identify with the biotic com-
munity and to shelter life. However, we may learn someday to value
nature beyond the wildest dreams of present-day economists. At least we
should hold out the possibility, and doing so may even help us to mature
a bit.

SOURCES

Daly, H. 1991. Towards an Environmental Macroeconomics. Land Economics, 67,
In weighing the question concerning the existence of God, seventeenth-century philosopher and mathematician Blaise Pascal (1623-1662) proceeded in a manner perhaps instructive for other and more mundane questions. “Reason,” he declared, “can decide nothing here.” Nonetheless, “you must wager. It is not optional.” You have, he believed, two things to lose, the true and the good; and two things to stake, your reason and your will, your knowledge and your happiness; and your nature has two things to shun, error and misery.

What would you lose by believing that God exists and living a life accordingly? Pascal’s answer was “If you gain, you gain all; if you lose, you lose nothing.” By doing so you would become “faithful, honest, humble, grateful, generous, a sincere friend, truthful.” The opposite decision that God did not exist and a life lived in pursuit of “poisonous pleasures, glory and luxury,” whatever its short-term gains, would be one of misery. In other words, if you chose not to believe and it turned out that God did exist, you would have hell to pay. On the other hand, if God did not exist and you had lived a life of faith you would have sacrificed only a few fleeting pleasures but gained much more. Pascal’s argument for faith, then, rested on the sturdy foundation of prudential self-interest aimed to minimize risk.

The world now faces a somewhat analogous choice. On one side a large number of scientists believe that the planet is warming rapidly. If we continue to spew out heat-trapping gases, such as carbon dioxide, methane, chlorofluorocarbons, and nitrous oxide, these scientists say we will warm the planet intolerably within the next century. The consequences of dereliction and procrastination may include killer heat waves, drought,
CHAPTER THIRTEEN

Rating Colleges

One of the more consistent idiosyncrasies of Americans is their penchant for ranking things. It is, on the whole, a harmless pastime, giving indoor pleasure to many, and bestowing high status upon those called on to create and maintain various rankings. It has also been known to boost sales of publications of one sort or another and, like *Sports Illustrated*‘s annual swimsuit issue, it provides either agreeable diversion or a source for moral indignation during an otherwise dull part of the year. One should not presume, however, that the relationship between such lists and reality is great. Nor is it necessary that it be so. Their function, rather, is to gratify, amuse, employ, sell, or fuel disagreement, hence the development of subsequent lists and rankings.

Until recently, colleges and universities, for the most part, ranked themselves. After due consideration the great majority solemnly proclaimed themselves to be “excellent.” But hundreds, if not thousands, of institutions laying claim to an attribute scarce by definition gives scant basis for ranking. The subsequent loss of pleasurable contention has been considerable. We have been rescued from this plight by various guides to colleges, including those by *The New York Times* and *U.S. News and World Report*. These and others like them rank colleges on such things as peer reputation, Scholastic Aptitude Test scores of incoming freshmen, size of endowments, number of books in the library, percentage of PhDs on the faculty, publications by faculty, tuition, faculty–student ratios, and so forth. These purport to describe, in one way or another, the capacity of educational institutions to educate.

Educational institutions, however, are not like football teams, so judging the capacity of a college to cultivate the higher qualities of life
and mind is considerably more subtle and complex than appraising the ability of 11 men to do mayhem for 60 minutes. Good education, in fact, may be inversely proportional to many of the qualities now used to rank educational institutions. Peer reputation may be an index only of snobbery and pomposity. Faculty publications may be an indicator of student dissatisfaction and the decline of forests. Large endowments might be a reasonable index of institutional torpor. Research grants may, on occasion, reflect ties to corporate and U.S. Department of Defense activities that Boards of Trustees might rather conceal.

Ranking works best when things are simple and can be easily counted. But good educational institutions are complex, creative, and difficult to describe in numbers. This is why I think that the editors of U.S. News and World Report’s college issue would have ranked Plato’s Academy rather far down on its list of “regional” institutions. Its library by all accounts was small, it had no laboratories, its student body consisted mostly of locals, and the major professor of the founder, whose work has descended to us by hearsay, was highly discredited through a lifetime of rabble rousing and carousing among the city’s young.

There is yet a second problem. Most ranking systems face backwards, using measures that no longer describe present realities or the role of the institution in relation to those realities. For example, whatever their stated purposes, colleges and universities have played a major role in the industrialization of the world in the belief that the domination of nature, on balance, was a good thing. The reality, however, has changed. We have several centuries of hard work ahead of us to clean up the mess: sequestering toxic and radioactive wastes; restoring depleted and mined land; cleaning up lakes, seas, and rivers; stabilizing climate; replanting forests; protecting whatever biological diversity we can; rebuilding decayed urban areas; and bringing all of the other vital signs of earth back to health.

Accordingly, I propose a different ranking system for colleges based on whether or not the institution and its graduates move the world in more sustainable directions. Does four years at a particular institution instill knowledge, love, and competence toward the natural world or indifference and ignorance? Are the graduates of this or that college suited for a responsible life on a planet with a biosphere? This is an admittedly difficult, but not impossible, task. I propose that colleges and universities be ranked on the basis of five criteria.

The first of these has to do with how much of various things the insti-

- tution consumes or discards per student. Arguably, the best indicator of institutional impacts on the sustainability of the earth is how much carbon dioxide it releases per student per year from electrical generation, heating, and direct fuel purchases. Other ratios of interest would include amounts of paper, water, materials, and electricity consumed per student. These can only be determined by careful audits of how much of what enters and leaves the campus (Smith, 1992). On this basis colleges might compete to become increasingly efficient in lowering resource use per student.

A second basis for ranking has to do with the institution’s management policies for materials, waste, recycling, purchasing, landscaping, energy use, and building. What priority does the institution give to the use of recycled materials? What percentage of its material flows are recycled? Does it limit the use of toxic chemicals on the grounds and in buildings? Does it emphasize energy efficiency and solar energy in renovations and new buildings? Does it use nontoxic materials?

Third, does the curriculum provide the essential tools for ecological literacy? What percentage of its graduates know the rudiments of ecology? Do they understand that no good economy can be built on the ruins of natural systems? Do they have experience in the out-of-doors? Is there opportunity and encouragement to restore some part of the nearby rivers, prairies, worn-out farmland, or strip-mined land? Do they understand the rudiments of environmental ethics? Do they understand the difference between optimum and maximum, stocks and flows, design and planning, renewable and nonrenewable, dwelling and residing, sufficiency and efficiency, can do and should do, health and disease, development and growth, and intelligence and cleverness? This presumes, of course, that the faculty itself is ecologically literate and relates environmental themes to course material.

My fourth criterion has to do with institutional finances. Does the institution use its buying power to help build sustainable regional economies? What percentage of its food purchases come from nearby farmers? In studies of food buying at Hendrix College, Oberlin College, Saint Olaf College, and Carleton College, for example, students discovered significant opportunities to increase food quality, decrease costs, and help the local economy. The same approach could be applied throughout all institutional purchases, giving priority to local craftspeople, merchants, and suppliers. Use of institutional buying power to help rebuild local and regional economies is also a prudent hedge against future price shocks.
associated with higher energy costs coming from supply interruptions, future scarcity, and the eventual imposition of carbon taxes to reduce emission of greenhouse gases.

Colleges and universities also have investment power. To what extent are their funds invested in enterprises that move the world toward sustainability? All institutions should set long-term goals to harmonize their investments with the goal of sustainability, seeking out companies and investment opportunities, doing things that need to be done to move the world in sustainable directions.

Fifth, institutions might be ranked on the basis of what their graduates do in the world. On average, what price will future generations pay for the manner in which graduates of particular institutions now live? How much do they consume over a lifetime? How much carbon dioxide do they contribute to the atmosphere? How many trees do they plant? How do they earn their keep? How many work through business, law, social work, education, agriculture, communications, research, and so forth to create the basis for a sustainable society? Are they part of the larger ecological enlightenment that must occur as the basis for any kind of sustainable society, or are they part of the rear guard of a vandal economy? Most colleges make serious efforts to discover who among their alumni have attained wealth. I know of no college that has surveyed its graduates to determine their cumulative environmental impacts.

This leads me finally to an observation and a modest suggestion. All educational institutions honor alumni in various ways, including the granting of honorary degrees mostly in direct proportion to wealth, power, fame, and gifts not yet received. None to my knowledge has ever revoked a degree for any cause whatsoever. Perhaps they should. If, for example, it were discovered that a graduate could not read, the embarrassment would be great and the institution's reputation would be greatly and deservedly damaged. No such shame as yet is attached to graduates who are merely ecologically illiterate and ignorant of how the planet works. There is, I think, only one reasonable course of action, the precedent for which is the practice of recalling defective automobiles at the manufacturer's expense. Likewise, defective minds should be "recalled" and offered an opportunity to return to the institution's tutelage to undergo remedial instruction. Alternatively, the institution that awarded the degree may wish to refund the tuition plus interest charges with its apology. It would, of course, remain liable for the damage done to the earth by the degree holder as a result of an ecologically defective education. In either case the nation, the institution, and the offender would be well served, and all would be greatly edified.

SOURCES

The Problem of Disciplines and the Discipline of Problems

We experience nature mostly as sights, sounds, smells, touch, and tastes—as a medley of sensations that play upon us in complex ways. But we do not organize education the way we sense the world. If we did, we would have Departments of Sky, Landscape, Water, Wind, Sounds, Time, Seashores, Swamps, Rivers, Dirt, Trees, Animals, and perhaps one of Ecstasy. Instead we have organized education like mailbox pigeonholes, by disciplines that are abstractions organized for intellectual convenience. Hardly one scholar in ten could say why or when this came to be, but most would state with great conviction that it is quite necessary and irrevocable. The “information explosion” has further added to the impulse to divide knowledge into smaller and smaller disciplinary categories, and the end is not in sight.

There is, nonetheless, a good bit of grumping about academic specialization, intellectual narrowness, and pigeonhole thinking. But despite decades of talk about “interdisciplinary courses” or “transdisciplinary learning,” there is a strong belief that such talk is just talk. Those thought to be sober, or at least judiciously dull, mostly presume that real scholarship means getting on with the advance of knowledge organized exclusively by disciplines and subdisciplines. It does not seem to matter that some knowledge may not contribute to an intelligible whole, that some of it is utterly trivial, that parts of it are contradictory, or that significant and life-enhancing things are omitted.

If this were all that happened as a consequence of the way we organize knowledge, the results would be merely unfortunate, but the truth is that the consequences are, in a deeper sense, tragic. The great ecological issues of our time have to do in one way or another with our failure to see things in their entirety. That failure occurs when minds are taught to think in boxes and not taught to transcend those boxes or to question overly much how they fit with other boxes. We educate lots of in-the-box thinkers who perform within their various specialties rather like a dog kept in the yard by an electronic barrier. And there is a connection between knowledge organized in boxes, minds that stay in those boxes, and degraded ecologies and global imbalances. The situation is tragic in that many suspect where all of this is leading but believe themselves powerless to alter it.

Our situation is tragic in another way. Often those who do comprehend our plight intellectually cannot feel it and hence are not moved to do much about it. This is not merely an intellectual failure to recognize our dependence on natural systems, which is fairly easy to come by. It is, rather, a deeper failure in the educational process to join intellect with affection and loyalty to the ecologies of particular places, which is to say a failure to bond minds and nature. It is no accident that this bonding happens far less often than we might hope. Professionalized and specialized knowledge is not about loyalty to places or to the earth, or even to our senses, but rather about loyalty to the abstractions of a discipline. The same can be said of the larger knowledge “industry,” which was intended to make us rich and powerful by industrializing the world. This may help to explain why increasingly sophisticated analyses of our plight coincide with a paralysis of will and imagination to get at its roots.

And so we tinker. We add a course here and another requirement there and hold a symposium in some exotic place. Those who are bold enough track on another outshelled to the rambling curricular edifice of Babel and call it “environmental studies.” If our crisis, however, is first and foremost a crisis of mind and perception, as I believe it to be, the time has come for a fundamental reconsideration of how we might encourage what Edith Cobb (1977) has called “an acute sensory response to the natural world” (p. 30). I offer two ideas.

First, I suggest that at all levels of learning K through PhD, some part of the curriculum be given to the study of natural systems roughly in the manner in which we experience them. The idea is hardly novel. In various ways it is the basis of programs offered by the National Outdoor Leadership School, Outward Bound, and can be found in courses in a few innovative institutions, such as Prescott College in Arizona, and in others offered by a few nonprofit institutes. It is also an old idea, going back at least as far as the belief that nature has something to teach us. The idea
is simply that we take our senses seriously throughout education at all levels and that doing so requires immersion in particular components of the natural world—a river, a mountain, a farm, a wetland, a forest, a particular animal, a lake, an island—before students are introduced to more advanced levels of disciplinary knowledge.

For example, a course on a nearby river might require students to live on the river for a time, swim in it, canoe it, watch it in its various seasons, study its wildlife and aquatic animals, listen to it, and talk to people who live along it. A river becomes, as biologist Carl McDaniel (1993) phrased it, “a microcosm of the world” and a doorway to wider knowledge. Each student might research a particular aspect of the river, say, its folklore, social history, evolution, art, chemistry, ecology, literature, or the politics and law that govern its use. Collectively, a picture of the river might begin to emerge that would be more than the sum of the individual projects. I am not proposing just a weekend field trip but a longer period of time to allow the senses to soak in the experience as sights, sounds, tastes, smells, and feel until something like profound respect, or more, begins to take root.

What might such experiences do? First, they would remove the abstractness and secondhand learning that corrupts knowledge at its source. Natural objects have a concrete reality that the abstractions of textbooks and lectures do not and cannot have. Second, a course on a river or a forest or a farm might help make up the experience deficit now common among urban and suburban young people whose minds have been exposed overly long to shopping malls, video games, and television. Third, it would cultivate mindfulness by slowing the pace of learning to allow a deeper kind of knowing to occur. Fourth, it would give students stronger reasons to want to learn those things that require the knowledge of various disciplines. Fifth, it would teach the art of careful field observation and the study of place. Sixth, it would teach students that there are some things that cannot be known or said about a mountain, or a forest, or a river—things too subtle or too powerful to be caught in the net of science, language, and intellect. It would introduce students to the mysterious and unknowable before the mere unknowns of a particular discipline.

What I am proposing, more broadly, is rather like a courtship between mind and nature, or perhaps like an awakening. I believe that we should introduce students to the mysteries of specific places and things before giving them access to the power inherent in abstract knowledge. I am proposing that we aim to fit the values and loyalties of students to specific places before we equip them to change the world. I propose that we give students a stronger reason to want to know while making them more trustworthy in the use of knowledge. I am proposing that we make them accountable in small things before giving them the keys to the creation.

Among the preconditions for the kind of experience I am proposing are Thoreau’s Walden, Aldo Leopold’s approach to natural history, Annie Dillard’s (1974) sojourn at Tinker Creek, John Hanson Mitchell’s (1984) study of 15,000 years on a square mile in Massachusetts, and William Least Heat Moon’s study of Chase County, Kansas, what he calls “a deep map” (Moon, 1991). And there is the experience, if we are willing to acknowledge it, from indigenous cultures, many of which were extraordinarily adept at drawing mind and nature together.

I have a second and related suggestion for overcoming disciplinary narrowness and the aloofness that is all too often characteristic of academic institutions. Alan Mermann (1992) at the Yale School of Medicine described the problem in these words:

Careful studies and accurate reports are done; papers are published in distinguished journals; but evidence of efforts to engage the problems on site is sadly lacking. . . . We have a long history of avoidance of unpleasant tasks requiring commitment and sacrifice. . . . We find it easier to use our minds and our resources for the solution of intellectual problems because we are then freed from the burdens of seeing our interdependence and our indebtedness as persons.

I believe this, in the main, to be true. Educational institutions and professionalized scholars do tend to seal themselves off from the unpleasant and less rewarding challenges around them. And when they do engage those challenges, they do so as “research,” not as serious efforts to solve real problems.

In contrast, I propose that we engage young people and faculty together in the effort to solve real problems. I do not propose such efforts as “service” projects alone but as ways to integrate learning with service. Opportunities are all around us. Virtually all schools and institutions of higher education are located in places that are losing biological diversity and the means for right livelihood, rural and urban places alike that are polluted, overexploited, and increasingly derelict. What do we know that might restore such places? How might the effort to solve real problems
be made a part of the conventional curriculum? How might the discipline of solving problems change the organization of education?

Problem solving requires broadening what we take to be our constituency to include communities in which educational institutions are located. It requires institutional flexibility and creativity, which in turn presuppose a commitment to make knowledge count for the long-term health of local communities and people. It requires overcoming the outmoded idea that learning occurs exclusively in classrooms, laboratories, and libraries. It requires acknowledgment of the possibility that learning sometimes occurs most thoroughly and vividly when diverse people possessing different kinds of knowledge pool what they know and join in a common effort to accomplish something that needs to be done. When they do, they discover ways to communicate that disciplinary education alone cannot produce. They quickly learn to distinguish what is important from what is not. And students and faculty alike discover that they are competent to change things that otherwise appear to be unchangeable.

We are not likely anytime soon to dispense with disciplinary knowledge, nor do I propose to do so. What I do propose is that we seek out ways to situate disciplinary knowledge within a more profound experience of the natural world while making it more relevant to the great quandaries of our age.

CHAPTER FIFTEEN

Professionalism and the Human Prospect

The mind can be permanently profaned by the habit of attending to trivial things, so that all our thought shall be tinged with triviality.

— HENRY DAVID THOREAU

I have always tried not to be a professional scientist.

— ERWIN Chargaff

The tenure system was originally created to protect the right of professors to speak freely without fear of reprisal. One might have expected great and radical things to emanate from the safely tenured. With some notable exceptions, however, this has not happened often. Derek Bok (1990), former President of Harvard University, for one, has lamented the results:

Armed with the security of tenure and the time to study the world with care, professors would appear to have a unique opportunity to act as society's scouts to signal impending problems. . . . Yet rarely have members of the academy succeeded in discovering emerging issues and bringing them vividly to the attention of the public (p. 105).

Similarly, why have so few of the tenured joined the effort to preserve biological diversity and a habitable earth? Why are so few of the tenured willing to confront the large and portentous issues of human survival looming ahead?
As Homo sapiens's entry in any intergalactic design competition, industrial civilization would be tossed out at the qualifying round. It doesn't fit. It won't last. The scale is wrong. And even its apologists admit that it is not very pretty. The design failures of industrially/technologically driven societies are manifest in the loss of diversity of all kinds, destabilization of the earth's biogeochemical cycles, pollution, soil erosion, ugliness, poverty, injustice, social decay, and economic instability.

Industrial civilization, of course, was not designed at all; it simply happened. Those who made it happen were mostly singleminded men and women innocent of any knowledge of what can be called the "ecological design arts," by which I mean the set of perceptual and analytical abilities, ecological wisdom, and practical wherewithal essential to making things that "fit" in a world of trees, microbes, rivers, animals, bugs, and small children. In other words, ecological design is the careful meshing of human purposes with the larger patterns and flows of the natural world and the study of those patterns and flows to inform human purposes.

Ecological design competence means maximizing resource and energy efficiency, taking advantage of the free services of nature, recycling wastes, making ecologically smarter things, and educating ecologically smarter people. It means incorporating intelligence about how nature works, what David Wann (1990) called "biologic," into the way we think, design, build, and live. Design applies to the making of nearly everything that directly or indirectly requires energy and materials or governs their use, including farms, houses, communities, neighborhoods, cities, transportation systems, technologies, economies, and energy policies. When human artifacts and systems are well designed, they are in harmony with the larger patterns in which they are embedded. When poorly designed, they undermine those larger patterns, creating pollution, higher costs, and social stress in the name of a spurious and short-run economizing. Bad design is not simply an engineering problem, although better engineering would often help. Its roots go deeper.

Good design, begins as Wendell Berry (1987) stated, by asking, "What is here? What will nature permit us to do here? What will nature help us to do here?" (p. 146). Good design everywhere has certain common characteristics including the following:

- right scale,
- simplicity,
- efficient use of resources,
- a close fit between means and ends,
- durability,
- redundancy, and
- resilience.

Good design also solves more than one problem at a time. They are often place specific or, in John Todd's words, "elegant solutions predicated on the uniqueness of place." Good design promotes

- human competence instead of addiction and dependence,
- efficient and frugal use of resources,
- sound regional economies, and
- social resilience.

Where good design becomes part of the social fabric at all levels, unanticipated positive side effects (synergies) multiply. When people fail to design carefully, lovingly, and competently, unwanted side effects and disasters multiply.

By the evidence of pollution, violence, social decay, and waste all around us, we have designed things badly. Why? There are, I think, three primary reasons. The first is that while energy and land were cheap and the world relatively "empty," we simply did not have to master the discipline of good design. We developed extensive rather than intensive economies. Accordingly, cities sprawled, wastes were dumped into rivers or landfills, farmers wore out one farm and moved on to another, houses and automobiles got bigger and less efficient, and whole forests were converted into junk mail and Kleenex. Meanwhile, the know how necessary
to a frugal, well-designed, intensive economy declined and words like realistic or convenience became synonymous with habits of waste.

Second, design intelligence fails when greed, narrow self-interest, and individualism take over. Good design is a community process requiring people who know and value the positive things that bring them together and hold them together. Old-order Amish farmers, for example, refuse to buy combines not because they would not make things easier or more profitable but because they would undermine community by depriving people of the opportunity to help their neighbors. This is pound wise and penny foolish the way intelligent design should be. In contrast, American cities with their extremes of poverty and opulence are products of people who believe that they have little in common with other people. Suspicion, greed, and fear undermine good community and good design alike.

Third, poor design results from poorly equipped minds. Good design can only be done by people who understand harmony, patterns, and systems. Good design requires a breadth of view that leads people to ask how human artifacts and purposes “fit” within the immediate locality and within the region. Industrial cleverness, however, is mostly evident in the minutiae of things, not in their totality or in their overall harmony. Moreover, good design uses nature as a standard and so requires ecological intelligence, by which I mean a broad and intimate familiarity with how nature works. For all of the recent interest in environment and ecology, this kind of knowledge, which is a product of both local experience and stable culture, is fast disappearing.

As an example of this kind of knowledge, George Sturt (1984), one of the last wheelwrights in England, described in The Wheelwright's Shop what he called “the age-long effort of Englishmen to fit themselves close and ever closer into England” (p. 66). Sturt built wagons crafted to fit the buyer’s particular habits, needs, and topography. To do so, he needed to know a great deal about how his customers used a wagon, whether they drove fast or slow, whether their land was rocky or wet, and what they hauled. As a result,

we got curiously intimate with the peculiar needs of the neighborhood. In farm-waggon or dung-cart, barley-roller, plough, water barrel, or what not, the dimensions we chose, the curves we followed, were imposed upon us the nature of the soil in this or that farm, the gradient of this or that hill, the temper of this or that customer or his choice perhaps in horseflesh. (p. 18)

Furthermore, the wheelwright needed to know what kinds of trees gave particular parts extra strength, or flexibility, or weight, where these trees grew, and when they were ready to harvest. And finally he needed to know the traditions and skills unique to his craft that were passed down as folk knowledge:

What we had to do was to live up to the local wisdom of our kind; to follow the customs, and work to the measurements, which had been tested and corrected long before our time in every village shop all across the country. (p. 19)

The kind of mind that could design and build a good wagon depended a great deal on time-tested knowledge and intimate familiarity with place. The results were wagons that fit particular people and a particular landscape.

A contemporary example of ecological design can be found in John Todd’s “living machines,” which are carefully orchestrated ensembles of plants, aquatic animals, technology, solar energy, and high-tech materials to purify wastewater, but without the expense, energy use, and chemical hazards of conventional sewage treatment technology. According to Todd (1991),

People accustomed to seeing mechanical moving parts, to experiencing the noise or exhaust of internal combustion engines or the silent geometry of electronic devices, often have difficulty imagining living machines. Complex life forms, housed within strange light-receptive structures, are at once familiar and bizarre. They are both garden and machine. They are alive yet framed and contained in vessels built of novel materials. . . Living machines bring people and nature together in a fundamentally radical and transformative way. (pp. 335–343)

Todd has created several working examples of living machines, each resembling a greenhouse filled with exotic plants and aquatic animals. Wastewater enters at one end; purified water leaves at the other. In between, the work of sequestering heavy metals in plant tissues, detoxifying toxics, and removing nutrients has been done by biological systems driven by sunlight. A decade earlier he designed and built structures that similarly used aquatic systems to process waste, grow food, and store heat. Living machines and biologic imply changes in the way we process wastewater, grow food, and build houses and in the ways we integrate
these and other functions into systems patterned after natural processes to do what industrial technology can only do expensively and destructively.

Ecological design also applies to the design of governments and public policies. Governmental planning and regulation require large and often ineffective or counterproductive bureaucracies. Design, in contrast, means

the attempt to produce the outcome by establishing the criteria to govern the operations of the process so that the desired result will occur more or less automatically without further human intervention. (Ophuls, 1977, pp. 228–229)

In other words, well-designed policies and laws get the macro things right like prices, taxes, and incentives while preserving a high degree of micro freedom in how people and institutions respond. Design focuses on the structure of problems as opposed to their coefficients. For example, the Clean Air Act of 1970 required car manufacturers to install catalytic converters to remove air pollutants. Twenty-two years later emissions per vehicle are down substantially, but with more cars on the road, air quality is about the same. A design approach to transportation would lead us to think more about creating access between housing, schools, jobs, and recreation that eliminate the need to move lots of people and materials over long distances. A design approach would have led us to reduce dependence on automobiles by building better public transit systems, restoring railroads, and creating bike trails and walkways. A design approach would also lead us to rethink the use of urban land and to reintegrate agriculture and wilderness into urban areas.

The Liberal and the Ecological Design Arts

Ecological design requires the ability to comprehend patterns that connect, which means getting beyond the boxes we call disciplines to see things in their ecological context. It requires, in other words, a liberal education, but nearly everywhere the liberal arts have tended to become more specialized and narrow. Design competence requires the integration of firsthand experience and practical competence with theoretical knowledge, but the liberal arts have become more abstract, fragmented, and remote from lived reality. Design competence requires us to be students of the natural world, but the study of nature is being displaced by the effort to engineer nature to fit the economy instead of the other way around. Finally, design competence requires the ability to inquire deeply into the purposes and consequences of things to know what is worth doing and what should not be done at all. But the ethical foundations of education have been diluted by the belief that values are relative. All of this is to say that from an ecological perspective the "liberal arts" have not been liberal enough. I think this is evident in four respects.

First, the liberal arts have not been liberal enough in their response to the rapid decline in the habitability of the earth. Global and national policy change are necessary but insufficient to reverse downward trends in the earth's vital signs. It is also essential that we educate a citizen constituency that supports change and is competent to do the local work of rebuilding households, farms, institutions, communities, corporations, and economies that (1) do not emit carbon dioxide or other heat-trapping gases; (2) do not reduce biological diversity; (3) use energy, materials, and water with high efficiency; and (4) recycle wastes. In other words, a constituency that is capable of building economies that can be sustained without further reducing the earth's potential to sustain life. At a minimum this will require a modification of the skills, aptitudes, abilities, and curriculum by which we learned how to industrialize the earth.

Second, the liberal arts have come to mean an education largely divorced from practical competence. Inclusion of the ecological design arts in the liberal arts means bringing practical experience back into the curriculum in carefully conceived ways. The reasons, in Alfred North Whitehead's (1967) words, are straightforward: "First-hand knowledge is the ultimate basis of intellectual life. . . . the second-handedness of the learned world is the secret of its mediocrity" (p. 51). In contrast to the distinction that John Henry Newman once drew between desirable and useful knowledge (Newman, 1862, pp. 84–88), Whitehead argued that there is a "reciprocal influence between brain activity and material creative activity" essential for good thinking. In other words, good thinking and practical experience are mutually necessary. Accordingly, he thought, "The disuse of hand-craft is a contributory cause to the brain-lethargy of aristocracies." J. Glenn Gray (1984) has argued similarly that the exclusion of manual skills from the liberal arts is dangerous "because it first divorces us from our own dispositions at the level where intellect and emotions fuse" (p. 85). Purely analytical and abstract thinking "separates us from our natural and human environment" (p. 85). Geo-
unively liberal education, in contrast, cultivates the full person, including manual competence and feeling as well as intellect.

Third, the liberal arts have come to include any number of fields, subfields, issues, and problems excepting those that are closest at hand in the local community. Inclusion of the ecological design arts suggests a symbiotic relation between learning and locality. Here, too, the reasons are part of an older tradition going back to John Dewey. In 1899 John Dewey wrote that “the school has been so set apart, so isolated from the ordinary conditions and motives of life” that children cannot “get experience— the mother of all discipline” (Dewey, 1990, p. 17). His solution required integrating opportunities for students “to make, to do, to create, to produce” and ending the separation of theory and practice. Dewey proposed that the immediate vicinity of the school be a focus of education, including the study of food, clothing, shelter, and nature. Through the study of these things, students might learn “the measure of the beauty and order about him, and respect for real achievement.” Gray (1984) has likewise argued that liberal education is “least dependent on formal instruction. It can be pursued in the kitchen, the workshop, on the ranch or farm” (p. 81). It can also be pursued through the study of energy, water, materials, food, and waste flows on the campus.

How can competence in the ecological design arts be taught within the conventional curriculum? There are at least two broad possibilities. The best, but most difficult, approach is to make over entire institutions so that their operations and resource flows (food, energy, water, materials, waste, and investments) become a laboratory for the study of ecological design. There is a strong case for doing this for economic as well as pedagogic reasons (Orr, 1990). A second possibility follows the suggestion of Herman Daly and John Cobb to establish separate centers or institutes within colleges and universities with the mission of fostering ecological design intelligence (Daly and Cobb, 1989, pp. 357–360). Ecological design arts centers would aim to (1) develop a series of ecological design projects that involve students, faculty, and staff; (2) study institutional resource flows; (3) develop curriculum; and (4) carry out studies on environmental trends throughout the region. Ecological design projects could include, for example,

- development of a bioregional directory of building materials;
- inventory campus resource flows;
- restoration of a degraded ecosystem on or near the campus;
- design of a low-input, sustainable farm system;
- economic survey of resource and dollar flows in the regional economy; and
- design of solar aquatic wastewater systems for campus effluents.

The list could be easily extended, but the point is clear. The functions of ecological design institutes are (1) to equip young people with a basic understanding of systems and to develop habits of mind that seek out “patterns that connect” human and natural systems; (2) to teach young people the analytical skills necessary for thinking accurately about cause and effect; (3) to give students the practical competence necessary to solve local problems; and (4) to teach young people the habit of rolling up their sleeves and getting down to work.

SOURCES

CHAPTER SEVENTEEN

Architecture as Pedagogy

IT IS paradoxical that buildings on college and university campuses, places of intellect, characteristically show so little thought, imagination, sense of place, ecological awareness, and relation to any larger pedagogical intent. The typical academic building seems to have the architectural elegance and performance standards common to shopping malls, motels, and drive-through funeral parlors: places where, one might infer, considerations of “throughput” are uppermost in the minds of designers. How has this come to be? Some believe it is the result of a conspiracy of sorts between a wealthy donor wishing to make an end run around mortality by having his or her name on a building; a college president wishing to enhance a reputation for getting things done; and an architect seeking a professional reputation by designing showy buildings that do not work very well; and a financial officer whose job it is to economize on beauty, humanity, and common sense in the name of fiscal integrity. Personally, I do not believe that the design of academic buildings is the result of a conspiracy at all. Most academic administrators and trustees are fully capable of doing all of this on their own in broad daylight. They have not conspired, because they did not need to—faculty and students have been effectively excluded from the process whereby ambition tempered by dullness and tortured by utility is rendered into architectural form.

The problem is not just that many academic buildings are unsightly, do not work very well, or do not fit their place or region. The deeper problem is that academic buildings are not neutral, aseptic factors in the learning process. We have assumed, wrongly I think, that learning takes place in buildings, but that none occurs as a result of how they are designed or by whom, how they are constructed and from what materials, how they fit their location, and how—and how well—they operate. My point is that academic architecture is a kind of crystallized pedagogy and that buildings have their own hidden curriculum that teaches as effectively as any course taught in them. What lessons are taught by the way we design, build, and operate academic buildings?

The first lesson is that architecture is the prerogative of power and not that of those who teach or learn. Implicit in this view is the assumption that architecture does not influence the flow of ideas, the quality of learning, and the human relationships in which learning is embedded. Therefore, faculty and students are rarely consulted on whether or what to build or where. From this, they learn that power can impose what it wishes on the academic landscape without having to explain much.

The second lesson is that architecture and building design are merely technical and are thus best left to people with technical competence. It follows that ethical, ecological, or aesthetic aspects of building do not matter nearly as much as technique and technology. In deference to expertise, then, we learn passivity toward the “built environment.” This may explain our subsequent failure to protest the spread of ugliness and banality across the landscape as well as our apparent obliviousness to how these cheapen our lives and diminish our prospects.

From the design and materials used in construction, a third lesson is learned: The environmental and energy costs of building do not matter much. Academic buildings are seldom designed to maximize solar gain or energy efficiency, to minimize unpriced environmental costs of materials, or to utilize local materials. Thus, we learn the callousness that accompanies waste and inefficiency, as well as callousness to the degradation of other places from which materials and energy originate.

Fourth, a “successful” building is one that quietly serves the educational process but requires no mindfulness of those who use it. From this we learn passivity and disengagement from our surroundings and the irresponsibility invited by never having to know how things work, or why, or what alternatives there might have been. The same building in which sophisticated theories are propounded unobtrusively teaches its occupants that it is OK to be oblivious to the most basic aspects of life support.

Fifth, the process teaches us about the limits of imagination. It is assumed, without anyone ever saying as much, that intellect can be nurtured in sterile places largely devoid of imagination. Therefore, creativity in academic architecture is mostly confined to facades replete with lots of
glassy flourishes of form disengaged from any purpose beyond that of impressing the easily impressionable. The use of imagination mostly stops short of the places where learning is supposed to happen, the design of which is still the cubical classroom or the lecture hall (a cavernous space with audiovisual equipment), both of which reached near state of the art sometime before the “Dark Ages.” Such spaces do little to lift the spirits, stir the imagination, fuel the intellect, or remind us that we are citizens of ecological communities.

We have not thought of academic buildings as pedagogical, but they are. We have not exercised much imagination about the design of academic buildings, and it shows in a manifest decline in our capacity to envision alternatives to the urban and suburban excrecence oozing all around us. We have assumed that people who know little about learning and pedagogy were competent to design places where learning is supposed to occur. They are not, not alone anyway. What alternatives do we have?

Let us begin by asking what might be learned from the design, construction, and operation of the places where formal education takes place. First, the process of design and construction is an opportunity for a community to deliberate over the ideas and ideals it wishes to express and how these are rendered into architectural form. What do we want our buildings to say about us? What will they say about our ecological prospects? To what large issues and causes do they direct our attention? What problems do they resolve? What kind of human relationships do they encourage? These are not technical details but first and foremost issues of common concern that should be decided by the entire campus community. When they are addressed as such, the design of buildings fosters civic competence and extends the idea of citizenship.

Second, the architectural process is an opportunity to learn something about the relationship between ecology and economics. For example, how much energy will a building consume over its lifetime? How much of what kinds of materials will be required for its upkeep? What unpriced costs do construction materials impose on the environment? Are they toxic to manufacture, install, or, later, to dispose? How are these costs paid? What is the total energy embodied in materials used in the structure? Is it possible to design buildings that repay those costs by being net energy exporters? If not, are there other ways to balance ecological accounts? Can buildings and the surrounding landscape be designed to generate a positive cash flow?

These questions cannot be answered without engaging issues of ethics. How are building materials extracted, processed, manufactured, and transported? What ecological and human costs do various materials impose where and on whom? What in our ethical theories justifies the use of materials that degrade ecosystems, jeopardize other species, or risk human lives and health? Where those costs are deemed unavoidable to accomplish a larger good, how can we balance ethical accounts?

Fourth, within the design, construction, and operation of buildings is a curriculum in applied ecology. Buildings can be designed to recycle organic wastes through miniature ecosystems that can be studied and maintained by the users. Buildings can be designed to heat and cool themselves using solar energy and natural air flows. They can be designed to inform occupants of energy and resource use. They can be landscaped to provide shade, break winter winds, propagate rare plants, provide habitat for animals, and restore bits of vanished ecosystems. Buildings and landscapes, in other words, can extend our ecological imagination.

Fifth, they can also extend our ecological competence. The design and operation of buildings is an opportunity to teach students the basics of architecture, landscape architecture, ecological engineering for cleaning wastewater, aquaculture, gardening, and solar engineering. Buildings that invite participation can help students acquire knowledge, discipline, and useful skills that cannot be acquired other than by doing.

Finally, good design can extend our imagination about the psychology of learning. The typical classroom empties quickly when not required to be used. Why? The answer is unavoidable: It is most often an uninteresting and unpleasant place, designed to be functional and nothing more. And the same features that make it unpleasant make it an inadequate place in which to learn. What makes a place a good educational environment? How might the typical classroom be altered to encourage ecological awareness, creativity, responsiveness, and civility? How might materials, light, sounds, water, spatial configuration, openness, scenery, colors, textures, plants, and animals be combined to enhance the range and depth of learning? My hunch is that good learning places are places that feel good to us: human-scaled places that combine nature, interesting architecture, materials, natural lighting, and “white sounds” (e.g., running water) in interesting ways that resonate with our innate affinity for life.

My point is that the design, the construction, and the operation of academic buildings can be a liberal education in a microcosm that includes virtually every discipline in the catalog. The act of building is an
opportunity to stretch the educational experience across disciplinary boundaries and across those dividing the realm of thought from that of application. It is an opportunity to work collectively on projects with practical import and to teach the art of “good work.” It is also an opportunity to lower lifecycle costs of buildings and to reduce a large amount of unnecessary damage to the natural world incurred by careless design.

CHAPTER EIGHTEEN

Agriculture and the Liberal Arts

It is incumbent on us to take special pains . . . that all the people, or as many of them as possible, shall have contact with the earth and that the earth’s righteousness shall be abundantly taught.

— Liberty Hyde Bailey

Until quite recently much of what people knew about the natural world they learned from the experience of growing up on a farm or by periodic visits to nearby farms. For all of their flaws, farms were schools of a sort in natural history, ecology, soils, seasons, wildlife, animal husbandry, and land use. The decline of ecologically diverse farms and the experience of the natural world that they fostered explains in large part, I think, the increasing gap between the broad support for environmental causes evident in public opinion polls and a growing ignorance of how ecosystems work and how private consumption and economic growth destroy the environment. In other words, the sharp decline in the number of farms and the shift toward industrial farming has had serious consequences for our collective ecological intelligence.

To be sure, the experience of farm life varied greatly with the quality of the farm and differences in individual perpectivity, intelligence, and skill. Moreover, in the absence of vital rural communities, farm life was sometimes tedious, narrow, and parochial. On balance, however, I believe that it was mostly otherwise. But in either case farms did what no other institution has ever done as well. They taught directly, and sometimes painfully, the relationship between our daily bread and soil, rainfall, animals, biological diversity, and natural cycles, which is to say land stew-
Prices and the Life Exchanged: Costs of the U.S. Food System

The cost of a thing,” Thoreau once wrote, “is the amount of what I will call life which is required to be exchanged for it, immediately or in the long run.” Thoreau knew what some have yet to discover: the difference between price and cost. Prices, what we pay at the checkout counter, are specific and countable. Costs, on the other hand, include (1) things of value that cannot be measured in numbers; (2) things that could be measured but that we choose to ignore; and (3) the loss of things that we did not know to be important until they were gone. Americans, we are proudly informed, pay only 15% of their disposable income on food, compared with the 23.8% that Europeans pay (National Research Council, 1989, pp. 34–35). But this figure clearly does not represent the true costs of supplying food. Another of my favorite economists, Will Rogers, once said that “It ain’t what we don’t know that gives us trouble, it’s what we know that ain’t right.” What “we know that ain’t right” about the price of food is the source of a great deal of trouble with worse yet to come. The prices we pay for food do not reflect the life we exchange for it or that which we will subsequently forfeit. This is so, in large measure, because life—biotic resources and the health of rural communities essential to a healthy agriculture and culture—is not included in our present accounting system, which instead tends to regard these “factors of production” as if they are as replaceable as worn-out machines.

The practice of ignoring the difference between price and true cost is the stuff out of which historians write epitaphs for whole civilizations. The difference between price and cost is also a matter of honesty and fair-

ness between those who benefit and those who, sooner or later, are required to pay. One effect of not paying full costs is that we fool ourselves into thinking that we are much richer than we really are. Prices that do not “tell the truth,” in Amory Lovins’s words, eventually lure us (or our children) toward bankruptcy. But the truth that needs to be told cannot be spoken only or even primarily in the language and with the numbers of economics alone. It must be told in the language of ecology, culture, and politics as well.

The True Costs of Food

What are the true costs of the U.S. food system? The first and most discussed are costs resulting from damage to natural systems that accompanies industrial food production. Average soil erosion rates in the United States are estimated to be 7.1 tons per acre per year, 14 times faster than the rates at which soil is created. Cornell University scientist David Pimentel (1990) has estimated that soil erosion and associated water runoff cost the United States $44 billion annually (p. 8). If one considers water overdrafts, land subsidence, soil salinization, and public subsidies for western water, waste of both surface and groundwater costs billions of dollars more than we pay. Pesticides, for which farmers spend $4 billion annually, are estimated to cause $2 to $4 billion in health and environmental damages, including an estimated 20,000 cases of pesticide-caused cancer each year (Pimentel, 1990, p. 11; National Academy of Sciences, 1987). Five billion livestock in the United States produce 41.8 billion tons of manure each year, half of which is wasted, becoming a source of pollution for groundwater and streams and a source of methane, a powerful greenhouse gas. Agriculture has become progressively more dependent on fossil fuels at an uncalculated cost to the environment from the extraction, processing, transport, and combustion. Food packaging is another source of environmental costs. One third of the solid waste stream is food packaging. David Pimentel has estimated that the total unpriced costs of the U.S. food system fall between $150 and $200 billion dollars per year. A recent study by economists at the World Resources Institute similarly showed that “where everything relevant is counted, the traditional accounting method’s $80-per-acre profit becomes a $26-per-acre loss” (Faeth et al., 1991, p. vi).

A second unpriced cost of the U.S. food system is the loss of farms
and rural communities. U.S. Census Bureau data show that America is now overwhelmingly an urban nation, with 77.5% living in metropolitan areas and 50.2% living in large metropolitan areas (The New York Times, February 21, 1991). The number of farms in the United States has dropped from 6.5 million in the late 1930s to less than 2 million in 1990. The number of full-time, owner-operated farms is considerably smaller still. Each farm failure means a loss of three to five rural jobs. The loss of six farms means one failed rural business (Strange, 1990, p. 7). Agricultural communities lost nearly 6% of their population between 1969 and 1986 and now have higher poverty rates (17%) than do urban areas (9%). The farm population of 4.6 million (less than 2% of the total population) is now so low that the U.S. Census Bureau will no longer keep separate records on it (The New York Times, October 10, 1993). Farms and farming communities are dying, and the U.S. food system is increasingly dominated by “super farms,” which are roughly to farming what WalMart is to retailing. What do these things mean?

If one counts only farm “productivity,” the gross tonnage of food generated, the answer is “not much.” By broader criteria, however, the answer is radically different. Cornell University horticulturist Liberty Hyde Bailey (1980) once questioned

whether the race can permanently endure urban life, or whether it must be constantly renewed from the vitalities in the rear. (p. 27)

According to Bailey, rural communities

beget men and women [who are] serious and steady and know the value of every hour and of every coin that they earn; and whenever they are properly trained these folk recognize the holiness of the earth. (p. 29)

Barring a serious national commitment to foster reruralization, the experiment to which Bailey referred is now nearly complete. We are, by and large, an urban people without much vitality in the rear. Rural areas continue to send their young to the cities, and their economies are thoroughly colonized by outside forces, not the least of which is television. We are not, however, more civilized or happier. To the contrary, statistics on virtually every kind of crime, social pathology, and insanity suggest that we are moving in the opposite direction: toward a kind of insensate high-tech barbarism.

PRICES AND THE LIFE EXCHANGED

Bailey, I think, had it right. We are losing, with barely a whimper, the cultural diversity—special skills, products, cuisine, human qualities, and traditions—that made small towns and rural areas distinctive. Is this just nostalgia? Jacquetta Hawkes (1951), in her classic book A Land, put it this way:

It would be sentimental blindness of another kind to ignore the significance of its [distinctive rural cultures and economies] achievement—the unaltering fitness and beauty of everything men made from the land they had inherited. (p. 144)

And we are losing a choice that a majority of Americans prefer. Gallup poll data consistently show that half or more of Americans would prefer living in small towns (34%) or on farms (22%) than in urban areas (The New York Times, September 11, 1990, p. A12).

Along with the loss of a vital rural culture, we are losing the ecological basis on which a rural culture must depend. Rural America is under assault from those who see it as only a place to dump urban refuse and toxic substances, to “recreate,” and to speculate (Fritsch, 1989). Acid rain and climate change will only accelerate the destruction.

There is a related loss that is even harder to measure: the loss of the sort of intelligence about the land that once resulted from the close contact with soils, animals, wildlife, forests, and the seasons fostered by farming and rural living. For all of their environmental destructiveness, farms have been in large part the places where Americans were instructed in the realities of nature. To be sure, the lessons were incompletely learned, and sometimes they were not learned at all. But when they were learned and practiced as a kind of craft work, great intelligence was evident and, I think, great satisfactions resulted from a collective effort “to fit close and even closer” into the land (Sturt, 1984, p. 66).

We no longer see agriculture that way but rather as an act of domination to force ever higher yields from the land. Whatever the gains in “productivity,” I think we are a less intelligent society than we otherwise might have been. What Gene Logsdon (1984) called “traditional agriculture” stretched and multiplied the intelligence of those who did it well (pp. 3-18). They had to know a fair amount about a great many things: animal husbandry, soil science, nonchemical ways to control bugs and weeds, crop rotations, wood lot management, timber-frame construction, mechanics, and even the weather. Good farmers were good natu-
ralists who knew their places well and knew how to use them well. They are still the best model we have for what is now called “sustainable farming.” Moreover, they had to be, in the main, good neighbors and community members. Some of those who still fit this description have learned how to use the sun to dry crops and heat livestock shelters. A few are relearning how to harness the wind. And a handful are way out in front of the society by learning to power their farms with solar-generated hydrogen fuels (Meadows, 1990).

The kind of intelligence evident in good “traditional farming” is in inverse proportion to the amount of purchased “inputs.” It is the result of the kind of mind that is willing to be instructed by a place and all that is part of it. Gretel Ehrlich (1990) has described the process in these words:

Once we understand where and why life occurs and how to stop destroying it, a mindfulness about everything spreads. The land tells us what it needs and when; we just have to be awake, to listen, and to scrutinize the ground... a ranch [or farm] is a teacher. (p. 111)

In traditional farming communities, information is passed from generation to generation and is woven into the culture of the region. It is decidedly not the monopoly of a separate caste of farm “experts,” or “researchers,” who mostly live in another place and occupy another mindscape. For the loss of farms as places of instruction and as a source of practical and ecological competence, I know of no good substitute.

There is a fourth cost of the U.S. food system that also defies easy economic calculation. This is the increasing concentration of wealth and power as agriculture and food processing and distribution have become big business. One effect of concentration is that land is being priced beyond the means of those who must pay for it by farming it (Davidson, 1990, pp. 13-46). Another is that the foods we eat are the product of industrial processes described by longer and longer labels listing chemical additives and ingredients (Rogoff and Rawlins, 1987). Concentration throughout the food system also means that formerly self-reliant rural communities, consisting of owner-operated farms and local markets, have lost control over their economies. Taxes, land-grant university research agendas, and public policies have combined to favor concentration of ownership, suppliers, banks, processors, speculators, and large-scale corporate farming. Jefferson’s dream of rural life is rapidly disappearing and with it, in Wendell Berry’s words,

the idea that as many as possible should share in the ownership of the land and thus be bound to it by economic enterprise, by investment of love and work, by family loyalty, by memory and tradition.

(quoted in Bryan and McLaughry, 1989, p. 7)

We do not know whether democracy can long survive without widely dispersed control of rural land and resources, but there are good reasons to think that it cannot.

Fifth, in the list of unaccounted costs of the food system are the costs of future investment and capital depreciation, which well run businesses include in current prices (Strange, 1990, pp. 116-117). Agriculture and the food sector have done no such thing. Instead, both have become increasingly dependent upon oil, which is no longer abundant in the United States and the use of which adds to global warming, ecological devastation, and political insecurity. The costs of the transition to renewable sources of energy are not included in the prices we pay for food (Gever et al., 1986, pp. 177-215). If the energy used throughout the food sector were to be priced at the rate of the cheapest renewable alternative, prices would rise dramatically. Whether because of scarcity, restrictions by exporting nations, or the imposition of carbon taxes to prevent climate change, energy prices will rise in coming decades. Agriculture is unprepared for this transition. Nor is it prepared for what some believe may be a period of climate surprises, which may require the resuscitation of farming east of the 100th meridian, where we have been converting prime farmland into housing tracts and shopping malls for the past 50 years. Finally, future costs would have to include those associated with the discovery or rediscovery of how to farm on current solar income. I do not know what the Amish would charge to teach agronomy departments and extension agents such things, but they have a reputation for paying and charging full costs.

Sixth, and finally, the cost of the U.S. food system should include the damage it does to our health. Americans eat too much and too much of the wrong things. As a result we are unique among the nations of the world in the range and novelty of diet-related ailments, such as heart disease, cancer, diabetes, and tooth decay. Diet-related health problems are a sizable part of the nation’s medical bill. No doubt, acolytes for the status
quod would point out that sizable economic benefits also accrue from the growing sector of the economy that concerns itself with selling remedies: “health” clubs, diet clinics, vendors of exercise videos and books, plastic surgeons willing to “liposuction” various parts of the anatomy, and jogging equipment suppliers. But one could also call these hidden costs of a mismanaged food system.

**Sources of the Problem**

History, climate, and natural abundance have conspired to make Americans less attentive to cost than we might have been in a less well-endowed land. There are, however, other reasons why we have paid so little attention to the costs of agriculture. Among these, I am inclined to believe that our manner of thinking about economics is the most important. It is no mere coincidence that the discipline of economics began in the same places (Scotland, England, and America) and in the same period as did the industrial revolution. Economics from its early beginnings was steeped with the industrial mind-set and with those assumptions convenient to industrialization. Foremost among these was the belief that the economy ought to be the central institution of modern life. We became Economies with societies instead of Societies with economies. The economy was no longer effectively restrained by obligations to a larger community (Daly and Cobb, 1989). The industrial stamp on economics was also apparent in the belief in the permanence of expansion. The discipline of economics consequently lacked any concept of appropriate scale or sufficiency. Had economists been more attentive to biologists, such egregious errors might have been avoided. Closely related was the belief that human wants were insatiable and should be liberated from the stigma previously associated with greed, avarice, gluttony, and the other “deadly” sins. These former vices were, accordingly, transmuted into economic virtues essential to the proper functioning of the fully modern economy.

If the model of “economic man” was fundamentally deficient, it was at least good for business and for the business of economics. The technologically developed, industrial nations now routinely assume what no other decent culture risked assuming or justifying: that everyone and everything has its price. The market, accordingly, became the arbiter of matters formerly thought to be appraised differently, including land and labor. The industrial mind-set also left economists with an overriding sense of optimism about the beneficence of technology and its ability to overcome the limits of nature. It is now an article of faith in American culture that technology will rescue us from all sorts of ecological malfeasance and hubris. Finally, the industrial mind-set is evident in the practice of discounting the future. The mythical Dr. Faustus, as economist George Foy has noted, was the first economist to practice discounting, assigning to his soul a 5% discount rate over the 20 years of his contractual association with Mephistopheles. The case he made for the transaction is, with due allowance for its archaic language, that still made by many economists. By discounting the future value of farm and rural lands to present value, the practice has contributed in no small way to the destruction of the independent family farm and farm communities.

A second reason why costs of the food system have been ignored has to do with the organization of agricultural research and education. The Morrill Act of 1862 (which created land-grant institutions), the Hatch Act of 1887 (establishing agricultural experiment stations), and the Smith-Lever Act of 1914 (the extension service) were intended to improve the lives and livelihoods of rural people by establishing a “permanent agriculture” fostered by local institutions and undergirded by “liberal and practical education.” But land-grant universities, in Wendell Berry’s (1977) words, “reduced ‘liberal and practical’ to ‘practical,’ and then for ‘practical’ they substituted ‘specialized’” (p. 147). The result was to convert agriculture from a broadly conceived enterprise with technical aspects and based on a solid agrarian philosophy and moral foundation into a series of technical specializations.

The problem, however, goes deeper. The Hightower Report of 1972, for example, concluded that “Land grant college research is science for sale [and] ultimately it is corrupt of purpose” (Hightower, 1978, p. 85). Many observers believe this, in the main, still to be true. Martin Kenney in his 1986 study of university-industry relations, concluded that “the university is bought and parcelled,” and is therefore incapable of conducting an unbiased debate on issues such as biotechnology (p. 246). The “subservience” described by Kenney has also precluded unbiased debate within many land-grant universities about increasing farm scale, chemical inputs, farm diversity, organic agriculture, and rural communities. As the mission of land-grant universities became more and more closely identified with the interests of agribusiness, the chemical industry, food engineers, the processors, conglomerates, and banks, questions about the full costs of conventional agriculture have been mostly asked outside the U.S. Department of Agriculture (USDA)—land-grant university complex in
small nonprofit institutions, such as The Center for Rural Affairs, the Land Stewardship Project, the Land Institute, the Institute for Food and Development Policy, and the Institute for Alternative Agriculture, and by irate citizens.

A third reason why we have ignored full costs has to do with the agricultural policies that defer ecological and social debts to a future electorate. This is not an abstract impersonal process but a failure of political leadership and of particular presidents, senators, congress representatives, and secretaries of agriculture who have failed to concern themselves with long-term costs of the present food system. Instead they have followed the path of least resistance, which means a policy of cheap food and cheap energy for which we will pay dearly in the long run. The loss of family farms, the decay of rural communities, pesticide contamination in groundwater, and the loss of topsoil have happened for reasons that can be found in federal tax laws, commodity programs, USDA-funded university research agendas, farm credit programs, and most recently the North American Free Trade Agreement and the larger free trade agenda contained in the General Agreement on Tariffs and Trade (GATT). The failure to properly reward good farming practices that conserve soil and biological diversity and the failure to support rural communities and rural livelihoods are a product of systematic neglect and studied ignorance of things rural, biological, ecological, and long-term. It is an intellectual failure, a moral failure, a failure of leadership, and a failure of our collective vision.

Finally, the tendency to ignore full costs of the food system must be placed in its larger cultural context. From that perspective, it can be seen not as an aberration but as part of a larger pattern evident in our failure to develop a coherent, long-term energy policy, deal with nuclear wastes, confront the challenge and threat of global warming, eliminate the national debt, deal with the savings and loan crisis, and build decent, sustainable cities. From one perspective, Americans have always been the "people of plenty" in David Potter's phrase, shaped by abundance and consequently inclined to be wasteful. But the tendency to ignore full costs of our actions has, I believe, become worse in the past two decades. Both political parties in this era deserve the harsh judgment of future historians. But so too does the public that elected them and tolerated shortsighted mismanagement of the nation's public estate and its future commonwealth. The failure to distinguish cost and price is part of our national mind-set, a way of thinking that we must now confront.

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**Towards an Honest Food System**

It is always easier to describe a problem than it is to offer sensible and workable solutions to it. This is certainly true of the discrepancy between cost and price in the U.S. food system, which is part of a larger pattern of deeply ingrained values, behavior, and policy. But there is another pattern in American history that we might dust off and put to work. I am referring to the minority tradition represented by Thomas Jefferson, Henry David Thoreau, George Perkins Marsh, Liberty Hyde Bailey, F. H. King, J. I. Rodale, E. H. Faulkner, Russell Lord, Paul Sears, Rachel Carson, Wendell Berry, Wes Jackson, Marty Strange, and many others. This second tradition is a minority refrain throughout our history, but for good reasons, it has never died out. It has been, on the whole, more honest about the costs of the industrial economy than its boosters and benefactors have been. On fundamentals, the big questions of agriculture, food, and national policy, it has been mostly right, and I think there are encouraging signs that it is gaining ground. Drawing from this newer version of agrarianism, I conclude this chapter with four suggestions about the outlines of a food system that pays its full costs.

First, we need an accounting system that includes all of the costs of consumption. Development of an "ecological economics" is a hopeful step in this direction. As stated by Robert Costanza et al. (1997),

> Ecological economics differs from both conventional economics and conventional ecology in terms of the breadth of its perception of the problem, and the importance it attaches to environment-economy interactions. It takes this wider and longer view in terms of space, time and the parts of the system to be studied. (p. 3)

In contrast to conventional economics, ecological economics does not assume that the biosphere is unlimited. Nor does it assume the centrality of human wants or that these should necessarily take precedence over the stability and integrity of the natural systems on which the fulfillment of real needs and wants ultimately depends. It does not make prudent assumptions about technological progress or the ability of technology to compensate for human stupidity or ignorance. Nor does it assume that technology can be adequately substituted for the loss of "natural capital," such as fertile soils, clean water, abundant wildlife, healthy forests, burgeoning wetlands, intact ozone layers, and stable climate. It does not assume that nature is only a fund that can be depleted at will and without
penalty. It does not assume that economic growth is everywhere and at all times a good thing. To the contrary, ecological economics makes a distinction between growth and development and between optimum and maximum. Ecological economics does not discount the future in the manner of conventional economics. Nor does it confuse honest accounting with complex, elegant abstractions far removed from life and lived experience. In short, ecological economics regards the economy as a partial means to higher ends and not as its own end and the study of things economic as "life science," not as the study of greed efficiently practiced (Daly, 1980, pp. 238–252).

Second, we need better farm and food policies that encourage decisions in accord with long-term well-being and that require full-cost accounting. Such policies are simple to describe in the abstract: They will reward ecologically sound agriculture and penalize that which is destructive. The latter, I believe, results in large part from excessive scale of land and machinery and the separation of ownership from management. Destructive agriculture also results inadvertently from federal commodity programs that still encourage farmers to ignore resource costs. Economists at the World Resources Institute showed that "farmers still [after the 1990 Farm Bill] have strong financial incentives to plant just a few crops and use energy-intensive chemical means of fertility maintenance and pest control" (Faeth et al., 1991). These economists concluded that it is possible to "lower the resource costs of U.S. farming, while raising agricultural productivity and lowering the fiscal burden of supporting farm incomes" (p. 29). From a different perspective, Marty Strange (1988) has proposed a variety of policy changes, which include (1) ending subsidies to capital through tax and credit policies; (2) mandatory controls on production; (3) interventions in the land market to equalize opportunity; (4) closer regulation of industries selling farm inputs; and (5) redirection of research to benefit smaller scale farms and reduce adverse impacts (pp. 254–290). While disagreements will undoubtedly occur about specifics, we know enough to use the policy tools available [regulation, pricing, taxes, fees, "feebates," permits, subsidies, and things we have not thought of yet] to achieve a dependable food supply and a sustainable prosperity that is fair and ecologically durable. The heart of the problem, I think, is not one of knowledge or even accurate accounting, but one of political will.

This brings me, third, to matters having to do with our desire to do what is right over the long term. The problem of food and agriculture cannot be reduced to prices and economics alone. Too many of the core assumptions of economics, such as the belief in perpetual growth and the rationality of self-interest over community interests or those of the larger land community, will work against long-term protection of land and rural communities. If economic "efficiency" is the standard, sooner or later someone will win the Nobel prize in economics by showing that one vast, centrally located (presumably in Nebraska) farm can feed the entire nation most efficiently. Another perhaps will win it by showing that it is even more efficient to do away with that farm and food altogether in favor of genetically engineering our capacity for direct photosynthesis. I know of no good reason to place our trust so squarely, so absolutely, and so blindly in the grip of a rationality ultimately so narrow. The only answer is to subordinate a lower rationality to a higher order of rationality.

The prospects for a sustainable agriculture will in the end depend on a larger movement away from the consumer economy toward an economy that supplements efficiency with sufficiency and refuses to place any price whatsoever on priceless things. As Alan Durning (1991) noted, this is an economy that returns

to the ancient order of family, community, good work, and good life;
to a reverence for excellence of skilled handiwork; to a true materialism that does not just care about things but cares for them; to communities worth spending a lifetime in. (p. 169)

The recovery of moral and civic virtue Durning proposes is no quick fix. It is rather a long process, perhaps requiring centuries to undo what the industrial economy has done to the land and to us in the past 150 years.

Such an undertaking is nowhere on the national agenda at present. The leadership of this country is mostly in the hands of those proclaiming themselves to be practical and realistic. But the present time, in Lewis Mumford's (1973) words, "is one of those periods when only the dreamers are practical men. By the same token, the so-called practical men have become makers and perpetuators of nightmares" (p. 415). Is the dream of a sustainable economy and healthy cities surrounded by a prosperous countryside only utopian? I think not. Is it utopian to believe that prices ought to include all costs? To the contrary, these are the only practical and realistic alternatives we have.

SOURCES

CHAPTER TWENTY-THREE

Refugees or Homecomers?
Conjectures About the Future of Rural America

Long before 2050 the trend toward ever larger cities and an increasing ratio of urban-to-rural dwellers is likely to have reversed.

— L. BROWN ET AL.

America is an overwhelmingly urban and suburban society and is becoming even more so. In 1950 almost half of Americans still lived in rural areas. By 1990, however, the number was less than one in four (22.9%), and only 1.9% Americans lived on farms. (The New York Times, September 11, 1990, p. A12). The great forces that have driven urbanization—technological change, population growth, economic growth, and centralization—are widely believed to be permanent features of all modern and postmodern societies. Most of those remaining in rural areas work in extractive industries, or they are poor, retired, or just too stubborn to give up. The urban vision has always depended on the belief that rural life could not compete with the comforts, convenience, affluence, and excitement of city life. The corollaries are (a) that a prosperous and democratic culture does not require a stable and prosperous rural foundation; (b) that a healthy culture does not need, as Wendell Berry once put it, a stream of farm-born and farm-bred young people; (c) that we are smart enough to provision megalopolitan areas with food, water, energy, materials, public safety, transport, employment, and entertainment, haul off the waste, and do all of these in perpetuity; (d) that urban and suburban life can satisfy our deepest human needs; and (e) that we will never change our minds. The idea that Americans might ever return in large numbers to rural areas—whether by choice or otherwise—is,