

CHALLENGES OF SUSTAINABILITY

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To Will Amesbury, who generously lent invaluable help to this project.

INTRODUCTION

Challenges of Sustainability

For most of us the idea that civilization itself could disintegrate probably seems preposterous. Who would not find it hard to think seriously about such a complete departure from what we expect of ordinary life? What evidence could make us heed a warning so dire—and how would we go about responding to it?

—Lester R. Brown

It is increasingly apparent that the future of humanity is in jeopardy. All the major indicators are down. We are now in the process of exploiting and destroying ecosystems essential to life. The oceans are 90% fished out of major commercial species and the over-fishing continues. The ocean is now 30% more acidic than pre-industrial levels. Soil everywhere is being lost to erosion and its nutritional value is steadily declining. Deforestation is rampant almost everywhere especially in the global south. Natural resources are progressively extracted to increasing scarcity. A world-wide crisis in water supply is looming and the world's nations are in denial. Global warming with all its ominous possibilities is in some ways proceeding more rapidly than expected. The sustainability of our food supply is now in question due to its being "processed" in ways that compromise its health giving quality. And over all there looms a human population glut of such magnitude that many question whether our planet has the resources to support it. Briefly stated – humanity is presently ravaging the planet.

All of which leads to the question: How are we going to sustain human civilization on planet earth? Before going further let us define just what we mean by that protean word "sustainability." The following brief definition comes from the North-west Earth Institute discussion guide, *Choices for Sustainable Living*. It reads:

Sustainable development is meeting the needs of the present without compromising the ability of future generations to meet their own needs.

On the other hand, our activities are non-sustainable when they require continual inputs of non-renewable resources, when renewable sources are used faster than their rate of renewal, and when human activities cause cumulative degradation of the environment."

This whole matter of sustainability raises a fundamental question: Why does Homo sapiens have a sustainability problem? The rest of the animal kingdom doesn't. Why do we? The answer is that with the evolution of Homo sapiens' big brains, we humans now possess a measure of transcendence over the immediacy of time and the constraints of nature's physical processes—in other words a significant measure of freedom. As the theologian Reinhold Niebuhr once observed, we humans are at once an integral part of nature yet with the capacity to significantly rise above it. Some thinkers deny any such freedom. Yet they do not really act and think as if we were mere automatons. Let us concede the obvious—our thinking mind and will is never completely free of psychological and physical determinants. In this sense we are indeed without free will. One of the most brilliant and renowned biologists of our time, Edward O. Wilson of Harvard, argues this point in his formidable work *Consilience: The Unity of Knowledge*. He also suggests that free will is an illusion. (p.129-131) Yet he is passionately concerned about the matter of sustainability as demonstrated in his books *Creation: An Appeal to Save Life on Earth* and *The Future of Life*. Hovering everywhere over these books is the call for decision which might ensure the sustainability of human existence. In other words, a genuine and terribly important reality of human freedom forms the indispensable premise of these books. Perhaps such an apparent inconsistency is a matter of definition. We are never free of the constraints of physical laws. Yet it is hard to deny that our large brains enable us to become at least partially aware of the physical and psychic forces impinging upon us. And insofar as there is such awareness there is a measure of transcendence. And with this transcendence there is freedom to choose among these perceived forces. And insofar as we are not limited to the immediate present we can anticipate and prepare for the future, choosing among its many possibilities. Sustainability is not a given. It is a human project. The Danish existentialist Soren Kierkegaard had it right when he insisted that the self is a synthesis of freedom and necessity. One cannot do justice to the experienced realities of human existence without affirming both of these polarities. *The Sickness Unto Death* (p. 173) Therefore we are not hapless victims of our physical and mental environment. We are called to decision to anticipate and shape our human future. In other words we Homo sapiens have a problem of sustainability. We have the powers both to alter the balances of nature and even to undermine and destroy those forces making life possible. We might say, what a prodigy has been let loose on this planet!

So the question of sustainability is nothing less than the question of whether humanity can learn to use its science and technology to enhance human civilization without destroying the very basis of human and non-human life. And for this we clearly lack adequate guidelines. Our way forward is unclear. History tells us that every previous civilization has had its rise followed by its decline and fall (as Spengler has reminded us) with new cultures rising to take their place. But our present situation is unique. It is world-wide and global. And if history repeats its previous Spenglerian pattern what then? Do we face the threat of the collapse of world-wide civilization which could threaten the very existence of Homo sapiens? Or as is more likely could the adaptability of our species bring out of that collapse a new level of human existence out of the ruins of the old?

Chapter 1

The Present Human Situation

Easter Island as a Cautionary Tale

We begin with a haunting meditation on the fate of Easter Island. It is relevant as a cautionary backdrop to the essays which follow. For factual material here I draw from Chapter 2 of Jared Diamond's book *Collapse*. In 1722 Jacob Roggeveen, a Dutch explorer, discovered an island located about 2,000 miles west of the South American coast. Its area was about 64 square miles. Its subtropical latitude meant that it had a mild climate. Yet, instead of an expected island paradise it appeared to Roggeveen as a wasteland exhibiting what he termed "a singular poverty and barrenness." What the captain saw was an uninterrupted grassland without a single tree or bush over ten feet high. There was no source of firewood, no native animals larger than insects, no bats, land birds, land snails or lizards. All the surviving natives had were chickens. All the land birds and other animals native to the island had become extinct. Since Roggeveen's visit the tragic history of what has become known as Easter Island has come gradually to light. Through studies in archeology, pollen analysis and paleontology we get this sobering picture. Yes, those original Polynesians had indeed stumbled upon an island paradise about 400 A.D. It was covered with a subtropical forest dominated by a rare palm that grows to 82 feet tall and 6 feet in diameter. From site analysis it is evident that for centuries the inhabitants used the wood to build their sea going canoes which enabled them to go offshore several miles to fish for porpoises as a valuable food source. As indicated by burial bones they also feasted on seabirds of at least 25 nesting species. In fact, as Jared Diamond notes in an article in Discover Magazine, Easter Island was the richest seabird breeding site in Polynesia and perhaps the whole Pacific. But gradually, life at Easter Island began to unravel. By about 1400 the palms became extinct. Around 1500 A.D. porpoise bones disappeared from garbage heaps as there was no more wood with which to build their canoes. Seabird colonies were also wiped out. In response to looming food shortages the islanders did two things: they intensified chicken production and turned to eating each other. Human bones became all too common in the garbage heaps. In short, what had been life in a virtual paradise ends with bloody clan warfare, starvation and cannibalism. In other words, they blew it big time. This is the general picture pieced together by scientists who have studied Easter Island. We may ask how this could happen? Could they not have anticipated in some way the consequences of cutting down those huge palms? It seems almost inconceivable. Yet they shared our humanity. They had brains as big as ours. Who can say they were not just as intelligent as we are?

Now fast forward to the beginning of the twenty first century. Like those Easter Islanders we too live on finite real estate—our planet. Further, some of us at least, realize that our civilization is on an unsustainable course. And there are indications that we might not do any better. To begin with, we face the most serious ecological threat of human history—global warming. There is the progressive exhaustion of natural resources. We are hearing more and more lately about "peak oil," namely the inevitable time when world oil production is met by demand and prices sky-rocket. Fresh water is an increasingly serious problem here and around the world. As Maude Barlow warns in her recent book, *Blue Covenant* we are actually in the process of running out of it—right here in America. For example, there is the Ogallala aquifer, a vast geological formation sprawling under eight states from South Dakota to Texas, equivalent in volume to Lake Huron. But it is being mined (it is too deep to regenerate) by two hundred thousand bore wells around the clock. This enormous aquifer has made possible the fabulous agricultural wealth of our Middle and Southwest. But give or take a few decades it will be gone. What then? From the dust bowl days of the early thirties until now billions of tons of top soil is lost each year. The situation is clearly unsustainable. What about the seemingly limitless ocean? Depending on who you are reading, serious damage is being inflicted on much of it, including the far away regions of the north and south poles. Fish stocks in most areas are mostly gone. The March 2008 issue of Scientific American tells of the looming extinction of those magnificent fish, Bluefin tuna. But what gives one pause is the observation of the author Richard Ellis that with the prices being paid by the Japanese, a change in the remorseless fishing of Bluefin tuna would require nothing less than "a moderation of the fundamentals of human nature."

But enough to make the point that a lot of what our civilization is doing is unsustainable and that we are headed in the direction of Easter Island. Further, speaking of the need of "moderation of the fundamentals of human nature" dramatizes the present need for a basic change of our current values. I suggest two things here, two psychic shifts. First, we must face the awful prospect that the worst could very well happen with all its attendant horrors for our children and grandchildren. After all, our situation is infinitely more complex and daunting for us than it was for the denizens of Easter Island. Second we must give voice to that mysterious force deeply within us, that no matter what the probabilities we must join in a growing insurgency against the prevailing value system. Participation here generates hope even if it may be an audacity of hope. There are signs of hope. As Jared Diamond points out unlike the Easter Islanders we have histories of the past—especially histories of other doomed societies that can save us. And there are signs of a growing realization of that danger.

Consumerism

The issue of sustainability takes us deeply into the territory not only of moral values but of spirituality. As professor Cameron Wake reminded his audience at a UNH lecture on global warming, we are under a moral imperative to see that our children and grandchildren have the privilege of enjoying the kind of wonderful world we did. As one columnist Robin Blumner warns, in our frantic consuming we are really consuming our greatest ideals. More on this later. As Alan During suggests in *Choices for Sustainable Living*. (Northwest Earth Institute) we are presently on a 50-year shopping spree that threatens to bankrupt the ecology of our planet. As E. O. Wilson, famous Harvard entomologist cautions us in his book, *The future of Life*, if the rest of the world lived as we Americans, we would need extra earths. Before going further, a little historical perspective on "consumerism."

For the following observations I am indebted to Sallie Mcfague's *A New Climate For Theology* (pp. 86-87). What we have

come to call “consumerism” has its roots in a particular economic model originating in Europe in the eighteenth century under the influence of Adam Smith. In the particular version practiced by the major economies of our time it is called “Neoclassical Economics” Its key feature is the allocation of resources as a result of individual market transactions. At the center of this model is a particular anthropology—individuals are motivated primarily by self-interest. The underlying premise of this “free market capitalism” is that by maximizing human self-interest all will eventually benefit—the so-called invisible hand of classical economic theory. But the actual result on North American soil of this model was the blossoming of an ideology of radical individualism undergirded by the social Darwinism of Herbert Spencer. Central to this American version was an insatiable greed for “stuff,” a yearning for immediate gratification, an indifference to the needs of the poor and the common good. Out of this ideology came what we now call “consumerism” And this life-style with its enormous energy consumption has led to a deterioration of the health of our earth and fueled global warming.

Shortly after the end of World War II mass consumption came of age. In 1946 Fortune Magazine announced that the “Great American Boom was on.” By 1950 young American families were moving into 4,000 homes each day. And they were filling those houses with appliances, furniture, and all the other equipment new houses need, but especially televisions. It was officially proclaimed by our government that the ultimate purpose of our economy was to produce and sell ever more consumer goods. And so it has gone ever since. Our levels of consumption have increased dramatically and at great environmental cost. Yet there is nothing so much as the power of our media and television to appeal to our acquisitive impulses and more particularly, its power to create needs. All manner of advertising is today omnipresent. It intrudes everywhere. As I ride up the slope on a ski lift there are ads on each stanchion. Due to our compliant congress, drug companies now regularly interpose themselves between you and your physician on TV. The production and cultivation of human need is an enormous commercial enterprise. Central here is the suggestive power of television. Just about every American home has two or three sets operating on average seven hours a day. Today our culture is saturated not only with TV advertising but with thousands of huge suburban shopping malls using every conceivable artifice to encourage ever higher levels of consumption.

The end result of all this is that consuming has become our primary cultural activity. Typically we Americans spend about six hours a week shopping. Our teenagers spend more time in malls than anywhere except school or home. Yet, a mall is not in any way a community. It is solely a commercial enterprise designed in minute detail to manufacture desires and to prompt impulse buying. Yet, this all-embracing environment of TV, ads, and shopping centers is recent in human history. But it is producing changes in our thinking and habits that are radically opposed to a sustainable human future on this planet. The seriousness of this new kind of cultural existence is underlined by the subtle changes it is bringing about in the contours of our common shared humanity. It is all laid bare for us in a recent book by Benjamin Barber: *Consumed: How Markets Corrupt Children, Infantilize Adults, and Swallow Citizens whole*. As Barber puts it, by elevating acquisition to our primary goal, we have become consumers over citizens, consumers over neighbors, consumers over family members. In other words, in our present consumer culture even our humanity is not sustainable let alone our planetary environment. It turns out that this ideology with its egocentric value system is not just a minor defect. It led directly to the financial collapse of 2008. It also led our consumers to lose all common sense restraint. A poll taken during 2008 found that the average American had not only ceased to save but had on average 9 credit cards and 17,000 dollars debt. Apparently many people ceased acting and thinking like adults, where one has to pay eventually for what one wants or thinks they “need.” All this demonstrates how moral corruption can bring the world’s richest and most powerful country to its knees. But these consumerist values are formed early in life. Where do they come from? One powerful source—our food corporations spend literally billions brainwashing toddlers in front of TV screens. Studies show that these values—namely that one’s happiness depends on how much stuff we accumulate is long lasting even into adulthood. Further these values have consequences far beyond our national borders. Americans consume about twice as much energy per person as our counterparts in other developed countries. Yet there are signs of hope. Consumerism is a recent phenomenon in human history. We can reclaim more enduring values such as those available in our major religions. Another hopeful sign: the finding reported by Bill McKibben in his book *Deep Economy* that when the immediate needs of most people have been satisfied they experience a basic happiness which is not increased by more affluence.

Life as Having vs. Life as Being

In my previous essay I discussed the rise of consumerist culture, its destructive effects on earth’s ecology and its increasing impact on the contours of our shared humanity. But what is to be done to reclaim more satisfying and sustainable values? The way things are going it looks like they are in need of resuscitation. Here are a few observations towards that end. First, we must become aware of our existential situation. Until that happens we are like fish oblivious of the water in which we swim. Delving for a moment into existentialist philosophy, one of its principle thinkers Soren Kierkegaard liked to symbolize life this way: There are two ways to go in life suggested by two metaphors. First there is a horse and wagon with the driver asleep with the rein dangling uselessly from his hands. The horse wanders aimlessly without any direction or control. That’s one way to go in life. However there is another way. The driver is fully awake and alert, the reins firmly in his hands. He knows just where he wants to go. He is fully awake and therefore fully conscious of all the various forces impinging upon his progress along life’s journey. Speaking existentially he is fully alive and exercising his powers of decision.

How awake are we? The first requirement for our full awakening is to become aware of the nature of our cultural environment. In other words, what are its dominating values and beliefs? What do they look like? Here is a representative sampling. First, the reigning life style is that of having rather than being, (more on “being” later). Life as having means that acquisitive-

ness is the preeminent value. One evaluates one's life according to one's material possessions. This life style has one inevitable ideological consequence. It is inherently isolating and egocentric. Life is lived on the surface. There is a lack of inwardness and contemplation. The "inner life" is a void. If acquisitiveness is our major value, any impact of your material wealth on anybody else is irrelevant. Missing here is any concern for the common good. It is a Darwinian world. Social justice concerns are out. Herbert Spencer's social Darwinism is in. Another corollary of this outlook is that it is a self-evident good that we consume more and more. Going into debt in the process is good for us and the economy. Saving is an unnecessary hindrance to getting what we want. When it comes to housing the bigger the better regardless of energy waste and regardless of our genuine need. And don't worry about the environment. Nature is limitless and indestructible regardless of our exploitation and pollution. Whatever problems arise will be solved by technology. Whatever problems arise from our indebtedness and over-consumption will be solved by our government. Our particular brand of capitalism is both ideal and inevitable. All will be well if it keeps growing. Continued growth is a must. The laws of the free market must be obeyed. Quality of life? It is determined by having enough stuff. All will be well as long as we keep spending and increasing our consumption.

In contrast to this materialistic, acquisitive life-style where having stuff is the goal, life as being looks at life in depth. Inner contemplation and meditation are no strangers here. Above all, life is a never ending quest for meaning and purpose. Quality of life is the main concern. That means life with as few material possessions as possible. Therefore, life as being entails a commitment to intentional simplicity. Life as being is in a sense the polar opposite of the egocentricity of life as having. For it is a life lived to the fullest through interrelationships with family, community, nature, and the rest of the cosmos. It is a life fulfilled by love rather than by that insatiable greed for material possessions which drives consumerism so essential to our contemporary brand of capitalism. Far from viewing nature as limitless and indestructible, life as being is aware of its limits and the extent to which we are desecrating the delicate balances of our fragile, beautiful, limited planet. It must be cherished and our environment preserved as much as possible. The prospect of global warming is a deeply moral issue because we are all one not only today but one with all generations yet to come. So life as being implies that we live simply so as to leave as small a carbon foot print as possible. It is not too much to say that life as being is a spiritual journey of shared love, shared mutual responsibility, and reverence for life.

All this calls for personal awareness and decision. Decision is called for with the express intention of being part of an ideological insurgency against the prevailing cultural environment. This is an insurgency fueled by the hope that if enough of us join in, our numbers will eventually reach a critical mass and bring about what one writer called a "turning" towards a genuinely sustainable future. Is "being" or "having": going to determine our future? It is a serious question. Presently, we are all on board the Titanic on a non-sustainable course and icebergs lurk everywhere on the horizon. If enough of us wake up we can avoid them.

Chapter 2:

The Laws of Ecology

The Laws of Ecology as Guidepost

The material in the previous essays has hinted at an alternative, more sustainable lifestyle. But this is merely one aspect of a transvaluation of values necessary for an enduring sustainability. For it is my conclusion in looking at various levels at which this civilization is functioning, at practically every level one finds unsustainability. How does Homo sapiens find a sustainable way forward? It surely will not be through science and technology, essential as they are to this and any future civilization. For reflecting its inventors, every advance in our technological powers over nature inevitably opens up new possibilities of both good and evil, creation and destruction. Let us remember that science and technology made possible the blood-bathes of two world wars which culminated in the atom bombing of Japan. And it was this same science and technology which made possible the industrial revolution. And this brought forth the industry and affluence which unknowingly gave us our present problem of global warming, and that resulted in the end of nature as we have known it. Another frightening truth about our human situation is the fact that while science and technology continually progress, human morality does not. There is no convincing evidence that morality is in some way steadily evolving. Hence human history gets increasingly dangerous. Humanity is blest and cursed with a measure of freedom over natural processes that cannot be evaded. So we are destined to determine our own fate for better or for worse. Unlike the rest of the animals we do not fit naturally into a sustainable system of behavior governed by instinct. So over the fate of humanity there hangs a huge question mark. And as of now the future of Homo sapiens bears some unsettling resemblances to the denizens of Easter Island. Or have we learned something from the cultural disasters of the past? All we can confidently say at present is that the evidence is inconclusive.

Yet, there is significance guidance into a future of a seeming wilderness of options and choices with what ecologists call the “laws of ecology.” While they are not precise like the laws of physics nevertheless they operate with as much power and restraint. They are part and parcel of our physical environment and we ignore them at our peril. They operate as significant guideposts through the jungle of possibilities we face as we seek to go forward in a sustainable way.

A further note to underline our dire need for guidelines in the employment of our technology: Every use of our “power over nature” no matter how small, results in some kind of disruption of natural processes. It may be trivial and harmless to the human presence and beneficial to humanity. Yet it always happens and we should be aware of it. It is due to our being oblivious to what we are doing to nature that is presently leading us down the road of environmental deterioration. Finally, in our explication of the laws of ecology the high cost of ignoring them will be only too evident.

So far in these essays I have done a lot of talking about environmental sustainability in general. I have also mentioned ecology. But just what is ecology? The word is used frequently by experts writing about the environment. And it has special meaning. I find that meaning well expressed by perhaps one of the most important early books ever written on the subject: Barry Commoner’s *Closing Circle*. Although published in 1971 its message is just as relevant now as it was then. Commoner writes: (pp. 28-29)

Each living species is also linked to many others. . . . All this, many times multiplied and organized species by species in intricate, precise relationships, makes up the vast network of life on earth. The science that studies these relationships and processes linking each living thing to the physical and chemical environment is ecology.

He goes on to say that it is a young science and much of what has been learned so far has come from the study of only small segments of the whole network of earthly life. Further, while it is not to be compared in exactitude to the physical sciences, there are a number (four so far) of generalizations that can be organized into a kind of informal “laws of ecology.” My intention is to treat each one of these “laws of ecology” to provide a necessary background of the thinking behind these essays. This will help to make sense of the underlying causes of our looming environmental crisis, and where appropriate, illustrate the perils of ignoring them.

First Law: Everything is connected to everything else

To begin to unpack the implications of this first law of ecology, a little historical background is helpful. For the better part of the last three centuries the predominating ideological world view in the west has been the Newtonian world machine. The basis of this world view was Newton’s combining Galileo’s laws of falling bodies on the earth with Kepler’s laws of planetary motion, to form one vast system of mechanical relations which could be understood using mathematical reason. The paradigm growing out of this great synthesis came with an emphasis on the methodology of reductionism. More on this later. Along with this mechanical view of our universe it was believed that such disciplines as biology could be “reduced” through mathematical analysis to physics and chemistry. During the eighteenth century and beyond into the nineteenth the Frenchman La Mettrie spoke for many in his famous book entitled *Man a Machine*. It was another Frenchman even more influential on subsequent thought, the mathematician and philosopher Rene Descartes, who made a fateful dualistic distinction between mind and matter. To him these were two entirely distinct realms. In his view all of nature including animals, was a machine to be understood by mathematical reason. Another influential contribution to this mechanical Newtonian paradigm was his method of analytical thinking. This methodology involved breaking down a complex phenomenon or problem into its ultimate constituent components in order to understand the nature or behavior of the whole. In other words—reductionism. Small wonder that historians refer to this period as The Age of Reason. At this point you may be wondering what all this has to do with the first Law of Ecology. But bear with me a little longer. Fast forward now to the intellectual revolution that occurred at the beginning

of the 20th century with the coming of quantum mechanics. With the pioneering work of scientists such as Werner Heisenberg and Niels Bohr, it was established that what we call “matter” reduces at the subatomic level into patterns of probabilities. Further, as Fritjof Capra points out in his book *The Web of Life*, “These patterns do not represent probabilities of things but probabilities of connections.” (p. 30) He goes on to suggest that atomic particles have no meaning as isolated entities. They are rather a set of relationships interrelated to other entities. Needless to say, these discoveries challenged significant elements of classical physics and led to various intellectual movements forming a new paradigm to replace the older discredited paradigm based on Newtonian and Cartesian thought. This new paradigm was built on two pivotal assumptions (1) Mechanistic rationalism is outmoded and with it the analytic methodology of reductionism and (2) on nature’s deepest level everything is interconnected and mutually dependent. As it turned out, the radical interrelatedness of quantum mechanics functioned as a powerful and pervasive metaphor of the same kind of interrelatedness found among all living organisms of our biosphere. I will now mention briefly some of these developments as cited in Capra’s informative book:

First, the rise of organismic biology deserves mentioning, as it protested the mechanistic interpretation of living things derived from the Newtonian world view, especially its reductionism when applied to living things. Its proponents insisted that an organism can be understood only when it is viewed as an integrated system. Further, the essential behavior of an organism arises not from its individual parts but only in the relationships between its parts. This movement in biology helped give rise to a new way of thinking- “systems thinking” which emphasized connectedness, relationships, context. According to this “holistic” approach the nature of the whole is always different from the mere sum of its parts. As Capra notes, one of the greatest insights of twentieth century science has been that systems cannot be understood by reductive analysis but only within the context of the larger whole. The concept of “networks” further illustrates this same theme of interconnectedness and interdependence of all living systems. Since living systems at all levels are networks, Capra suggests, we may visualize the web of life as living systems interacting in network fashion with other networks. In other words, what he calls “the web of life” consists of networks within networks. (p. 35). The interactive complexity of organisms became evident to me as I was reading a book on cells. I remember the author recounting the time when microscopes became sufficiently powerful to really see what went on inside our cells. Instead of a few major structures researchers were astonished to see literally thousands of organic chemicals, all moving about and reacting concurrently to transform the cell’s nutrients, maintain its basic structures, and eliminate its waste products. So much for mechanistic reductionism.

All these developments have brought us much closer to an adequate understanding of the actual nature of the intricate processes and delicate balances of our ecological environment that is the creation of millions of years of evolution. And we have a lot of catching up to do if we are to avoid ecological catastrophe or Easter Island on a global scale. For our ignorance has already led to many unpleasant and unforeseen surprises, stemming from our current science and technology. For example, we were surprised to find that DDT caused bird’s eggshells to be so fragile that they shattered prematurely. We were dismayed to find that our air-conditioning was destroying the ozone layer so essential for protection against radiation damaging the earthly life-forms. We were unprepared not only to find PCB’s in the tissues of human mother’s milk but in the tissues of marine creatures at depths of 6 thousand feet as well as everywhere in the far reaches of the Arctic and Antarctic . Even more ominous, our marine scientists, as reported in the June issue of Discover Magazine, are deeply alarmed at finding that the buildup of carbon dioxide in the atmosphere producing global warming has led to a 30% increase of acidity in the ocean since the industrial revolution. This could be catastrophic not only to coral reefs globally, but to all ocean creatures with calcium carbonate shells and even to plankton generally, the bottom of the oceanic food chain. What our reckless ignorance has wrought! Let’s hope that our increased understanding of the dynamics of living systems has not come too late.

To conclude this brief survey of one of the laws of ecology, a word about one of the most recent movements in the quest for sustainability. It is called “deep ecology” and as it speaks to all of us, I feel compelled to quote Capra here at length: (p. 7)

Shallow ecology is anthropocentric, or human centered. It views humans as above or outside of nature, as the source of all value, and ascribes only instrumental, or use value to nature. Deep ecology does not separate humans—or anything else- from the natural environment. It sees the world not as a collection of isolated objects, but as a network of phenomena that are fundamentally interconnected and interdependent. Deep ecology recognizes the intrinsic value of all living beings and views humans as just one particular strand in the web of life. When the concept of the human spirit is understood as the mode of consciousness in which the individual feels a sense of belonging, of connectedness, to the cosmos as a whole, it becomes clear that ecological consciousness is spiritual in its deepest essence.

The Second Law: Everything must go somewhere

This may sound like an obvious law of physics, yet its implications are enormous for sustainability and the threatened health of our ecosystem. For what it is saying is that in nature there is no such thing as waste. In natural systems the excretions of all living organisms are completely recycled into other natural substances by microorganisms to be further used by living things. The same thing happens whenever a living organism dies. Through natural processes of decay and deterioration which we have probably all observed, the corpses of once living things are consumed and returned to the soil. And soil or humus is an incredibly complex system made up of countless thousands of organisms from microscopic bacteria to worms, grubs, etc. The same is true of the ocean. Whether on land or sea, there is no waste in nature. Everything is continuously recycled.

But then along came Homo sapiens, a large brained creature millions of years evolving until this species became self-conscious and gifted with a measure of freedom over the immediate constraints which govern the behavior of all the other animals of the planet- a bewildering synthesis of freedom and necessity. Indeed, a creature which has already created the means of

destroying human civilization and which faces a daunting challenge of living sustainably on planet earth. So far human history is punctuated by the seemingly inevitable rise and fall of empires. Recent thinkers like Jared Diamond in his book *Collapse* speculate about the causes of the fall of great cultures like the Sumerians and Mayans both of which apparently perished largely through deforestation and failure to solve problems of food production. Indeed, it is the thesis of a recent book, *Empires of Food*, by D. G. Fraser and Anthony Rimas, that the key to understanding the rise and fall of all past civilizations lies in the progressive exhaustion of the soil which provided their food. Having said all that there is something especially unique in our contemporary problem of sustainability. Whereas in the past there were always other areas of the world where culture flourished to replace those which had perished, today may be different. With globalization came enormous increases in population, modern means of travel and communication, and finally the spectacular rise of science and technology following the Industrial Revolution. Today we have perhaps reached the stage of world civilization when the quest for sustainability may be the only alternative to world-wide catastrophe. We may locate the recent emergence of this stark alternative to the unprecedented surge of affluence and technological achievements in the west and recently in China and India, all since World War II. Barry Commoner, in his book *The Closing Circle*, pinpoints the technological, commercial, and scientific developments that have led to the environmental crisis we now face. At the root of it all, he finds, there is one stark fact – the unprecedented production of materials never previously found in nature. For countless millions of years nature has evolved ways of dealing with any substance found in the natural ecosystem. Organisms which could not adapt were eliminated. Those with sufficiently adaptive mechanisms thrived. Everything else was recycled. Then Homo sapiens came upon the scene and proceeded to introduce entirely new substances which could not be recycled. At first, it didn't matter that much. There weren't that many people. Their technology was not sufficiently large scale to significantly alter or upset the balances and harmonies that nature had evolved over millions of years. But the human presence introduced a new phenomenon. Instead of recycling back to the soil, humanity proceeded on a larger and larger scale to mine minerals, manufacture all kinds of synthetic goods which could not be recycled, and these materials were then dumped into oceans and landfills where they polluted air, water and soil. In other words, humanity invented waste. To be sure, much of our present ecological crisis has to do with enormous increases in population. But whereas this is a major factor in our environmental crisis, Barry Commoner is careful to point out that there is something else just as important—mainly, the mass production of innumerable synthetic products. Let's mention one of them- chemicals. It all began back in 1828 with the first man-made organic substance- urea. From then on chemists learned more and more about how to synthesize all kinds of organic compounds for all kinds of uses. Now there are hundreds of thousands of these chemicals in our environment, many of which do not degrade but persist indefinitely. They resist any kind of recycling. They are foreign to nature. Many end up as waste in our physical environment, or in our bodies and in the bodies of all living things on land and in the sea. Underlining the seriousness of what these chemicals have done to our environment, James Speth in his just published book, *The Bridge at the edge of the World*, (p. 35) reports these troubling findings: Researchers at the Mount Sinai School of Medicine in New York report that today just about every person on earth harbors detectable levels of dozens of "persistent organic pollutants" (POPs) and other toxic substances. Samples of Canadians were tested for the possible presence of eighty-eight toxic chemicals, on average forty-four were found in each person tested.

What we are looking at here is not the mere burgeoning of population and industry but rather the synthetic nature of much that we are producing. Natural fibers such as wool and cotton have been largely replaced by synthetic ones. Soap powder has been replaced by detergents. Manures have given way to vast amounts of nitrates and other commercial fertilizers. Returnable bottles have been replaced by non-returnable ones. Older methods of controlling insects and weeds are now controlled by insecticides and herbicides. The list goes on and on. But the mother of all these inventions is plastic. The trouble is it is highly resistant to degrading. And this gift of our chemists is now ubiquitous in the environment. The Alcatraz Marine Research Foundation based in Long Beach, California, is now conducting a study of plastic in the ocean. Their report is included in the June 2008 issue of Discover Magazine. And what they are finding is appalling. Due to the confluence of marine currents in the Pacific there is an ever growing area at least one hundred feet deep and one and one half times the size of the United States which consists of a great drifting mass of floatable trash. And it is mostly plastic. But this is not the only such area in the oceans of the world. There are several others as well. But the subject of their study is called the Great Pacific Garden Patch. It lies about one thousand miles from the California coast and about the same distance north of the Hawaiian Islands. In this area, the researchers report, pieces of plastic outweigh surface zooplankton by a factor of six to one. Speaking of pieces of plastic, the trouble is it not only doesn't simply degrade. It breaks up into tiny fragments which are often microscopic. And these tiny fragments are everywhere in the ocean as well as in most sea creatures including fish. I quote from one of the researchers:

Ninety percent of Laysan albatross chick carcasses and regurgitated stomach contents contain plastics. Fish and seabirds mistake plastic for food. Plastic debris releases chemical additives and plasticizers into the ocean. Plastic also absorbs hydrophobic pollutants like PCB's and Pesticides like DDT. These pollutants bioaccumulate in the tissues of marine organisms, biomagnify up the food chain, and find their way into the foods we eat.

Over a period of six years they note a doubling of the plastic fragments per cubic meter of seawater. During the same period plastic production in North America alone experienced double digit growth, topping 113 billion pounds in 2006. Considering the enormous damage non-degradable plastic is doing to the ocean, not to speak of the rest of our ecosystem, you might think there would be a serious effort to develop degradable plastic. But one of the supposed virtues of the plastic now being manufactured is precisely that it does not rapidly degrade. Yet considering that plastic waste is now doing perhaps irreversible and grave damage to the oceanic ecosystem you might think there would be powerful voices in our country raised against its enormous and growing production. Which brings us to the disturbing conclusion found in Commoner's book: Apparently in our present culture, with its system of values based on free enterprise, with its corporations considering only short term profit, this system may be leading us today on a path to environmental disaster. All of which brings up probably the most serious question in this whole matter of sustainability. That is, how can environmentalists work to bring about a transformation of our present system of capitalism so that the market can be made to work for the environment rather than against it? Today's

environmentalists are increasingly united in voicing the concern expressed by James Speth, distinguished dean of the School of Forestry and Environmental Studies at Yale University in his recent book, *Capitalism, the Environment, and Crossing from Crisis to Sustainability*, when he warns (p. 116): “The planet cannot sustain capitalism as we know it.” I shall be dealing with this matter in detail in later essays. America is referred to by those marine scientists at the Great Pacific Garbage Patch as the “biggest trash monger on the planet earth.” Underlying our egregious blindness to the Second Law of Ecology is the observation made by Lester Brown in his book *Plan B 3.0—Mobilizing to Save Civilization*, he notes that it was American industry that perfected what is called “planned obsolescence” as a means of increasing demand and profitability. This led to the vast increases in trash and what Brown refers to as “the throwaway economy” which he characterizes as “putting us on a collision course with the earth’s geological limits.” (p. 115)

Aside from running out of landfills near cities (NYC now transports its trash to Virginia) and probably facing the end of cheap oil, a recent U.S. Geological Survey tells us that there is not enough readily accessible metals (such as lead, tin, copper, iron ore and bauxite) to sustain our throw away economy beyond another generation or two. Think of those Easter Islanders.

In conclusion let me introduce a note of hope into this gloom. In his book *Eco Economy* Lester Brown tells of the growing movement of major corporations around the globe towards an awareness of the serious nature of our gathering environmental crisis. These include such oil companies and giant corporations as BP, Royal Dutch Shell and Dupont. Other corporations following their lead include Ford Motor Company, Daimlerchrysler, Texaco, and General Motors. As time goes on, more and more corporations are becoming environmentally concerned. I mention these developments because meaningful and serious participation on the part of the American market system is essential to affectively dealing with problems of environmental sustainability.

Third Law: Nature knows best

Like the Second Law, this one sounds ridiculously folksy. Yet its implications take us to the heart of the problem of sustainability. It certainly goes against the grain. Obviously our technological prowess has given us the benefits we so enjoy in our modern civilization. It would seem self-evident that we have enormously improved on dear old mother nature. Surely, we do not envy our early ancestors’ life of hunting and gathering. However, to get a grasp of the truth underlying this law I will begin with an example taken from Barry Commoner’s seminal book *The Closing Circle* (p. 38). Let us suppose that we set out to improve on the intricate construction of a precision watch. Now unless a miracle occurs our amateurish attempt will only serve to damage that watch. Why? Because it is the end result of centuries of highly skilled research and development (R & D) which we cannot even begin to match. Let’s switch to mother nature. The natural world of which we are an integral part is the result of untold millions, even billions of years of R & D. Thomas Berry puts it well in his book *The Dream of the Earth* (p. 65):

Nature has, during some hundreds of millions of years through numberless billions of experiments, worked out the eco-systems that were flourishing so abundantly when humans and human civilization emerged into being. It is a brash and destructive thing for humans to intrude on this system without carefully observing just how these ecosystems function and how humans are best present within this context.

Our modern civilization is a testament to the power of technology over nature. But one big trouble is that our technology is inherently ambiguous. It inevitably expresses the ambiguity of its human creator. It has been noted by many observers of the human scene that every measure of human power over nature releases forces of both good and evil. What better illustration can there possibly be of this law of human existence than the mastery of atomic power. Will the fate of human history be defined by an atomic holocaust or the benefits of atomic energy from nuclear power plants? We can readily think of the numberless benefits brought to us by our technology that we would not want to be without. Yet, think of huge bulldozers tearing off mountain tops in West Virginia to mine coal, while the pollutants released flow down the mountains ruining streams and rivers in valleys below. Think of those enormous machines cutting down the Brazilian rain forest. Think of those spotter planes relentlessly tracking down those last few remaining schools of bluefin tuna leaving them no place to hide. And so on. The power of modern technology over nature seems unlimited. Yet this same technology, so powerful and the source of such blessings, is presently inflicting irreversible damage to the delicate and complex balances of our ecosystem essential to human life. Why? Obviously, this ravaging of our environment has everything to do with the kind of human consciousness and its values that presently dominate our civilization.

There is something else. And that has to do with the very methodology of technology. Here Commoner cites a passage from the work of the economist John Kenneth Galbraith’s definition of the essence of technology’s methodology. (pp 184-185) It consists, Galbraith points out, in the isolation of any problem into its constituent parts and then attacking one of those cleanly distinguishable parts. In other words—reductionism. But there’s the rub. As we have previously noted, in nature there are no neat subdivisions into isolated manageable parts. In nature, everything is related to everything else and all is mutually dependent. Which means that the application of technology to improve upon nature is problematical from the start. There is an inherent incompatibility between technology on one hand and the attempt to improve nature on the other. It is just such “improvements” done on a massive scale that have resulted in our present environmental crisis. And this crisis is a clear verification of the Third Law of Ecology: Nature knows best. This is not to condemn technology as such. Neither you nor I would like to sit in a nineteenth century dentist chair. Yet, it is becoming increasingly evident that our present assault on the environment to “improve nature” with technology as it is now being conducted is not sustainable.

After having said all this, let it be emphasized that technology is essential to creating and maintaining human civilization.

The problem is to utilize it in such a way that the life-giving qualities of our ecosystem are preserved. Just how to do this defines the contours of our present environmental challenges. But here are just a few of the attitudes and values that are creating a situation in which our technology is destroying our human planetary habitat: First, there is the arrogant belief that we must dominate and master the very nature that gives us life. Secondly, there is the idea that we are destined to exploit animate and inanimate nature solely for our human benefit, especially profit. Thirdly there is the attitude that our present self-indulgent consumerism trumps all other considerations. Missing here is reverence for all life and humility before a creation taking billions of years to evolve. Then there is just plain ignorance considering the irreversible nature of some of what has already been done and what we are now doing. Yet, there are abundant indications of just how we should employ our technology for the betterment of life. We needn't proceed blindly. There are principles rooted in our "laws of ecology" that can be a guiding light in the darkness of our arrogance and ignorance.

Here are a few of those principles pertaining to our chemical industry. First, the organic compounds found in living organisms comprise but a tiny fraction of what is chemically possible. And I do mean tiny. Commoner notes that if just one molecule of each of all the possible type of protein were made, the total would weigh more than the observable universe! Conclusion: First, during the billions of years of evolution there must have been a lot of proteins made which were found harmful and therefore eliminated. Secondly, any chemical compound, especially those containing attached nitrogen and oxygen atoms, are extremely rare in living things. Therefore, the artificial introduction of such substances into the living ecosystem is dangerous and is to be avoided. Such substances have been found to be usually toxic and frequently carcinogenic. Another fact to keep in mind: the first law of ecology reminds us that in nature there is no waste. As Commoner reminds us, in nature, for every organic substance produced by a living organism there exists somewhere an enzyme capable of breaking it down. Therefore recycling is ensured. Conclusion: When synthetic organic chemicals are produced significantly different from what already exist in nature, they are likely to accumulate and resist recycling. This is just what has been happening to our environment with such substances as PCBs and DDT. A further comment- such chemicals are very likely dangerous to living things and should be treated with great caution. I allow Barry Commoner to speak for himself (p. 41):

... such caution or prudence is, of course, impossible when billions of pounds of the substance are produced and broadly disseminated into the ecosystem where it can reach and effect numerous organisms not under our observation. Yet, this is precisely what we have done with detergents, insecticides, and herbicides. The often catastrophic results lend considerable force to the view that Nature knows best.

Think for a moment of the pharmaceutical industry. They have been forced to keep some of these insights in mind simply because they cannot harm too many people in too short a time without losing money. Therefore their search for possible drugs has wisely centered upon organic substances already found in living creatures. Before going further, I want to make a basic point concerning the whole matter of pharmaceuticals. I am grateful, as you are, for the enormous benefits to human life and health of many drugs. Truly, some of these have improved upon mother nature. But it has to be said that all drugs have side-effects, some of which are utterly harmless, some of which are debilitating and some of which are deadly. I shall return to this matter in my next essay on the fourth law of ecology: In nature there is no free lunch. Suffice to say that medical technology suffers from the same complications inherent in all technology wherever it is applied to living or inanimate natural systems. So there is much research to specifically target certain chemicals for use in our bodies. But the drugs inserted into a system where all is connected to everything else, (in other words non-linear) are seldom limited in their action. Therefore the ubiquitous phenomenon of "side-affects." Which, by the way, could be a useful metaphor and guide in the whole question of how to anticipate and mitigate environment damage wherever technology is employed to "improve on nature".

What is to be done to successfully pursue our quest for sustainability? A complex question indeed—the most demanding and critical question of our age. Commoner makes one important suggestion: We must make our biological sciences more aware of what our technology is actually doing to natural systems. The ominous fact that now every human has detectable traces of several synthesized organic chemicals in their bloodstream (it has been called a veritable chemical soup)—exhibits inexcusable ignorance and heedlessness. Who knows what the long run consequences will be? As previously noted, reductionism is seriously flawed when applied to living natural systems for it ignores the first law of ecology. In biological science as elsewhere in our dealing with nature we must employ a methodology appropriate to the subject matter under consideration. Something else even more fundamental—if we are to employ our technology without destructive effects on the organic basis of life, we must have an ideological and evaluational conversion concerning the operation of our commercial and financial affairs. As I mentioned earlier, environmentalists are increasingly raising a fundamental and disturbing question: Is our present economic and political system, with its free market capitalism and corporate devotion to continual growth and short term profit fundamentally incompatible with the long term viability of our ecosystem?

Fourth Law: There is no such thing as a free lunch

This "law" proclaims that every gain is won at some cost. You will find, as I elaborate this law that to a large extent it recapitulates the previous three. After all, everything in nature is related to everything else. Anyway, this fourth law provides another perspective on our sustainability problem and a very useful one at that. To begin let us meditate for a moment upon coal and oil. Think of those millions of years (even billions) that nature spent using vegetative growth under heat and pressure to create those massive deposits of concentrated energy in various forms in various depths of the earth. Then along came Homo sapiens. And all that prodigious storage of energy was just waiting to be exploited as soon as our technology developed to the point of appreciating and finding ways to make use of it. What serendipity! What a tremendous gift to human life! After all, the coming of our Industrial Revolution, which created our modern civilization, has been based on fossil fuels. What other source of energy could have been so concentrated in such convenient form to fuel our present industrial establishment? What

an extraordinary gift of nature! To be sure it brought pollution and lots of it. Yet this seemed small change compared to the benefits of the fossil fuel age. Our modern civilization would be inconceivable without it. Was this not a colossal free lunch?

But wait. Enter Charles David Keeling, a graduate of Northwestern University who went to work as a geochemist at California Institute of Technology in Pasadena, Cal. While there he became interested in measuring the CO₂ in the air. I will skip over the details. Anyway, he perfected a manometer to extract and measure CO₂ in parts per million. He took measurements at various locations at differing parts of the day and found they all came out the same—315 parts per million. The International Geophysical year was about to begin and Keeling was offered the task of taking air samples of CO₂ at an isolated station at Mauna Loa in Hawaii. You have probably seen the resulting Line Graph. Anyway, since beginning his measurements in 1955 average CO₂ levels have kept climbing and they are now rising faster all the time. Shortly thereafter the scientific community realized that human activities were producing what we now call global warming. And at an ever accelerating rate. Further, that it was the burning of fossil fuels that comprised the planet's major source of greenhouse gases. So it was, that what initially seemed such a free lunch has morphed into the mother of all threats to our planetary environment, at once threatening future disasters to our ecosystem and almost impossible to bring under control. It seems almost a cruel joke on the human race, coal and oil being so essential to our present civilization. Some free lunch.

Let's consider another candidate for free lunch status. As you may know, nitrogen makes up about 78% of the air we breathe. The rest is oxygen and a few trace elements. Nitrogen of course, is one of the most essential soil nutrients. But how does it get from being a gas to being a nitrate compound that the roots of plants can take into their system? The Indians and later the colonists could raise corn because certain organisms in the soil (this was discovered in 1886) had the capacity to incorporate gaseous nitrogen into a chemical compound (nitrate). In the language of chemistry they could "fix" nitrogen into a compound usable by plants. Then the chemists got busy. Eventually, led by Fritz Haber, a German Chemist, they developed methods of "fixing" nitrogen into chemical compounds for use in agriculture and industry. While early methods were quite expensive, by the early nineteenth century scientists came up with a fixation process both economical and convenient for large scale agricultural and industrial use. What they came up with was ammonium nitrate.

Fast forward now to the late twentieth century and beyond where Barry Commoner in his book *The Closing Circle* provides a brief look at what happened to that seemingly free lunch from mother nature's infinite supply of nitrogen, "fixed" to ammonium nitrate. Concerning farms in Illinois, for example, in 1949 about 20,000 tons of nitrogen fertilizer were used to produce about 50 bushels of corn per acre. By 1968 that same area used about 600,000 tons to produce about 93 bushels per acre. If my arithmetic is correct that is a 30 fold increase to get from 50 to 93 bushels per acre. Here's Commoner's explanation (p. 148) "The reason for the disparity between the increase in fertilizer and yield is a biological one: the corn plant, after all, does have a limited capacity for growth, so that more and more fertilizer must be used to force the plant to produce the last few bushels of increased yield. Therefore, in order to achieve such high yields the farmer must use more nitrogen than the plant can take up. According to the second law of ecology that extra nitrogen has to go somewhere. In this case it proceeded to pollute nearby family wells making them unsafe for drinking. But it didn't stop there. It polluted rivers and streams which fed into the Mississippi. But it didn't stop there. It has since created a huge and growing "dead zone" south of the Mississippi delta. Marine organisms cannot live in these "dead zones" because the excessive algae fed by all that ammonium nitrate uses up the oxygen in the water. The process is called eutrophication or over-fertilization. And this excessive use of nitrate fertilizer has just about destroyed the once fabulous oyster beds of Chesapeake Bay. The same farming methods in south Florida have created a growing dead zone south in the Gulf of Mexico. The irony here is that farmers on those huge industrial farms find they must use all that fertilizer in order to make a reasonable profit. In other words they cannot survive without producing all that pollution. As Commoner put it: (p. 149) "The new technology is an economic success but only because it is an ecological failure." So it turns out that this abundant nitrogen is no more a free lunch than fossil fuels.

For as the authors of an article in the February 2010 issue of Scientific American caution us, nitrogen in its reactive form (not the N₂ gas of earth's atmosphere which is harmless) which emanates from farms and fossil fuel burning factories and vehicles, is today causing many serious problems to human health and the environment, including an increasing role in climate change. But this poses a huge question: What sort of economic success would this use of nitrogen be if we factored in all the cost of peoples' wells being destroyed, uncounted millions of fish killed in those dead zones, the destruction of the oyster fishery in Chesapeake Bay, etc. etc. What would that corn cost if we actually figured in its actual cost to the environment? It is a very serious question which goes to the heart of what we are really doing to nature. Namely what is the real cost of what we are producing? As Lester Brown notes in his book *Plan B 3.0* (p.7) this failure to include the actual cost of what we are producing and consuming leads to market decisions so distorted they are threatening our civilization. For example, what we are actually paying at the pump for gas is a gross distortion of its actual cost. What happens when you factor in such things as climate change, tax subsidies to the oil industry, the cost of protecting our oil supplies, health care for treating respiratory illnesses from polluted air, etc.? According to the International Center for Technology Assessment, these costs now total nearly 12 dollars a gallon. Add these hidden costs to the actual expense of providing the gasoline itself and it adds up to about 15 dollars per gallon. Think of what our culture would look like if we were paying that actual cost. Our American way of life is not built on cheap oil. It is built on the illusion of cheap oil. It is a huge bubble.

Such are the quandaries and ironies of our egregious ignoring of the fourth law of ecology: In nature there is no such thing as a free lunch. We too often forget how utterly dependent we are on nature for every aspect of life including our very existence. And there are limits to those resources. Indeed everything we do to live uses up these resources in some way. The theologian Sallie McFague has expressed this well in her article in the Winter/Spring issue of Harvard Divinity Bulletin "Cities, Climate Change and Christianity" (page 59). She puts it this way, implicating entropy and the Second Law of Thermodynamics as an essential component of the fourth Law of Ecology:

Thus as living things seem to increase in order, they always do so by a decrease somewhere else, by sucking orderliness from their environment. A good example is the high level of orderliness in cities versus the price paid for this comfort and complexity by “nature”—clear-cutting forests, degrading arable land, lowering diversity in fisheries, draining water from aquifers . . . With every energy exchange—from the ones moving our cars to those in our electric toothbrushes—a decrease occurs, quality is lost, something somewhere “pays” in house rule language, if we keep raiding the fridge this way there will be nothing left to eat.

Getting back to coal for a moment: America has been called the Saudi Arabia of coal. Right now there are 600 coal fired power plants in operation in the U.S. Generating 49% of our electricity. It is also estimated that burning coal is responsible for about 40% of global warming. In the meantime there are about 150 additional coal plants in various stages of development. Can all this be stopped somehow? Our environmental movement is increasingly trying to do just that. And their success should give all of us what Obama called “the audacity of hope.” Concerning these proposed new plants public opposition has had a powerful affect. Lester Brown in his book *Plan B 3.0* notes that California for example, in 2007 prohibited the signing of any new contracts to import electricity produced with coal. Several other states, including Florida, Texas, Minnesota, Washington, and Kansas followed suit refusing licenses for coal power plants or otherwise preventing their construction. Brown goes on: (p.215)

Coal’s future took a telling blow in July 2007 when Citigroup downgraded coal companies across the board and recommended that clients switch to other energy stocks. In August coal took another hit when U.S. Senate Majority Leader Harry Reid of Nevada, who had been opposing three coal-fired power plants planned for his own state, announced that he was extending his opposition to building coal-fired power plants anywhere in the world. Investment analysts and political leaders are now beginning to see what has been obvious for some time to scientists such as NASA’s James Hansen, who says that it makes no sense to build coal-fired power plants when we will have to bulldoze them in a few years.

It is great news that our government and even corporations are finally getting seriously involved in this problem of global warming. Concerning the four laws of ecology, their explication in these essays provides a useful framework in dealing with the biggest problem of sustainability, namely, how do we employ our technological prowess without ruining our ecological environment? As noted in my last article “the Third Law of Ecology” the ubiquitous occurrence of “side effects” when taking prescription drugs provides a useful warning whenever we apply technology with its linear reductionism to non-linear natural systems. There is an inevitable cost which must be anticipated and carefully evaluated. The systematic failure to do this explains much of the present and past grievous damage which has and is being inflicted on our environment. Enron, by the way, began its descent into bankruptcy with its failure to include actual expenses in its balance sheets. Perhaps Enron’s fate is a kind of parable illuminating what our human civilization is doing and where it is headed, most ominously with global warming. But there is something else even more fundamental—the nurturing of a genuinely ecological consciousness or spirituality. And that concerns each and every one of us. In this regard I print here a passage from the writing of the poet Wendell Berry (in his *Recollected Essays*) who has taught us a lot about the spirituality of sustainability:

We have lived by the assumption that what was good for us would be good for the world. We must change our lives so that it will be possible to live by the contrary assumption that what is good for the world will be good for us. And that requires that we make the effort to know the world and learn what is good for it. We must learn to cooperate in its processes, and to yield to its limits. But even more important, we must learn to acknowledge that the creation is full of mystery: we will never clearly understand it. We must abandon arrogance and stand in awe. We must recover the sense of the majesty of the creation, and the ability to be worshipful in its presence. For it is only on the condition of humility and reverence before the world that our species will be able to remain in it.

Chapter 3

The Problem of Our Food System

Nutritional Challenges

Nothing is more important, relevant and personal than the question of what we eat. The focus of this section and the next will be on the gathering nutrition crisis we are facing and which is already having a profoundly negative impact on American's health. This affects us primarily in two ways: First, through, what is being produced by our industrialized farm complex and secondly, what is being done to that produce by our current food processing industry.

As I begin to sketch in what can only be described as a parlous situation concerning what we Americans are presently eating, I lead off with the byline of the January 1, 2008 issue of Time magazine: "The Sorry State of American Health: Despite advances in medicine, Americans are less healthy than we used to be, and the next generation may be even worse off." You may have seen some of the statistics mentioned in the Time article: 67% of Americans are currently over-weight or obese, 27% blood pressure too high, 40% get no exercise, more than a doubling of diabetes since 1997, etc. As to the origin of these problems and other chronic conditions such as cancer, heart attacks, diabetes and stroke, the authors of the article although mentioning lack of exercise, place the major blame on a system designed to respond to illness rather than to prevent it. One more grim statistic: it is predicted that if things continue the way they are presently, approximately one third of our children will eventually develop diabetes 2. This would bring a loss of life span of 11 or 12 years plus a lifetime of continually contending with heart disease, cancer and stroke. And this, of course, would amount to a medical tragedy. But this would be especially tragic because generally diabetes 2 is eminently preventable and even curable simply by better diet and more exercise. The picture you get is a medical system costing twice as much as it does in other industrial nations yet at the very bottom concerning its effectiveness in promoting health. There is no doubt that the authors have identified a major flaw in our medical care. Yet I see another factor at work, perhaps even more important and pervasive than the failing of American medicine, in fact a veritable elephant in the living room, Here I refer to the nutritional quality of the food which issues forth from our industrialized farm complex and our food processing corporations. Naturally, Time does not mention this aspect, their being owned by a large corporation.

I refer first to an article from our text *Menu for the Future* by Marco Visscher aptly entitled "Unhappy Meal." He finds the prevailing farming methods are bringing about an alarming shortage of minerals according to recent reports gathered by the United Nations Food and Agricultural Organization. He goes on to present a list of disturbing trends reported by another recent study: The vitamin and mineral content in beans declined by 60%, by 70% in potatoes, 80% in apples, cauliflower 50%, broccoli a 50% decline, and in wheat a decline in protein from 90% to 9%. Can these shocking figures be authentic? Unfortunately Visscher does not identify that recent study that he mentions. I found this in Michael Pollan's recent book *In Defense of Food* where on p. 115 he cites ongoing studies conducted by the USDA (US Department of Agriculture). These show that since the widespread use of chemicals in the 1950s, of 43 crops studied, the nutritional quality has substantially declined: vitamin C content by 20%, iron by 15%, riboflavin by 38%, calcium by 16%, etc. While I cannot vouch for the accuracy of Visscher's grim statistics there seems no reasonable doubt as verified by Pollan, that something fundamental is going on with our food supply and which is an increasingly significant factor concerning the deteriorating health of the American people detailed in the Time article.

Just what is there about present farming methods that would lead to such a decline in nutrient quality? There may be several reasons. But I am convinced that one of the major ones stems directly from one of the most egregious violations of the laws of ecology in our time. An explanation calls for a little history: It all began in mid-nineteenth century when Justus Baron von Liebig (famous as the father of organic chemistry) concluded that only three chemicals (or three macronutrients)—nitrogen, phosphorus, and potassium, (known in the periodic table as NPK) are necessary for plants to not only grow but thrive. This conclusion has been tacitly accepted ever since. The trouble is, soil is an exceedingly complex interactive system of literally billions of various kinds of bacteria, many kinds of fungus, worms, grubs, etc. plus all the many nutrients essential to a healthy human diet. There is a lengthy list of micronutrients (including minerals and vitamins) besides Liebig's three big macronutrients. Not only do we have a limited knowledge of what all these micronutrients are, we know even less about how they interact with each other, especially how they interact in our bodies. The first law of ecology cautions us that in living systems everything tends to relate to everything else in that shared system. The point is, Liebig's famous formula NPK is a typical result of applying inappropriate reductionist logic to a living system. That is, reducing an infinitely complex interactive system to one or a few discrete elements and then mistaking this abstraction for the concrete whole. To say the least, as Michael Pollan notes (p. 114) of his recent book *In Defense of Food* this NPK formulation is an extreme simplification of a very complex reality, in this case with negative implications for human nutrition. Yet it has stuck. Go today into any store selling chemical fertilizers and you will be handed a bag labeled NPK in varying proportions. Indeed, this rank violation of the laws of ecology is universally used in today's industrial farms which produce the food we consume. It is used because it is relatively cheap and easy to use on those huge farms.

I digress here with a personal note: From my experience in 60 years of gardening plus going through the Master Gardener course both at the University of Vermont and UNH, I have learned that each vegetable crop during the course of a growing season absorbs from the soil certain nutrients some of which are unique to that vegetable. And if that vegetable is grown repeatedly on the same piece of ground, the soil becomes increasingly deficient in those nutrients. Therefore, there is the necessity in gardening generally to rotate ones' crops or replace the nutrients. It is as simple as that. Consider what is being done regularly at the huge industrial farms raising soy beans or corn year after year on the same acreage. Knowing the chemical limitations of NPK is it any wonder that crops grown on that land are producing increasingly nutrient-poor produce? They can pour on

all the NPK they want but that will not prevent the progressive degradation of the nutrient quality of that soil if it is not fed annually with the full spectrum of nutrients contained for example in animal manures or by some kind of green manuring method. Another way of describing what goes on with these huge farms is that they sacrifice quality on the altar of quantity.

What our American farms have all too often become is well depicted by Tom Philpott in his article in our text *Menu for the Future* (pp. 28-29) In Iowa, which typifies the general trend, relatively small farms devoted to raising many kinds of produce utilizing animal manures, since WW2 have steadily devolved into a relatively few huge farms limited to only a few monocrops (soy, corn and wheat) entirely dependent upon yearly infusions of NPK. Philpott sees Iowa as a kind of

. . . vast machine whose inputs are artificial fertilizer, pesticide, hybridized and genetically modified seeds, and one of the world's richest store of top soil. . . . Other outputs include nutrient runoff from fields, manure spills and air pollution from confined animal feeding operations and *degradation of topsoil by chemical use*. (My emphasis)

A final comment here—so far one half of this fabulously rich store of topsoil has already been lost to American farming methods. Another sobering commentary is that of James Horne, President of the Kerr Center for Sustainable Agriculture and Maura McDermott, its Communications Director. They comment on some of the damaging aspects of these farming methods. One of the most destructive, they note, is monoculture (same crops on same soil year after year). This together with ever increasing use of chemical fertilizers (especially ammonium nitrate) and heavy machinery promote soil erosion and compaction which depletes the soil of its “life and health” (p. 26). Putting it bluntly, our farmers are mining this precious resource rather than using it as a renewable resource.

In conclusion it must be said that these huge industrial farms now provide indispensable produce for the world's billions of people. To be sure, the nutrient content of this produce is steadily declining. But there is no quick and easy way to replace this farming system with its enormous amount of NPK spread on the fields year after year. But this inexorable decline our farming methods are bringing about should be seen as a clear warning that this system is unsustainable. Eventually it will have to be overhauled for the sake of the health of our people and that of the rest of the world. Yet this is by no means the worst of our gathering nutritional crisis. There is another level of our food chain which cries out to be addressed. And that is what is being delivered to our supermarkets by our food processing corporations whose mode of operation further degrades nutrient quality. I intend to deal with that issue in my next essay.

Nutritionism and the Overuse of Reductionism

I begin this essay with the narration of an experiment performed recently that seems a good opening into one of the most serious problems facing our present “American Way of Life.” It is a problem so serious it is literally killing us at a rate dwarfing any possible terrorist threat we hear so much about. I refer here to what has become known among nutritionists as the “western diet.” Much of this material, by the way, is taken from Michael Pollan's recent book *In Defense of Food* (pp. 85-88).

Back in 1982 a group of ten middle-aged Australian aborigines agreed to take part in a simple test. Since leaving the hunter-gatherer life in the bush, all ten had developed type 2 diabetes, become overweight and acquired elevated levels of triglycerides, a major risk factor for coronary heart disease (CHD). They had been living in settlements on a westernized diet. That and a sedentary lifestyle had upset the intricate system by which the insulin hormone regulates the metabolism of carbohydrates and fats in the body. This “metabolic syndrome” has been implicated not only in the development of type 2 diabetes but also in obesity, hypertension, heart disease, and possibly certain cancers. Anyway, these aborigines were returned to their traditional homeland in an isolated part of the country without any access to store foods or beverages. Here they proceeded to live as they had previously on what they could hunt and gather—their traditional diet. After seven weeks blood samples revealed striking improvements in just about every measure of their health. All had lost weight and had lower blood pressure. Their triglyceride levels had become normal, etc. The usual symptoms of diabetes had greatly decreased or completely disappeared. Studies with Native Americans and Hawaiians have had similar results.

The question is, of course, just what caused these remarkable results? Was it the particular ingredients of their traditional diet? Was it the increase in exercise? No doubt this helped. But again, we naturally ask about specific elements in their traditional diet which was certainly very different from a typical “western diet” with its processed food and meat, plus lots of added fat, sugar, salt and not much in the way of fruits, veggies and whole grains. If it were merely a matter of identifying particular chemical ingredients of a healthy diet, then perhaps our way to improved health would be clear-cut and easily achieved. But the solution to this conundrum is at once simpler and more complicated than one might initially suppose. This will become evident as we proceed further with our study of American health and nutrition. Presently we are so confused we are not even asking the right questions. Mysteries abound. How different, for example, are the traditional diets of Eskimos, Japanese and Italians yet these disparate peoples share one thing—almost complete freedom from the devastating chronic diseases which afflict us Americans. You could say of us that never has a people had access to such a variety of foods yet suffered such bad results. What is wrong with our diet anyway, with its stupefying cornucopia of inexpensive and varied foods? Why is it killing us?

The beginning of an answer (only the beginning) lies with Michael Pollan's term “nutritionism.” And I must say I find his analysis here completely convincing. What does he mean by “nutritionism?” To begin with, he doesn't mean nutritionists. Lord knows we need good nutritionists! No, by “nutritionism” he refers to an ideology. And an ideology is made up of a coherent system of values and beliefs behind which is a world view or paradigm largely hidden from view yet implicitly driving a certain mode of thought. To put it simply, “nutritionism” is an outlook which operates on the assumption that we can solve our dietary problem by analyzing it down to its discrete irreducible constituents. Having done that, these discrete elements will add up to a complete whole—our requisite diet. Trouble is, this reductionist methodology is just one more violation of a fundamental law of ecology, in this case the fact that with living systems we have infinite complexity of interaction with more chemicals than we are presently even aware of. The sum of the parts of a living system add up to a lot more than the sum of

its discrete constituents.

This is not to simply dismiss reductionism. After all, it is central not only to technology, but to much of science as well. And these have achieved wonders in our modern age. Even concerning biology, as Sean Carroll reminds us in his exciting book on the new science of evolutionary development *Endless Forms Most Beautiful*, (p. 82) reductionism has made great contributions, particularly in revealing the mechanisms of inheritance and illuminating the causes of many diseases. Yet, when reductionism gets you down to the molecular level, such knowledge alone does not shed light on the dynamics of the levels above. This is especially true when one is analyzing the complex interactions of nutrients in a human system.

Just one illustration of how over-simplified this method is, Pollan, *In Defense of Food* (p. 65) notes that in a simple leaf of thyme there has been identified (so far) 34 antioxidants. Who knows how many more and what there really is? It should come as no surprise that the excessive use of reductive analysis in studying nutrition has delivered up a continuously moving target of results, some valid, some partially valid, all incomplete, some just plain false and misleading. No wonder the American people are confused. Certain vitamins or nutrients are highlighted, have their day of glory, only to fall eventually out of favor into well deserved obscurity. There is increasing skepticism about the value of taking vitamins and certain vitamin supplements compared with eating food containing them. Think of those faddish diets continually rising into public favor only to soon fade from view. Think of those modifications of federally sponsored food pyramids.

To be sure nutritional science has made enormous contributions to our understanding of proper nutrition which we ignore at our peril. But in spite of these valid insights we are still left with the nagging question: Just what is it about the “western diet” that seems to be accompanied by the declining health of the American people? Surely there are answers. The trouble is there are no simple answers. Our eating must be viewed as an integral part of our American life-style. So we will not have a satisfactory answer unless and until we have looked at the relevant aspects of that life-style. For example, not just what we eat, but how we eat, why we make certain choices concerning just what we do eat, and when we eat. These are all relevant. To begin to seriously address this whole matter I will devote my next essay to that which makes up far too much of our diet and which is a major part of our dietary problem—processed foods.

Nutritional Failures of Processed Foods

My last essay dealt with one of the problems generated by what Michael Pollan calls “nutritionism” in his latest book *In Defense of Food*. We go now to the bewildering environment of processed foods. This serious health problem has come about through a whole complex of factors which together form a kind of “perfect storm” negatively afflicting all of us who eat this stuff. These factors, which together constitute the effective contours of our nutritional environment are: The brainwashing power of our huge food corporations with their control of the media, their relentless drive for profit regardless of health consequences, a pliant congress ready and willing to be bought off by lobbyists with deep pockets, the present reign of “nutritionism,” the technological prowess of our industrial farming complex perversely subsidized by a government pandering to farmers for votes, a distracted, decadent consumerism with a driven, hectic life-style, and finally, the hapless ignorance and passivity of our people.

I shall begin our journey into the nutritionally challenged world of processed food with the fate of the “imitation rule.” Details are found in Pollan’s book *In Defense of Food* (pp. 34-35). In 1938 the “Food, Drug and Cosmetic Act” imposed strict rules requiring that the word “imitation” appear on any food product that was an imitation of the real thing. It read in part:

There are certain traditional foods that everyone knows, such as bread, milk and cheese, and that when consumers buy these foods, they should get the food they are expecting . . . (and) if a food resembles a standardized food but does not comply with the standard, that food must be labeled as an imitation.

Sounds reasonable enough. Yet, the food industry fought this rule relentlessly until it was finally tossed out in 1973. The revised rule held that so long as an imitation product was not “nutritionally inferior” to what it was impersonating it was marketable. Of course that gave the food processors free reign to sell just about anything as long as it was not demonstrably harmful. It also assumed they knew what was “nutritionally inferior”—a dubious assumption indeed. Ever since, food lobbyists have successfully beaten back or annulled just about every attempt of the FDA to exercise any meaningful control over the ingredients and ever shifting wordings on food packages no matter how misleading and absurd the health claims.

Welcome to the weird world of food packaging claims and enticements. Goodbye to any effective controls over what is inside or on the outside of those packages. But wait, what about those endorsements made on behalf of health organizations like the American Heart Association and the American Diabetes Association? What about them? We see such endorsements all over the place. For a disturbing answer we turn to the writings of Marion Nestle’s excellent books: *What to Eat* and *Food Politics*. She sets out to discover why such organizations would stick their necks out to endorse certain products which would seem to have no clear health benefits. Take, for example, benefits to the heart. I found little red hearts all over the latest box of Bisquick, with new messages. This was not just “Bisquick” any longer. It was “heart-smart Bisquick.” Obviously, it now enjoyed an endorsement from the heart association. Why? The lettering on the box explained: “Diets low in saturated fat and cholesterol may reduce the risk of heart diseases. Translation: If it doesn’t harm you therefore it’s good for you and merits an endorsement. According to this logic any glass of water from any household tap deserves a heart health endorsement. But why go to absurd lengths to endorse such products anyway? Because endorsements have to do with fees. The American Heart Association gets paid for these endorsements and paid handsomely. Just how do they justify this? Because they say they are working to promote heart health and Bisquick, they claim, does not harm the heart. A spokesman for the American Diabetes Association justified their endorsements with this rational: of *What to Eat* (p. 356) “If we want to prevent diabetes . . . we have

to get funds from someplace.” So much for the significance of food endorsements!

But all this aside, just what is so bad about processed food anyway? Why is it undermining our health? The nutrient problem is bad enough having produced a generation both overweight and undernourished. But there is a more serious problem here than a mere lack of nutrients, bad as that is. To zero in on it I turn again to Marion Nestle’s book, *What to Eat* (p. 314):

When too much glucose comes in (the bloodstream) at any one time, it swamps the ability of the body’s metabolism to handle it. If you habitually eat large quantities of foods with *rapidly absorbable carbohydrates* (emphasis mine) refined starches and sugars- the pancreas makes too much insulin. . . . Also, muscle cells start resisting taking in more glucose, and this means that more of this sugar is stored as fat. The result is that you put yourself at risk for weight gain, diabetes (the adult type 2 variety) cardiovascular disease, and other such problems.

Message: Occasionally eating this highly refined stuff may be OK but don’t consume it often and liberally (as most Americans are now doing) or you are probably headed down a dangerous path towards chronic illness and early death. This is what is actually happening to our population and this is where our food corporations are presently leading us. By the way, Bisquick, with all those little red hearts all over the box, is a prime example of those highly refined “rapidly absorbable carbohydrates” Nestle cautions us about. Be warned that unless the package includes “whole wheat” or “whole grains” in the ingredient list, the refined product will not include the fiber which both slows the rate of absorption of glucose into the blood and also carries many beneficial nutrients. The upshot of all this is that the “rapidly absorbable carbohydrates” problem is about as close to a “smoking gun” as we are likely to get in nailing down the destructive effects of processed food. Yet when the larger context is considered other major factors make their appearance. For example, the total calories in our diet, the hectic life-style of our “American way of life,” lack of sufficient exercise, the excess of salt, fat, and sugar in processed foods are all implicated in our looming health crisis.

Finally, we may ask: Why all this processing in the first place? There are basically two answers each deeply involved with the other. First, a lifestyle which demands it (more on that later) and secondly, “value addition.” Here’s how value addition works: Take potatoes. One pound unprocessed is worth about 75 cents. One pound of Lay (PepsiCo) is worth \$4.77. But one pound of Terra (Hain Celestial) Yukon Chips goes for \$10.21 The figures are taken from Nestle’s *What to Eat* (p. 538). The more value the greater the profit margin. We may add: the more processing the poorer the nutrient value. My next essay will continue our exploration into this weird artificial world and further examine that life style so addicted to it.

Life-Styles and Offerings of Our Supermarkets

You have wandered into the most dangerous area of your supermarket—those inner aisles festooned with those devilish but dubious creations of our food scientists—processed foods. You see an entire aisle devoted to bread most of which is filled with empty calories and other mysterious chemicals difficult to pronounce. Not much nutrition here unless you read “whole wheat” or “whole grains.” Another aisle is filled with sodas (sugared and flavored water). If it proclaims “fruit juice made from concentrate” you are back to sugared and flavored water. Yet another aisle is loaded with cookies and crackers. With few exceptions don’t expect any beneficent nutrients in that area. Search out the least harmful with careful reading of ingredients. Then there is that wonderful world of cereals. Perhaps nowhere else in those enchanted center aisles are endorsements and health claims so illusory. Search carefully here for exceptions such as oatmeal and shredded wheat. Concerning the soups, the excess of salt as a health issue is equaled only by the prodigious amounts of sugar among the cereals. Perhaps never before in human history has so much technological effort been devoted to creating stuff with such an empty and deplorable result.

Warning! Don’t get trapped in this area with your children or grandchildren. Marion Nestle tells us why in her book *What to Eat*. (p. 373): “Research on how to market foods to children is simply breathtaking in its comprehensiveness, level of detail, and undisguised cynicism.”

Here’s the general picture: Recent surveys have found an average of 5 TV sets in the average home. Usually there is one in the kids bedroom (a nutty idea). With kids spending on average more hours daily in front of the tube than they do in school, this has serious consequences. To provide perspective here the giant food corporations spend literally billions yearly (Nestle puts the figure at roughly 15 billion) brainwashing children from toddlers on up. Don’t think for a moment that the food corporations are wasting their money. This brainwashing works. In fact, it is so effective that the kids soon know all their favorite brands by name before they can barely talk. The evidence indicates that this conditioning is so powerful it can persist right into adulthood. Further, they are explicitly taught to demand their own “food” and not what their parents say they should eat. The end result of all this can be a nightmare if you escort children into the cereal section. The corporations refer to this as the “pest factor.” And what they pester for can only be described as “junk” or simply the equivalent of sugar cookies.

In my last essay I described what could be called a kind of “smoking gun” involved in this matter of highly refined food undermining our health. It came down to a property of processing that brings about a sudden rush of glucose into our bloodstream. “Rapidly absorbable carbohydrates” was Nestle’s term. This rush of glucose overstimulates the pancreas to make too much insulin, which together with muscle resistance leads to a vulnerability to all those chronic diseases (diabetes 2, obesity, heart disease and stroke) presently plaguing us. I also cautioned that to get a full picture of why this country’s health is deteriorating, this diet must be viewed in the larger content of our lifestyle behaviors. Just what is it in that lifestyle that makes the answer to our dietary problem at once simple and complex? That answer must take into account more than what we actually eat. It must include the behaviors embedded in that lifestyle. What about those behaviors? Following is a summary from Brody’s *Jane Brody’s Nutrition Book* of how this lifestyle shapes American eating behaviors (p. 15):

Breakfast is a hit-or-miss-affair. If any breakfast is eaten at all, more often than not it consists of presweetened cereal and milk or a vitamin-enriched breakfast bar (really a cookie in disguise) for the youngsters, and juice, toast, and coffee for the adults. Three quarters of American families do not eat breakfast together. In up to half the families, one or more persons regularly skip breakfast. And in 40% of families, the parents have nothing to do with the children's breakfast. For lunch, nearly everyone is on his or her own. . . . For many youngsters lunch is a candy bar or a bag of potato chips and soda pop from the school vending machine.

What about dinner? In half of our households both spouses work. This inevitably means either something quick and easy to serve up (naturally some kind of processed food) or something from a "take-out" restaurant. Michael Pollan reports *In Defense of Food* (p. 188) that among eighteen to fifty year old Americans roughly a fifth of all eating now takes place in the car, probably on long commutes because of a desire to live in a big house in the suburbs. Which raises the question of how often Americans actually sit down together to share a meal. Yet another issue—snacking. According to Pollan, Nestle and Brody snacking has increased dramatically in recent years. Pollan puts it this way (p. 188): "Americans have added another "meal" to the usual three, namely a fourth—a daily eating that lasts all day long: constant sipping and snacking while watching TV, driving, and so on." There is more. As Brody reports eating out has become an essential part of the "American way of life." By the mid eighties it was expected that 50% of American meals would be eaten outside the home. It has probably climbed further in our 21st century. A large proportion of those "meals" are at fast food restaurants. You know what that means. And we haven't even mentioned what goes on in households (there are millions) where a single mother or father with kids struggles to cope with the demands of daily eating. To top it all off, Brody is quite right in judging that our typical American is quite ignorant of good nutrition in the first place.

Now if this situation is at all accurate, we have a picture before us of an ongoing nutritional train wreck. A situation that is literally killing us—a clearly unsustainable situation that is not improving but getting worse. It comes down to a deadly combination of those processed foods joined at the hip with those hectic behaviors of our present lifestyle. Don't expect this unholy alliance to dissipate anytime soon. The forces producing and sustaining it are deeply embedded in the cultural trends of the last several decades. For one thing, too many people have swallowed and internalized the systematic and relentless conditioning of our huge food corporations. The American people actually like processed food just the way it is. A perverse trend is in motion here. The more salt, sugar and fat the more they like it. Marion Nestle tells us in her perusal of commercial breads that when the makers of Wonder Bread (that popular white tasteless glop) actually tried to enrich it a little with whole wheat, people stopped buying it. Can you believe it? The same confusion is on display with people preferring their orange juice without pulp. Many today no longer live in the world of real food. Add to this the sedentary character of the "America way of Life" and the family situation sketched in by Pollan, Nestle and Brody bespeaks a condition of profound alienation not merely with respect to good nutrition but on several other cultural levels as well—all critical to the sustainability question.

Alienation Down on the Farm

To provide an in-depth look at the eating behaviors described in my last essay it is necessary to deal with what has happened to farming in the United States as an example of the perverse use of technology. Like excavating an archeological dig it will become clear that what has happened on one level of our culture (its agricultural practices) affects those cultural levels above—even to what goes on inside the American home. By the same token I will be dealing with several levels of alienation. In what follows I will be drawing primarily on the writings of the poet, essayist and environmentalist Wendell Berry, in his book, *The Unsettling of America: Culture and Agriculture*. I will also draw on E.F. Schumacher's *Small Is Beautiful* and Rene Dubos's *So Human An Animal* to provide perspective. I begin with a brief description of American farming in the beginning of the twentieth century as remembered by Wendell Berry (p. 39):

In my boyhood, Henry County, Kentucky, was not just a rural county, as it still is—it was a farming county. The farms were generally small. They were farmed by families who lived not only upon them, but within and from them. These families grew gardens. They produced their own meat, milk and eggs. The farms were highly diversified. The main money crop was tobacco. But the farmers also grew corn, wheat, barley, oats, hay, and sorghum. Cattle, hogs, and sheep were also characteristically raised on the same farms. There were small dairies, the milking more often than not done by hand. Those were the farm products that might have been considered major. But there were also minor products, and one of the most characteristic of that old economy was the existence of markets for minor products. In those days a family farm could easily market its surplus cream, eggs, old hens and frying chickens. The power for field work was still furnished mainly by horses and mules. There was still a prevalent pride in workmanship, and thrift was a forceful social ideal. The pride of most people was still in their homes, and their homes looked like it.

Typical of those small farms which dotted the American countryside: crop rotation, regular use of animal manures as animals were routinely included among farming activities. Other features—those farmers had a strong feeling for the soil. It was not a resource to be simply exploited for profit but a precious resource to be carefully nurtured, its health carefully maintained. Pesticides and herbicides were used minimally or not at all. Quality was the first concern, not quantity. I don't wish to over romanticize all this. It was not an easy way of life. But it was above all a meaningful way of life. And it served as the heartbeat of thousands of rural communities besides providing a local source of good nutrition. Overall, the picture we have all probably seen idealized by the Norman Rockwell thanksgiving on the cover of the now defunct Saturday Evening Post fits well into this rural world. There was a cluster of values shared by the denizens of this world—the virtue of work, thrift, love of the soil, strong family life, good food etc. But this rural farm situation was soon to be transformed. Gathering momentum, especially since WWII, was the trend towards mechanization and ever bigger farms where machines replaced men, profit and quantity

ruled over all other considerations. Agribusiness was born. And as Berry and others have made clear, this trend was driven by governmental policy. The advice to farmers was well summarized by a slogan popular around the forties and fifties during the tenure of Secretary of Agriculture Earl Butz and others: “Get big or get out!” The end result for rural farm life was summed up by E.F. Schumacher *Small Is Beautiful* (p. 113): At the end of WWI 27% of the nation’s workers were in agriculture, 14% at the end of WWII, about 4.4 % by 1971. As Berry notes, these figures symbolize the wholesale displacement of millions from rural farm settings and the consequent withering of rural communities. And with this went a whole way of life with its particular values. Thousands of small farms were merged into huge industrial agribusinesses. Farm families were replaced largely by corporate absentee landlords. The soil was no longer a “thou” but an “it” to be exploited. Animals were relegated to huge feedlots generating widespread pollution problems. Chemical fertilizers replaced animal manures. Monoculture replaced diversity. The result—soil erosion (Iowa has lost half of its fabulous soil) and the progressive loss of crop nutrient value. This also represented a radical shift in the farmer’s relationship to nature. The farmer is now functioning as the would-be master and exploiter of a natural resource rather than a caretaker or nurturer. He is separate from nature rather than a part of it. In other words he and the whole enterprise of industrial farming is profoundly alienated.

Berry saves his most scathing critique for what he sees as the ideology or “orthodoxy” which has come to utterly dominate the thinking and policies of our landgrant colleges (pp. 41-42):

And this community-killing agriculture, with its monomania of bigness, is not primarily the work of farmers . . . It is the work of the institutions of agriculture: the university of experts, the bureaucrats, and the ‘agribusiness businessmen’ who have promoted so-called efficiency at the expense of community (and of real efficiency), and quantity at the expense of quality.

This strip mine mentality has no room for the kind of small town values symbolized by Norman Rockwell’s famous portrait of a family thanksgiving.

Another significant development of particular relevance to American eating behaviors—a transformation of values. For where did all those displaced farm folk go? To large towns and cities where they became urbanites and commuters with a different lifestyle. As Berry notes, these displaced farm people adjusted to what they could now buy from the local supermarket. Their focus of interest shifted from household to automobile. The previous ideals of workmanship and thrift were replaced by the goals of leisure, immediate gratification, comfort and electronic entertainments. Indeed, many morphed into a consumer class who valued above all the stuff they could acquire, and this consumerist debt-ridden lifestyle bubble became largely responsible for the financial collapse of 2008.

Earlier I mentioned the various layers of alienation which underlay the hectic and disjointed eating behaviors of our present culture. Most obvious is the alienation afflicting American families generally, as evidenced by the progressive loss of shared eating at the family table. This is no small loss. Shared eating is one of the most powerfully bonding and socializing forces of family life. And remember it is this processed food, which unlike ordinary food is very quickly prepared (microwave ovens, etc.) and does not spoil rapidly, which makes possible the slapdash and hectic approach to eating so essential to contemporary eating behaviors. There is alienation from nature brought about by the giant food processing corporations which so transforms what comes off the fields that Michael Pollan wondered—should we call this stuff food at all? But there is another layer of alienation at a very personal existential level. Insofar as these family members are seduced by the consumerist binge of the last couple of decades, that is, living to acquire stuff rather than the more important and deeper life of being, there is alienation from one’s own inner self. What about the farmer in all this? He is probably a corporation employee driving across a rented three-thousand-acre spread housed in a huge air conditioned machine guided by a GPS. He is tuned into the latest reports from the stock market. He does not experience any vital connection to the earth he is traversing. He is devoted entirely to exploiting a natural resource for profit, yet another level of alienation.

Finally, the alienation embodied in the American industrial farm model, viewed in its widest context represents an attempt to “master” nature through sheer technological prowess. This is alienation, indeed. It refuses to recognize any limitations to technology used in this manner. But this industrial farm model violates a natural living system—soil and its crops. Sooner or later there will be recognition that this is a Faustian enterprise. For this industrial farm model rides roughshod over laws of ecology which cannot be violated without incurring what the ancient Greeks called Nemesis, any more than the fabled king Canute could hold back the tide. Nobody is going to “master” nature. We violate its integrity only at fearful and inevitable cost. To sum all this up, this farm model is a demonstration on a large scale of how not to use technology if we wish to preserve the basis of life on this planet. These words from the writings of Rene Dubos seem particularly relevant here *So Human An Animal* (p. 188)

Man is rapidly destroying all the aspects of the environment under which he evolved as a species and which created his biological and emotional being.

My next essay will conclude this whole matter of nutrition with suggestions of how to survive our “western diet.”

Surviving the Western Diet

What is this “western diet?” First it is centered on processed food. It is high in meat (especially red meat), low in fruits, vegetables and whole grains, high in salt, fat and sugar. Now this is bad enough. But when you add to it our contemporary habits of overeating, eating out (where portions have recently doubled and where you lose all nutrient control) snacking, and

finally, our too prevalent lack of enough exercise, this so-called western diet when wedded to our American life-style, can be downright lethal.

We are now all in the midst of a financial crisis (largely brought on by our consumerist profligacy) yet another crisis is well underway, more serious than our financial one. Where we are headed is quite unsustainable. Our food situations today can only be described as a classic situation of predator and prey. And we are the prey.

It doesn't have to be this way. We can easily educate ourselves and therefore arm ourselves against these corporate predators. One important contribution to your defense: read books like Nestle's *What to Eat* and Pollan's *In Defense of Food*. When you enter the typical supermarket these days you are on treacherous ground. You need the education to choose wisely. Although the place is loaded with junk there is plenty of good stuff if you look for it. For instance, I found a healthful loaf of bread under Market Basket label that was loaded with whole grains. Remember, in America there is a wider and more varied food selection with the lowest cost of any country in the world. If you're not getting a nutrient rich diet it is your fault. Good food is out there among all the junk. It is up to you to find it.

Getting back to surviving the "western diet." It is really quite simple: Don't eat much meat, especially red meat. Consume a wide variety of fruits and vegetables and whole grains. Don't eat too much. Minimize snacking. And last but no means least, exercise systematically. It can be most anything as long as it gets your wind up. The lack thereof is just as serious for your health as the processed foods. Trouble is, we spent a million years or so evolving as hunter gatherers on a diet low in fat, salt and sugar. And we moved around all day. Now here we are in a situation high in fat, sugar and salt and we are encouraged in every possible way to be sedentary. And don't worry about being too old to exercise. I began weight lifting in high school. But when I entered my fifties I wondered if I should continue such vigorous exercise. Then I read of a study conducted by Tufts medical school. They chose a number of men in nursing homes aged seventies into nineties and put them through a course of several months of weight resistance training. Result: on average they doubled their strength. A couple of them threw away their canes. After having read that I resumed weight lifting and haven't looked back since. So exercise. Our bodies were made for it. Any kind will do as long as you enjoy it and keep at it. Remember—the western diet combined with lack of exercise brings serious risks of Diabetes 2 which the recent issue of Science Times characterized as "underrated, insidious, and deadly." Exercise here is essential to health. Having dwelt at length on the dangers inherent in the "western diet" and noting how dangerously wedded it is to a certain kind of lifestyle, I offer here a few guiding principles that may help those of us enmeshed in it (that is, most all of us):

1. The food corporations are not at all concerned with your health, but concerned above all with selling their stuff. They are under relentless pressure to increase sales every quarter or face the wrath of Wall Street and the stockholders.
2. Treat processed food as a radio-active substance with which you have a low tolerance.
3. Buy and eat locally and organically grown food when possible.
4. All processing removes nutrients. Ignore claims that the substitutes for those removed are of equal value.
5. The more costly the product the more processing and the poorer the nutrient value.
6. Health endorsements and other claims are worthless.
7. Study the ingredient list. The more lengthy the ingredient list the more reason there is not to buy it.
8. If the ingredient list contains things difficult to pronounce, don't buy it.
9. Remember, our government regulatory agencies have been lobbied into utter impotence. You are on your own.
10. In general, the shorter the ingredient list the better.
11. You may enjoy the high fat, sugar and salt, (as I do) on occasion but don't make a habit of it. You will probably regret it.

Add some of your own principles to this partial list.

Chapter 4

Water and the Looming Crisis of Supply

Its Origin and Centrality to All Life

According to reigning cosmological theory our universe began with a sudden expansion of an infinitely hot and tiny “singularity” into a primeval chaos of space and time—“the big bang.” After a matter of nanoseconds hydrogen formed out of this chaos. It was not until later that oxygen, a heavier molecule (about 16 times heavier) was produced by thermonuclear reactions inside stars. When the larger of these stars died, some exploded (as supernovas) spreading oxygen and the rest of the heavier elements throughout space. Under the influence of gravity new stars were formed as well as clouds of matter. From these clouds of matter came planets as well as all the other solid bodies such as comets and asteroids. During these events hydrogen (about 75% of the elements) combined with oxygen to form water.

Today this compound seems to be plentiful throughout the universe. In addition to its presence on earth, water is present on Mars. It is found also on several moons of our solar system such as those of Jupiter and Saturn as well as in comets which have even been characterized as “dirty snowballs.” It has also been detected in the hot atmosphere of our own sun as well as in clouds of interstellar gas. It has even been found on HD 209458b, a Jupiter-like gas giant 150 light years from earth in the constellation Pagasus. Julian Caldicott, *Water* (p. 4)

Why is water as essential to life as the air we breathe? Caldicott, in his book *Water*, mentions only some of the reasons. For the most part they have to do with the combination of atoms in the water molecule and how they behave in relation with each other and with other substances. To simplify chemical complexities here, as a result of the action of hydrogen bonds within the water molecule, one side is positively charged while the other is charged negatively giving each water molecule a polarity. This polarity makes water an almost universal solvent able to pick up and carry many other substances. It also makes water indispensable to the functions of every cell in our bodies: As Cladicott notes (p. 11)

Another is that it can help organize complex biological molecules, for instance in a cell, by attracting those parts of large molecules that are hydrophilic, and repelling other parts that are non-polar and hence hydrophobic.

Something else. Because of its chemical structure water possesses a high heat capacity. More heat is required to raise its temperature than with almost any other substance. And this heat has to be lost to cool it down. Consequently, blood circulating throughout our bodies can be maintained at an even temperature of 37 degrees Centigrade. This high heat capacity also makes it possible, together with our world-wide system of ocean currents, to maintain a fairly constant temperature throughout the world. Without this capacity much of our planet would be uninhabitable. The list goes on. The fact that water expands and freezes at a certain temperature has enormous consequences for all aquatic life. Finally, no other substance is commonly found as a solid, liquid or gas with local or seasonal transitions between these forms driving most if not all of the world’s ecology. Therefore most scientists believe that when we eventually discover earth-like planets beyond our own solar system, if water is detected this will constitute a powerful argument for the existence of life on those planets. In view of all this the comment in Philip Ball’s book, *Life’s Matrix: A Biography of Water* (p. 12) seems appropriate:

That the only solvent with the refinement needed for nature’s most intimate machinations happens to be the one that covers two thirds of our planet is surely something to take away and marvel at.

With this introduction we will proceed to survey the world-wide situation of water – a situation which, environmentalists are warning us, is building towards a crisis of supply. With two thirds of our planet covered with water how can we be facing a crisis of supply? The following provides at least the beginning of an answer. As Robert Glennon reminds us in his book *Unquenchable*: (p. 79) about 96.5% of the earth’s water is ocean water, another 1.7% is locked up in polar ice, and 1% is too brackish to drink. That leaves just 0.8% in lakes, rivers, wetlands in the ground and atmosphere. Which may sound like a lot if used so it would remain drinkable. But when you factor in waste, pollution, the needs of agriculture and industry, etc. all affecting that water supply, these factors tell us why it is that today all around the world we are using available supplies significantly faster than they are being replenished. (See Lester Brown’s *Plan B 3.0* ch. 4) In brief, our present rate of use is unsustainable. A crisis of water supply is looming on the horizon and this means inevitably a crisis of food supplies as well.

Finally, to grasp the contours of our water supply problem it is necessary to describe briefly what is called the hydrologic cycle. First, the sun’s heat causes water to evaporate from the surface of the ocean and other bodies of water. This moisture is carried over land and eventually, under the right conditions, condenses and falls on land as rain. Half of this rain is returned to the atmosphere. Trees and plant life absorb much of the other half. Much of the rest is returned to the ocean as run-off through rivers, etc. The rest infiltrates into the ground thereby feeding aquifers. Also important, this underground water continues to flow laterally through these aquifers thereby feeding nearby wells, rivers, streams, and lakes. All this is critical to keep in mind as we go on to future essays examining the various uses and problems encountered in our survey of the world’s water situation as it moves steadily and inexorably towards that supply crisis that alarms environmentalists and others involved in water use and supply.

Water Supply in America

The water supply here in the Northeast is generally good. What about the rest of U.S.? Southeastern U.S. has been locked

in a bitter legal battle stemming from a severe drought. The conflict centers on the sharing of water from Lake Lanier in Georgia with eastern Alabama and Florida to the South. The trouble is, Georgia also needs its water and the lake is in Georgia.

Considering our middle west, the Ogallala aquifer is worthy of note. This huge aquifer deep in the earth stretches from South Dakota in the north to Texas in the south. It is approximately equal in volume to Lake Huron. The land over it is semi-desert and former efforts to farm it led to the famous dust bowl catastrophe of the 1930s. But with improved drilling technology developed after the Second World War it became possible to mine it. I use the word “mine” because this aquifer is so deep it cannot readily be replenished by rain. Anyway, there are now 200 thousand bored wells working 24 hours around the clock making the Midwest so fabulously productive that it is now one of the world’s bread baskets. However, not much effort is being made to make it last. Much of it is being used to raise such water hungry crops as cotton and alfalfa. During the last several decades it has lost forever a volume of water equivalent to the annual flow of 18 Colorado Rivers. Maude Barlow’s *Blue Covenant* (p. 12). She further notes that it is now producing only half as many crops as in the 1970s yet food demand continues to rise. Depending upon where you measure it this huge aquifer has already dropped between 10 and 150 feet. Robert Glennon’s *Unquenchable*, (p. 125) In other words it is being rapidly depleted.

Let us just touch upon the rest of western US by describing briefly the situation of the Colorado River and its watershed, vital to the supply of no less than seven states. It is now so tapped out it is usually dry by the time it reaches the ocean. To guarantee a reliable source of water as insurance against the periodic droughts which have frequented the whole Colorado River watershed, Glen Canyon Dam was built to form a huge reservoir 186 miles long (Lake Powell) able to hold two years’ worth of water. Lake Mead is a second reservoir 250 miles downstream created by Hoover Dam. Both have been struck by the current drought and their future is uncertain. Lake Powell has dropped 100 feet and the end of the drought is nowhere in sight. Some hydrologists doubt it will ever be filled again. Add to this the fact that global warming is melting the glaciers which are the source of water for the river and the picture is not reassuring for the southwestern states depending upon the Colorado.

Question: Is the longevity of the current drought (entering its eighth year) nearing its end or is the whole area entering a new arid period of indefinite duration predicted by some climatologists? Nobody knows. Incidentally, for a detailed report on the plight of the Colorado River watershed I suggest the article: “Requiem for a River” in the Spring 2008 issue of the Natural Resources Defense Council magazine *On Earth*.

What about the rest of the American southwest and the rest of U.S? For the following brief overview I depend on Robert Glennon’s excellent book *Unquenchable: America’s Water Crisis and What to do About it*. He begins by using the situation at Las Vegas as a useful metaphor of what is happening in the rest of America—namely that it is running out of water. Las Vegas, of course, is built on the Mohave desert, with a population expected to add 1.2 million people by 2020. You are probably familiar with its egregious waste of water—lakes big enough for surfing, huge fountains, emerald green lawns, etc. Imagine if you will the water required by 150,000 hotel rooms and the flood of over 39 million tourists in 2006, more than the combined population of New York, Pennsylvania, and New Jersey. Las Vegas has fully exploited its water rights from the Colorado River and is now scrambling desperately for added supplies. Under the able leadership of Patricia Mulroy, general manager of the Southern Nevada Water Authority, a rigorous conservation program has been instituted, including banning water on thirsty front yards, water budgets on golf courses, limits on fountains, and finally, offering homeowners two dollars a square foot of grass removed. These measures have slashed water demand by more than 18 billion gallons a year between 2004 and 2008 even though population grew by 330,000. Yet the search for additional water supplies continues with no final solution in sight.

I have dealt briefly with Las Vegas for as our author Robert Glenning suggests what is going on there has become a national epidemic. In his sobering words: (pp. 17-19)

Water is a valuable, exhaustible resource, but as Las Vegas did until a few years ago, we treat it as valueless and inexhaustible. . . . A prosperous future depends on a secure and reliable water supply. And we don’t have it. To be sure, water still flows from taps, but we’re draining our reserves like gamblers at the craps table. . . . (Consider) that more than thirty five of the lower forty-five states are fighting with their neighbors over water. Our existing supplies are stretched to the limit, yet demographers expect the US population to grow by 120 million by mid-century. . . . Groundwater tables are plummeting around the United States. . . . Even lakes are not immune. Dozens in Florida have already gone dry.

If this accurately reflects realities then the matter of water supply is indeed a gathering crisis demanding corrective measures. Much can be done through conservation for there is currently such waste. For example, while the Colorado is being fully exploited by seven states, much of the water coming into Denver ends up on lawns. But beyond the obvious need for conservation there are other daunting factors. As our economy grows as it most likely will it will demand more water for industry and agriculture. Then there is the projected increase in our population by perhaps 120 million by the next generation. Where will the added water come from in a country already tapped out?

Finally, there is the personal question: Assuming that we should all do our part in water conservation what can we do? I suggest first a look at that which uses a large portion of our domestic water—our toilet. If yours is old, a new one will use substantially less than what you already have—a great deal less. Getting radical, there are now dry composting toilets available. Another place to look—if you have a lawn, how deeply are you attached to the color green? Untold millions of gallons of water are sacrificed to this value every year. And it doesn’t save the grass. In the absence of enough moisture grass turns brown and goes into a state of perfectly harmless hibernation only to turn green again when sufficient moisture returns. Another good way to conserve water is the old fashion rain barrel. When full, our rain barrel will supply water by hose to a garden bed 20 or 30

feet away. There are many other ways to conserve water. In many parts of our nation the water supply is already very tight and can only get worse. Our own water situation typifies what is as bad or much worse in much of the rest of our world. My next essay will deal particularly with two of the most critical areas affecting literally billions of people—namely China and India.

The Water Situation in the Rest of the World

No matter where you look in our world today, the water supply situation is critical or approaching crisis. For the following I draw mainly from Lester R. Brown's *Plan B 3.0* (pp. 68-84). First, how is water being used? Generally, 70% for irrigation, 20% for industry, the remaining 10% for residential use. Let's begin our brief survey by touching upon two critical areas affecting billions of people: China and India. A survey released in 2001 in Beijing revealed that the groundwater levels under the north China plain, which produces over half the country's wheat and a third of its corn, is falling rapidly. A World Bank report tells of wells around Beijing which now have to reach 1,000 meters (more than a half a mile) to tap fresh water. The World Bank foresees "catastrophic consequences" if present trends continue. Two factors to note here that apply throughout our world's water situation. First, because present water withdrawals far outstrip nature's capacity for replenishment, water is actually being "mined" as a non-renewal resource. Secondly, a shortage of water translates into a shortage of food. Pumping at such depths is so expensive that farmers are often forced to abandon irrigation for dry land farming. Result—falling food production. Present water pumping is not only unsustainable. There is another factor even more serious, lurking in the background—global warming. Glaciers in the Himalayas which have long provided necessary water during the summer growing season, are melting. This spring and summer melt has previously provided water for major rivers such as the Ganges River in India, the Yellow, Ahai and Huai in China along with the Mekong in Vietnam. The loss of this spring and summer melt could deprive billions of necessary water. And again, water shortage means food shortages. It takes 1,000 tons of water to produce one ton of grain.

As serious as this situation is in China it is even more critical in India. As Lester Brown reports in *Plan B3.0* (p. 71), India's 100 million farmers have drilled 21 million wells costing 12 billion dollars. Elsewhere, half of India's hand dug wells and millions of shallower wells have already dried up bringing a spate of suicides among those who rely on them. Brown cites one report from Kuppannan Palanisami of Tamil Nadu Agricultural University that 95% of wells owned by small farmers have dried up, leading to a return to dry land farming and reduced crops. In some locations wells are being drilled down to 1000 meters. Again, we have a situation which is unsustainable. And we have not even mentioned the question of water quality. In China and India there are areas where it is difficult to find water fit to drink.

Just to mention a few other countries—Pakistan is also mining its underground water—in other words withdrawals far outstrip replenishment in a country of 164 million whose population is growing by 3 million per year. Iran, a country of 71 million is overpumping its aquifers by an average of 5 billion tons of water per year. Saudi Arabia has been described as water poor as it is oil rich. Some Saudi farmers are now pumping water from wells 4,000 feet deep—nearly four-fifths of a mile. Just to mention one more critical area, a recent report in the *New York Times* (November 1, 2009) describes the desperate situation in Yemen. Let me quote from the article:

Across Yemen the underground water sources that sustain 24 million people are running out. It is a crisis that threatens the very survival of this arid, overpopulated country. . . Climate change is deepening the problem, making seasonal rains less reliable and driving up average temperatures in some areas.

Comments Abdul Rahman al-Eryani, Yemen's minister of water and environment, "We are reaching the point where we don't know if the interventions we are proposing will save the situation." As bad as the present supply problem is, there is the acceleration of population pressure, which is at work in much of Africa as well as the Middle East. For example, the numbers of Yemenis has quadrupled during the last 50 years and is expected to triple again in the next 40 years to about 60 million. Where's the water going to come from?

Let us now sketch the contours of this gathering crisis which afflicts much of our world. First, there is the rising temperature of climate change rapidly melting the world's glaciers whose spring melt has sustained billions of people and which threatens the reliability of the Colorado River here in the US. Secondly there is rising world populations (estimates run to a three billion increase in a few decades). Third, there is increasing urbanization especially in developing nations. Indian leaders predict a middle class of 575 million in 15 years. This is bound to increase demand for water as this rising middle class will want the same things we have in America. And we haven't even mentioned the huge rapidly rising middle class in China. It is estimated that in 20 years China will need as much oil as the whole world does now. Again, with rising living standards the demand for more water will also escalate. But how will this inevitable enormous increase in water demand be met?

As this crisis continues to build we can be confident that measures will be taken to mitigate it. Homo sapiens is the most dangerous and destructive animal this planet has seen yet he is very adaptable. His big brain enables a certain dimension of freedom over the immediacy of time and the constraints of natural processes. Our humanity has the capacity to anticipate the future and take action to meet its challenges. But solving this coming crisis of water supply is another matter. The challenges will be enormous and on a world scale. There will be no definitive solutions or quick fixes. We may well be headed into a time of world hunger, deadly conflict and the most rigorous conservation.

Among suggestions for meeting future water supply needs are these offered by Dr. Robert Peters, professor of Environmental Engineering at Harvard University, in an article in the August 2008 issue of *Scientific American*: Appropriate water

pricing to promote future development, more efficient methods of irrigation, especially drip systems; underground water storage to limit evaporation, exploitation of advanced desalinization, (present methods are extremely expensive and polluting), adoption of low-water sanitation (Dry composting toilets would save a lot of water). Concerning other possible measures out there, Dr. Peters notes, investment in water facilities as a percentage of gross domestic product has dropped by half in most countries since the late 1990s. If a serious crisis arises in coming decades, he warns, it will come from a lack of foresight and unwillingness to invest sufficiently in preventive measures. But we have seen in our sampling of conditions in China, India and the middle East, avoiding crisis conditions of water supply in these areas will take heroic measures which presently are not even contemplated let alone put into effect. As made painfully clear in Jared Diamond's masterly study in his book *Collapse*, Homo sapiens' capacity for anticipating the challenges of future events is all too often completely overwhelmed by concerns with the immediate present. What we can be sure of is that everywhere you look in today's world water usage is far outstripping replenishment and is clearly unsustainable.

The Problem of Pollution

I have dealt with the looming world crisis of water supply. We will now focus on water pollution. To lead off I draw from the work of Maude Barlow in her book *The Global Water Crisis and The Coming Battle for the Right to Water*. I do so with full confidence in the dependability of her findings. Here's a brief listing of her bonafides: Head of the Council of Canadians, Canada's largest public advocacy organization, and founder of the Blue Planet Project. A recipient of Sweden's Right Livelihood Award (the "Alternative Nobel") for her work in the water justice Movement. She is the author of sixteen books, including *Blue Gold*, which has been translated into sixteen languages and published in nearly fifty countries. I take the trouble to include these encomiums because her findings in *Blue Covenant* are shocking. Here is a brief rundown: (p.6 ff)

The world may not be running out of water but it is in the process of running out of clean, drinkable water. Ninety percent of waste water produced in the underdeveloped world is discharged, untreated into local rivers, streams and coastal waters.

In China, 80 percent of the major rivers are so degraded they no longer support aquatic life, and an astonishing 90 percent of all ground water systems under the major cities are contaminated. The World Health Organization reports that 700 million of the 1.3 billion people of China drink water that doesn't even meet the most minimum safety standards set by the world body.

Apparently this kind of thing is repeated in many Asian countries. Turning to India, Barlow finds:

Seventy-five percent of India's rivers are so polluted they should not be used for drinking or bathing. . . . And 2.1 million Indian children under the age of five die every year from dirty water. . . . The sacred Ganges, where millions come to worship, is an open sewer. (p. 7)

The situation in Russia is hauntingly similar. Turning to western Europe she cites the findings of the European Commission that 20% of all surface water in Europe is "seriously threatened." Things are surprisingly bad in our United States: 40% of our rivers and streams are too dangerous for swimming, fishing or drinking, as are 46 percent of our lakes. I turn again to her own words (p. 8-9):

(These conditions) are due to massive toxic runoff from industrial farms, intensive livestock operations and the more than one billion pounds of industrial weed killer used throughout the country every year. Two thirds of U.S. Estuaries and bays are moderately or severely degraded. The Mississippi River carries an estimated 1.5 million metric tons of nitrogen pollution into the Gulf of Mexico every year.

The picture is grim no matter where one looks. For example, in Latin America and the Caribbean more than 130 million people lack access to safe drinking water and only a fraction of the population is connected to adequate sanitation systems. The situations in Africa is as bad or worse: (p. 9)

More than one third of Africa's population currently lacks access to safe drinking water . . . Lake Victoria, the source of the Nile, is being used as an open sewer. It and dozens of other African lakes and rivers are imperiled, according to the UN Environmental Program whose October 2005 report, *The Atlas of African Lakes*, used satellite images to reveal the unprecedented deterioration of all of Africa's 677 major lakes. . . . Lake Chad has shrunk by almost 90 percent. . . . Eighty percent of South Africa's rivers are imperiled by pollution, and every year, residents (usually women) have to walk farther and farther to find clean water.

But there is something worse than the usual sewage type pollution going on. Something which affects us all. Something much more insidious, perhaps even more dangerous and difficult to deal with. I call it the "chemicalization" of our water supply. You got a whiff of it in one of my previous essays where I mentioned the fact that each and every one of us is a walking chemical soup of 50 or 70 (nobody knows exactly) traces of industrial chemicals. And millions of years of evolution did not evolve specifically to deal with any of them. They were carelessly introduced into our inner and outer environment as substances nature had never seen before and therefore had not given us any natural protection or means of recycling. Perhaps our bodies can adapt to them without serious problems. Perhaps. But nobody knows. Anyway they are loose and all the king's men are not going to get the Genie back into that bottle. Meanwhile, medical authorities are quite sure that these chemicals

cause much of our cancer.

Getting specific, there is the mercury present in fish in our rivers and lakes. We are cautioned not to eat much of it. The main source is coal plants. The Environmental Protection Agency found mercury in all fish samples it collected from 500 lakes and reservoirs from 2001 to 2003. 49 percent of those lakes and reservoirs contained mercury concentrations that exceeded levels that the E.P.A. says are safe for people eating “average” amounts of fish (whatever that is). Mercury can damage the nervous system and cause learning disabilities, especially in developing fetuses and young children.

Even more insidious and potentially harmful are what are called “endocrine disrupters.” Even in the tiniest amounts these chemicals interfere with normal reproductive processes. They are introduced into our taps in two forms- either estrogen itself or through medications and consumer products such as hair sprays which mimic estrogen. In a troubling article in the June 28th, 2010 *New York Times* the columnist Nicholis Kristof calls attention to what he terms a “potential health catastrophe.” He cites the appearance in bodies of water where frogs, salamanders, and other amphibians have sprouted extra legs. In heavily polluted Lake Apopka, one of the largest lakes in Florida, male alligators developed stunted genitals. Quoting from his column:

In the Potomac watershed near Washington, Male smallmouth bass have rapidly transformed into “intersex fish” that display female characteristics . . . (more) than 80% of the male smallmouth bass in the Potomac are producing eggs.

If only this was the worst of it. In case you’re not concerned about smallmouth bass, scientists are also finding evidence of increasing abnormalities among humans as well—especially increases of genital deformities in newborn boys. It must be said that definitive proof is not available yet for joining all the dots. Yet apprehension is growing among scientists that certain chemicals are at the bottom of this—namely those endocrine disrupters which are widely used today in agriculture, industry and consumer products. In various ways they make their way into our water supply, simply by what people flush down their toilets. Think of the manifold possibilities here—all those pills and other medicines we consume. Or, they may enter the water supply through estrogens in human urine—especially from women on the pill. From there all these various chemicals pass through treatment plants and come out of your tap. Think of all those chemicals that our conventional treatment plants are equipped neither to detect let alone remove. Of course chemical companies are loath to admit any connection between what they are producing and the problems that are now surfacing on an increasing scale. Yet, as Kristof points out, there is accumulating evidence that the male sperm count is falling and genital abnormalities in newborn boys is increasing. According to Kristof’s article, the Endocrine Society recently issued a 50-page report of their findings:

We present the evidence that endocrine disrupters have effects on male and female reproduction, breast development and cancer, prostate cancer, neuroendocrinology, thyroid, metabolism and obesity, and cardiovascular endocrinology.

The good news is that the EPA is finally moving toward removing endocrine disruptive chemicals from our drinking water. But as Kristof regrettably observes—at a “glacial pace.”

The “chemicalization” of our water has gone global. Gated communities are no more free of the problem than anybody else. Our earth, air and water from the arctic to the Antarctic to the depths of the sea, are universally contaminated by thousands of chemicals. And some of these chemicals are now in virtually every living creature on earth and in the sea. And it is scary. We are all chemical soups harboring dozens of them at least in trace amounts. And nobody knows what the long range effects will be. David Orr is cited in an article by Daniel C Maguire in *Christianity and Ecology* (p. 405) as claiming the male sperm count world-wide has fallen 50% since 1938. Let’s hope mother nature hasn’t found a method of permanently solving humanity’s population problem. Also from Orr’s book *Ecological Literacy: Education and the Transition To a Postmodern World*: Mother’s breast milk often contains more toxic chemicals than are allowable in milk sold by dairies. Finally this: at death some human bodies contain enough toxins to be classified as hazardous waste!

Another facet of our water problem—the neglect of clean water laws already on the books. The following is taken from the lead article in the *New York Times* September 13, 2009. Remember, we are not talking here of some place way out in the boondocks of Appalachia. We are describing what is taking place 17 miles from Charlestown, the state capital of West Virginia. I quote from the *New York Times* study:

Jennifer Hall-Massey knows not to drink the tap water in her home near Charlestown. In fact, her entire family tries to avoid any contact with the water. Her youngest son has scabs on his arms, legs and chest where the bath water—polluted with lead, nickel and other heavy metals—caused painful rashes. Many of his brother’s teeth were capped to replace enamel that was eaten away. Neighbors apply special lotions after showering because their skin burns. Tests show that their tap water contains arsenic, barium, lead, manganese and chemicals at concentrations federal regulators say could contribute to cancer and damage the kidneys and nervous system.

Apparently, such conditions are not limited to West Virginia. In spite of the standards of safety mandated by the Clean Water Act four decades ago along with fines and or jail sentences for infractions of these standards, violations of the Act have steadily risen and penalties have not been enforced. In the last five years alone, the *New York Times* study finds, violations have risen to more than half a million. Yet the vast majority of these polluters have escaped punishment. State officials have repeatedly ignored obviously illegal dumping, and the Environmental Protection Agency which can prosecute polluters when states fail to act has often failed to intervene. The picture is further clouded by the fact that it is always difficult to know how many

or specifically what illnesses are the result of water pollution generally, or just what contaminant is responsible for diseases like cancer in a particular individual.

There is hope that things will improve. The new IPA administrator Ms. Jackson, pledged in a recent interview that she intends to strengthen enforcement of the Clean Water Act and pressure states to apply the law. For the sake of the sustainability of our peoples' health it is hoped she means what she says.

Private vs. Public Control

We have already found that a worldwide shortage of water is looming especially in the global south where it is already reaching a state of crisis especially for the poor. That situation shall function as the widest context against which we must view the material in this essay.

Today there is a water policy struggle going on world-wide particularly in the global south. The parameters which define the contours of this conflict are as follows: Is water to be regarded and treated as an inherent human right as essential to human existence as the air we breathe? Or is it simply a commodity like the rest of earth's resources to be bought and sold for profit like any other commodity? The present contest over water supply and delivery takes place within the confines of these two parameters. First, the vast majority of water consumed in the global north (almost exclusively in the US) is delivered by local municipalities which charge their customers only enough to cover the cost of infrastructure to deliver it. And this cost is generally modest enough for even the relatively poor. We don't hear about Americans going without water because they cannot afford it.

But there has been a rise in recent decades of attempts by huge corporations such as Suez, Veolia Environmental and Thames Water, to gain control of water supplies in order to sell it for profit—in other words private rather than municipal or public water delivery. It all began in Britain under the urging of a conservative ideology espoused by Margaret Thatcher, to be followed by Ronald Reagan in U.S. In 1989 Barlow's *Blue Covenant* (p. 37) Thatcher privatized Great Britain's publically owned water authorities, selling off their infrastructures including the buildings, to private companies. And they were given free reign to charge whatever they liked. The result: water rates were jacked up and millions had their water cut off when they couldn't pay. Like all private corporations they couldn't compete with the cost of public management because they must not only pay for infrastructure delivery, they also operated under the mandate of putting money into the pockets of their shareholders. When Tony Blair came into office he ended the practice of cutting off those who couldn't pay. However, it was Thatcher's model that was subsequently exported to developing countries in the global south. It turns out that one of the most powerful forces for privatization of water services has been the World Bank. How come? Many developing nations became deeply in debt to richer countries which loaned them money at low interest rates. When these rates eventually soared, many undeveloped nations found it impossible to pay. The World Bank would then respond by renegotiating these loans on condition that there was agreement to undergo "Structural Adjustment Programs" that among other things required them to sell off public enterprises and to privatize essential public services including water systems. Maude Barlow provides the details of this development in her book *Blue Covenant*, (pp. 36-38).

This privatization was destined to have a profound effect on the accessibility of water to the poor. To illustrate some of the ambiguities and complexities of this question of access to water, what happened at Cochabamba, Bolivia is viewed as a kind of poster child exhibiting the very worst of what can happen when a public water system is privatized. It also reveals the possible problems with public water delivery systems as well. The Bolivian government invited in a water company (a subsidiary of Bechtel Corporation) to take over the water delivery system of Cochabamba. They immediately tripled the price of water, cutting off those who couldn't pay. When the people in desperation started to drink the water coming off their roofs, the company tried to make them pay for that. The end result was demonstrations sufficiently violent to result in some deaths to demonstrators. Finally, the government relented and invited the company to leave the country. Yet, as Robert Glennon informs us, *Unquenchable*, (p. 246) the cooperatively run system that replaced Bechtel is in shambles, possessing neither the capital nor the expertise to run a public utility. While in the global north municipal run water systems are the general rule, in the global south governments are often too poor, inept or corrupt to manage their water systems satisfactorily. Consequently, in many situations in the global south privatization can look like an attractive option. As Glennon points out, financially strapped municipalities often welcome a private corporation that offers to provide the capital and expertise necessary to update the crumbling infrastructure of their municipal water and sewer systems. There are several forms of privatization—various ways in which a municipality can enlist the support of a private corporation—all the way from taking charge merely of the business end to taking over everything including the buildings and work force. Protecting America from the problems of privatization is the mandatory existence in every state of a public utility commission to guarantee fair pricing and to see that nobody lacks access to water.

In the meantime, while the whole world is headed towards a crisis in water supply, private corporations are waging a determined campaign to gain control over supply on a large scale. In fact, there are signs over much of the global south that the apparent objective of the big water corporations is the complete commodification and control of the world's water resources similar to OPEC's control of the world's oil. For example, in some areas whole river systems are being bought up. In India, for example, entire river systems are being leased to companies to run them for profit without government interference. With control or even ownership of large segments of the world's water, water companies will be in a position to charge whatever they can get. If they are successful, it will likely be at the expense of the poor.

In view of these developments we may raise the question: Thus far how well have the water corporations actually been

doing? And particularly, how does their performance stack up against the question of sustainability—the question underlying this essay? This assessment by Maude Barlow is worthy of note: (p. 58) and it underlines further the challenge of world-wide privatization of water supply:

Almost twenty years of documented cases of the failure of privatization and growing opposition to the World Bank and the water service companies in every corner of the globe have revealed a legacy of corruption, sky-high water rates, cutoffs of water to millions, reduced water quality, nepotism, pollution, worker layoffs, and broken promises. .. Nor can competitive corporations supply water to the poor. This is and will remain the role of governments. The ultimate goal of private companies is to make a profit, not to fulfill socially responsible objectives such as universal access to water.

If Barlow's estimate is accurate the encroaching privatization of water supply raises serious questions concerning sustainability on several counts. For example, their record so far concerning "water justice" for the poor is not encouraging. There is more. Robert F. Glennon in his book *Unquenchable* (p. 249) calls attention to the lack of incentive on the part of private corporations to protect the environment from adverse effects of providing water:

Surface water diversions and unsustainable groundwater pumping may have horrible environmental consequences yet may be of little concern to the private corporation that delivers the water.

Glennon cites another concern centering around the specific kind of agreements worked out between the two parties. Many critical details have to be negotiated as the private company must enter into a specific time period in order to recoup a heavy initial investment—perhaps as lengthy as fifty years. And this duration may effectively cede control over a public resource to a for-profit corporation. Notes Glennon: (p. 249)

Moreover, the company has no incentive to invest money to maintain the existing infrastructure. At the end of the contract, the city may find itself with a system of pipes held together with duct tape.

Another problem of sustainability—water quality. Private companies often resist offering expensive monitoring programs for extremely low levels of pollutants such as endocrine disrupters which yet pose potentially serious health problems. Another factor which comes into view when seen in their widest context is the developing world-wide crisis of water supply; particularly relevant is the urgent need for conservation as one of the measures necessary to mitigate this gathering crisis. Here the fundamental *modus operandi* of private corporations seems inappropriate. I refer to the underlying engine of motivation of our present economic system which is to grow at maximum profit for the benefit of stock holders. Which means the greater the consumption the better—the exact opposite of the principal of conservation where less consumption is the goal. For the private company the goal is profit and the higher the consumption the higher the profit. There is another dilemma here with privatization at odds with sustainability. Corporations seem uninterested in fulfilling socially responsible objectives such as universal access as well as conservation. As Barlow tells it in *Blue Covenant* (p. 58):

In countries where most of the population earns less than two dollars a day notes Sarah Grusky of Food and Water Watch, private companies cannot meet shareholder obligations to provide a market of return. Nor can they expand their services to a population that cannot pay.

All of which serves to highlight the apparent unwillingness of the water privatization movement to deal with one of the most serious and urgent aspects of the coming worldwide water shortage—water justice for the poor.

A final editorial comment: At several points I have mentioned the drive for profit by the private corporations. This was not meant to be a value judgment. It was simply to state a fact of corporate life. This is what corporations do. It is essential to their successful functioning. And it makes our modern economy possible. It has also made it possible for us Americans to enjoy the highest living standard in the world. The question I have addressed in this essay is whether or not water delivery for all is an appropriate field of activity for the modern private corporation. Under the prompting of that question the evidence seems to be generally negative. Privatization in most cases, does not further the goals of sustainability.

To head off what many fear will be a time of deadly conflict and war generated by coming water shortages, Maude Barlow calls for what she calls a global "blue covenant." In her words: (p. 156)

This covenant would have three elements: *a water conservation covenant* that recognizes the right of the earth and of other species to clean water, and also pledges to protect and conserve the world's water supplies; *a water justice covenant* between those in the global north who have water resources and those in the global south who do not; to work in solidarity for water justice, water for all and local control of water; and *a water democracy covenant* among all governments acknowledging that water is a fundamental human right for all.

The Food and Water Nexus

In my previous essays I have dealt with one of our greatest problems of sustainability—the looming crisis of water supply. Then a recent article caught my eye, Lester Brown "Could Food Shortages Bring Down Civilization," *The Scientific American* May 2009 (pp 50-57). Scary, yes. Ridiculous alarmism? No. Lester Brown is not only one of the world's most influential

environmental thinkers. He is founder of both the Worldwatch Institute (1974) and the Earth Policy Institute (2001). He has authored or coauthored 50 books on the environment. His latest book is Plan B4.0. He operates from an enormous data base. When it comes to issues of sustainability he must be regarded as the guru of the environmental movement. So we should take him seriously.

Having made that point I suggest we keep one fact in mind while reading this article: It takes a thousand tons of water to grow one ton of wheat. *Plan B4.0* (p. 42). There you have the intimate connection between food and water in a nutshell. To summarize Brown's thesis in his article, the root problem is the increasing difficulty for countries with rapidly increasing populations to keep pace with rising demands for food in face of dwindling water resources. The resulting food-price inflation puts increasing stress on the governments of countries already teetering on the edge of chaos. In other words they are between a rock and a hard place. Everywhere you look aquifers are being overpumped and a day of reckoning is inevitable. No wonder Brown has not found a single instance where pumping and replenishment are being brought into balance. In such a situation, unable to buy grain or grow their own, people get desperate and take to the streets. Just what is a failed state? In Brown's words: (p. 52)

States fail when national governments can no longer provide personal security, food security and basic social services such as education and health care. They often lose control of part or all of their territory. When governments lose their monopoly on power, law and order begin to disintegrate.

It is such failing states that Brown believes are now the chief threat to international security. Why? Because they are a source of terrorists, drugs, weapons and refugees threatening political stability everywhere. The piracy off the coast of Somalia is but one example of where a failed state has already caused serious international security problems. Hoards of refugees crossing national borders in desperate search for food and employment is another threat. It has already become clear from American experience on its southern borders that there is no way to keep desperate refugees out. They will get in somehow as they are now all over Europe.

Meanwhile present trends towards food scarcity are accelerating mainly because the water problem is accelerating. And it is doing so world-wide. For this trend reflects a perfect storm of interrelated forces: Increasing melting of mountain glaciers which have fed and sustained the major rivers of much of the world (including our own Colorado), surging populations, exhaustion of soils due to deforestation which leads to soil erosion and even desertification, and the overpumping and progressive exhaustion of aquifers. And at the apex of all this is water.

Brown aptly applies the metaphor of a Ponzi scheme to characterize this situation—a huge and growing bubble destined to eventually burst simply because water is being used up faster than it is being replenished. We are not fooling mother nature here anymore than Bernie Madoff fooled our modern economy. In past weeks of reading about this situation, I have marveled that not a single country seems to be working to balance the extraction of water with its replenishment. In other words they all seemed in a paralyzed state of denial. I now think I understand the situation more existentially—that is, closer and more down to earth concerning what these countries actually face. Question: How does a country's leadership tighten the water supply when its people is already suffering food and water shortages? As Brown observed, these countries are already balanced on the edge of chaos with no additional water supplies in sight. So it is not a case of denial. It is a dreaded resignation to an insoluble problem. Then there is the matter of population. Turning to Brown's *Plan B4.0* (pp. 36ff) here is just a sampling of population projections to underline the seriousness of what we're heading into and why his concern for future world stability seems justified. In Nigeria, population is projected to rise from 37 million in 1950 to 148 million by 2007. Mexico from 109 million to 129 million by 2050. Sudan from 9 million in 1950 to 40 million by 2007. India is expected to grow from 1.2 billion to 1.6 billion by 2050. Egypt (which depends upon Nile water) is projected to grow from its present 82 million to 150 million by 2050. Finally, Ethiopia which controls most of the Nile's headwaters is expected to grow from its present 81 million to 174 million by 2050. Where is all the additional water and food going to come from? Nobody knows. Remember, it takes a thousand tons of water to grow one ton of wheat.

If all this weren't bad enough there is increasing desertification. It is reminiscent of our American dust bowl of the thirties and Steinbecks' *Grapes of Wrath* except that it is worse. Here's a sampling from Brown's *Plan B 4.0*: In 1950 Africa had 227 million people and 273 million livestock. By 2007 there were 965 million people and 824 million livestock. Result? Grassland turning into desert due to overgrazing. Nigeria is losing 860 thousand acres to desert by overgrazing every year. In Africa the Sahara desert is creeping both north and south. Turning to China where desertification is the worst in the world, hundreds of villages are being inundated every year. There is an average of 600 square miles turning to desert every year in its northern and western provinces.

According to the UN, Food and Agricultural Organization, after a lengthy decline for much of the twentieth century, world hunger has begun to climb, reaching 873 million around 2005 and passing one billion by 2009. As Brown speculates, the combination of rising populations, rising seas, melting glaciers, and crop-decimating heat waves could accelerate this rise in hunger. Hungry people are not reasonable people. The prospect then is for an increase in failed states. It is this situation that prompts Brown to pessimism concerning the future stability of our civilization. Let's hope he's wrong.

Chapter 5
Capitalism and the Environment

Dilemmas of the Corporate Growth Model

This essay should be read with the following as background commentary against which all that is said concerning the capitalist system is seen and evaluated; *At the core of our system is the most fundamental thing of all—the living, evolving, sustaining natural world in which our economy and everything else subsists and for which little or nothing is paid.*

One of the most challenging questions raised by environmentalists is whether or not our capitalist economy, which shares much of the blame for the devastation of our environment, can be made to work for it rather than against it? Most of the world’s industrial countries have economies that may be characterized as some form of capitalism. Although they vary in some respects they are all rooted in this definition taken from the Columbia Encyclopedia:

Capitalism is an economic system based on private ownership of the means of production in which personal profit can be acquired through investment of capital and employment of labor. Capitalism is grounded in the concept of free enterprise which argues that government intervention in the economy should be restricted and that a free market based on supply and demand, will ultimately maximize consumer welfare.

These are the basic principles Adam Smith set forth in his famous treatise *The Wealth of Nations*. It is obvious that America is the world’s foremost and purest form of capitalism. It has made America the richest of the world’s nations and its benefits are undeniable and enormous. Yet its success has been accompanied by the progressive decay if not downright destruction of our ecological environment both to human and non-human life. I will now be dealing with this question: Is this situation an inevitable corollary of capitalism or can our American version be modified to work for the environment while at the same time preserving our democratic freedoms? The answer to this question will be played out one way or another against the background of the coming century of global warming. Let us begin our inquiry into this question with the matter of growth – so central to our contemporary version of capitalism. For source material I draw primarily upon James Speth’s scholarly work *The Bridge at the Edge of the World*. Speth is a founder of several environmental institutions and dean of the School of Forestry and Environmental Studies at Yale University. He was awarded Japan’s Blue Planet Prize for his leadership in the search for science-based solutions to global environmental problems.

It is difficult to exaggerate how essential the concept of growth is to American capitalism. As Speth notes it has been called a “secular religion.” Economies today are judged not just by growth but by their rapidity of growth. For example our business press has criticized Japan for what they considered a harsh depression. In fact, during 1990-2005 Japan’s economy grew at 1.3% per year. So it was slow growth but surely preferable to the American crash of 2008. Which brings up the question—what do we mean by growth? The answer is unambiguous; all those material elements that go into the GDP (Gross Domestic Product). Now the relentless pursuit of this kind of growth has had a steep human cost. This from the book *Macroeconomics* by Samuelson and Nordhaus cited by Speth (p. 49):

Ours is a ruthless economy. People are increasingly judged on their current productivities rather than past contributions. Old fashion loyalty to firm or community counts for little. Suppose a firm finds it profitable to lay off 1,000 workers. . . . It is likely to move in the relentless pursuit of profits. . . . You can’t make an omelet without breaking eggs. This hard hearted focus on efficiency pays no mind to the incomes of laid-off workers, of bankrupt firms, of crumbling cities. . . .

With this kind of efficiency there has been spectacular growth in world economies from the 1890s to the 1990s with all its material benefit to our people but with serious problems for the environment. The problems of this growth are evident in the following data:

World economy	up 14 fold
World population	up 4 fold
Water use	up 9 fold
Sulfur dioxide emissions	up 13 fold
Energy use	up 16 fold
Carbon dioxide emissions	up 17 fold
Marine fish catch	up 35 fold

To further illustrate the ominous implications of such data, Speth provides two pages of graphs which show exponential growth patterns from 1950 to 2000 in such categories as species extinction, fisheries fully exploited, loss of tropical forests, flood frequency, motor transport, paper consumption, fertilizer consumption, water use, total GDP, etc. What stands out with these graphs is their “hockey stick” shape with the handle placed against the right hand side of the graph (year 2000) showing almost vertical growth increases in each category. In other words the data is showing enormous and rapid growth as we proceed into the twenty-first century. So these graphs speak volumes about the ecological situation we face and underline the dangers for our environment in this projected exponential expansion- growth which the leaders of our capitalist system regard with such religious veneration as absolutely essential to our well-being. It should be obvious that the trajectory of our economy is unsustainable. Our 200 year love affair with boundless growth is incompatible within the context of a finite planet with

steadily dwindling resources. What isn't mentioned in all this is that we could get by with all this continuous growth earlier in our planetary history when there were fewer billions of people. During that earlier time there was still room for the American consumerist life-style. But that era is gone—not only through our expansion in USA but because today there are several billion Chinese and Indians aspiring to live a middle class life similar to ours. As the famous biologist E. O. Wilson of Harvard noted recently, with that kind of world it would require several extra earths to be sustainable.

In view of this I find Bill McKibben's words from his latest book: *Eaarth: Making a Life on a Tough New Planet* to be relevant. The peculiar spelling of earth is deliberate, dramatizing his belief that because of what we Homo sapiens have done to our earthly home we now live in a new and different world. As he emphasized in an earlier book, we have brought an end to nature as it was given to us. Here is what he suggested in *Eaarth* (pp. 47-48)

In the world we grew up in, our most ingrained economic habit was growth. For the 250 years since Adam Smith, we've assumed that more is better and that the answer to any problem is another burst of expansion. That's because it worked, at least for a long while: the lives of comfort and relative security that we Westerners lead are the product of ten generations of steady growth in our economies. But now that we're stuck between a played out rock and a hot place, it's time to think with special clarity about the future. On our new planet, growth may be the one big habit we finally must break.

One basic problem: there is no necessary accountability between a corporation's operations and its effects on the environment. To try to correct this situation our government has enacted measures such as the Clean Water and Air Acts. And these have indeed helped. The trouble is they have not been strict enough either in their formulation or enforcement in face of constant corporate resistance. In spite of these measures the environment continues to deteriorate. Drawing upon Speth's analysis (p. 52ff.) the failure of an enterprise to be required to pay the actual cost of its basic resources such as clean air and water leads to what is called "market failure." The source of this failure is what economists call an "externality." That is, the true costs of these resources (clean air and water) are external to the workings of the firm. This cost, which may be enormous to the neighborhood environment, does not get into the firm's books. It is then born by others unless the company is forced to pay for damage and clean-up. The progressive ecological destruction of Chesapeake Bay by run-off waste from hog and chicken farms offers a good example of "negative externality." Apparently those farmers feel no responsibility for the untold millions in losses from the destruction of the Chesapeake Bay fisheries. We are left here with Speth's negative conclusion: (p. 63)

Capitalism as we know it today is incapable of sustaining the environment.

Another fundamental feature of capitalism; it hires workers to produce goods and human services that will be marketed with the purpose of making a profit. And this system operates in an environment of omnipresent and relentless competition. As described by Speth (p. 59): citing from Samuel Bowles' analysis in *Understanding Capitalism*:

In a capitalist economy, survival requires growth, and growth requires profits. This is capitalism's law of the survival of the fittest, analogous to Charles Darwin's notion of the evolution of species through natural selection. In the capitalist version, Darwin's idea of fitness—success in producing off-spring becomes success in making profits.

We can now easily see why capitalism and the environment are constantly colliding. In the name of profit capitalism is under pressure to remove or avoid all possible environmental costs of operating for the sake of profit. Its "externalities" are to be avoided at all costs. And profit demands growth. These pressures are so pervasive that they operate on all levels even in the processed foods filling the center isles of your local supermarket. A good illustration is found in Marion Nestle's book *What to Eat* (p. 367). It has to do with those Oreos you may have enjoyed:

Publicly traded companies are required to demonstrate growth every quarter, so it is not enough for Kraft Foods to sell half a billion dollars' worth of Oreos every year; it has to find ways to sell more of them all the time. Line extensions help. In 1990 you could only find six varieties of Oreo cookies in supermarkets; by 2003 there were twenty seven. Oreos came with chocolate filling, fudge filling, vanilla filling, and colored filling for holidays; they came flavored with mint and peanut butter, in mini sizes and double sizes, in cup and cone shapes. You could also buy Oreos in breakfast cereals, Ice cream, yogurt and candy bars.

I record all this detail to give you some idea of the intensity of the pressure exerted by Wall Street for continued growth and profit—every quarter. In conclusion it must be said that this version of capitalism must eventually be modified. Homo sapiens is an adaptable creature when present conditions require it and they surely will with perhaps suffering and turmoil. As Bill McKibben warns us, life on earth will not be as easy and livable as was our old earth. And as long as we dither, the more dire may be the consequences. There are signs of hope. In my next essay I will examine the nature and role of our corporations concerning our environmental situation. We shall find that some are becoming aware of their responsibilities for the health of our environment simply out of self-interest.

Corporations vs. the Environment

Let us examine briefly the structure of the modern corporation. As we do so it will become even clearer than it did in my last essay on why the relationship between corporations and ecology has proved to be such a serious problem. I do this with the risk of some repetition. This has the advantage of bringing into sharper focus just what it is about our capitalist economy

that poses such serious problems for environmental sustainability. We shall find that this problem is generated by the very inner structure of the modern corporation. Although they comprise only twenty percent of American firms (most businesses are proprietorships and partnerships) they account for 85% of business revenue. And corporations are the main engines of economic growth. Without going into more detail than necessary, here are some of the main features which have shaped the contours of their relationship to the environment. Here I draw upon James Speth's *The Bridge at the End of The World* (pp. 166 ff). In corporate structure there is a separation of ownership from management. Although shareholders own the corporation it is managed by the companies' directors and other hired officers. Secondly, and this is crucial to the whole matter of environmental accountability, directors and managers are legally bound to act according to the "best interests of the corporation." This means in practice to so act that the wealth of shareholders is maximized. As Speth comments (p. 167):

This principle—shareholder primacy—is a huge obstacle to corporation evolution towards a more socially responsible institution.

As he cites from Joel Bakan, *The Corporation*:

Despite their personal qualities and ambitions . . . their duty as corporate executives is clear; they must always put their corporations' best interest first and not act out of concern for anyone or anything else.

There is another aspect to all this equally problematic concerning the environment. The directors and managers of corporations are legally obligated to make corporations "externalizing machines" That is, all matters which might prove costly (including damage to the environment) are to be avoided if it interferes in any way with maximum wealth for shareholders. For example, if coal extraction means tearing off mountain tops and polluting streams in the valleys below that is of no concern to the coal corporation. It is an unavoidable "externality." If what the plastics industry produces is non-biodegradable but breaks down into tiny pieces which kills millions of marine animals, that is an externality of no concern to the manufacturer and shareholders. The sometimes disastrous effects of what corporations are producing is dismissed as an inevitable cost of operations and never appears on the firms' books.

Another disturbing feature of corporations is their enormous and pervasive influence on every aspect of our lives. First is their power to influence public opinion through their control and/or ownership of public media. We are subjected to an unrelenting bombardment of advertising. It is in our faces all the time and everywhere. Public radio is not immune. WGBH tells us of the wonders of Boeing, Monsanto, and Pepsi. That is, of the marvelous things they are generously contributing to our security and comfort. Moreover, a recent decision of the Supreme Court virtually guarantees that the influence of corporations over public opinion will rise to new heights. I speak here of the recent decision, *Citizens United*. Here the amazing claim is that corporations with billions to spend on advertising (including political campaigns) is no different from a single human being with one voice and one vote. In other words, corporations which are purely legal entities are now endowed with the full rights of human beings before the fourteenth amendment although corporations are not mentioned in the Constitution.

There is their economic power. Local communities understandably go to great lengths to entice them to establish local businesses because they provide jobs and pay taxes. The wealth at their command is enormous and liberally used to further their interests. Exxon-Mobil has allegedly expended untold millions on a decades long dis-information campaign to promote skepticism and disbelief in global warming. This to forestall any possible measures that might compete with consumption of coal or oil. Billions have been lavished by the processed food corporations indoctrinating toddlers watching TV. By the time they can walk they know and have chosen their favorite cereals, etc.

There is also their political clout. It is probably exaggeration when William Domhoff in his book *Who Rules America* claims that corporate leaders are the most important influence on the federal government. Corporate executives are regularly appointed to top positions in the executive branch. Policy recommendations of corporate experts are listened to carefully in congress. And we haven't even mentioned their power exerted through lobbying and campaign contributions. As Speth points out, of the one hundred largest lobbying efforts in Washington between 1998 and 2004, 92 represented corporations. When all this is considered, it must be admitted that their money was well spent. Bills coming out of congress almost always bear corporation foot prints. It must be said that all this power is not entirely a bad thing. After all, corporation executives include many of the finest minds of this country and we need their leadership. The problem comes when one considers the structure of corporations and its bearing upon their behavior concerning the health of our environment, together with their furthering of special interests.

There is more. And it comes with another important trend—globalization. Fifty three corporations are among the largest economies in the world. Exxon alone, according to Speth, has a larger economy than 180 nations. (pp. 170–171)

And of course, these multinationals have a huge impact on the global environment generating, for example, half the gases responsible for global warming. They also control half of the world's oil, gas, and coal mining and refining. . . . When unfettered by national or international laws, ecological understanding, or social responsibility, this freedom can lead to enormously destructive acts.

Thus globalism adds another dimension to the problem of somehow holding these industrial giants accountable for what they are doing to our environment. How do we move forward to making these huge power houses ecologically responsible? There are things that can be done and are being done. And they are encouraging- trends such as the "greening" not only of the American people but of some corporations themselves. In other words there are substantial signs of hope. It must be cautioned

that this does not mean making financial sacrifices simply for the good of the environment. It does mean the rise of enlightened self-interest. The question is how far can self-interest take the corporate world towards assuming a sustainable responsibility for the environment? Nobody can answer that question of course. I will be examining these trends in my next essay.

A Hopeful Note

In my last essay I focused on the nature of corporations and their problematic relationship to the environment. We will now examine some possible factors that may work towards the mitigation of some of these factors. One of these factors is the ever present problem of the abuse of power. It was inevitable that our government establish regulatory agencies.. But this did not cure the problem. Who is going to regulate the regulators? Yet, in spite of regulatory failures, these agencies have been a significant force in protecting the environment.

There is another source of hope recently highlighted by Jared Diamond, author of *Collapse*, a brilliant book on the causes of the breakdown of empires and civilizations. I refer here to his article in the December 6, 2009 edition of the *New York Times* under the eye-catching title: “Will Big Business Save the Earth?” His thesis: “Major U.S. Corporations are now a force for environmental progress.” But they are not making sacrifices simply out of concern for the environment. Self-interest plays a major role. Here is Diamond’s assessment of their reasoning drawn from his serving on corporate boards in many fields such as mining, retail, logging and finance:

The embrace of environmental concerns by chief executives has accelerated recently for several reasons. Lower consumption of resources saves money in the short run. Maintaining sustainable resource levels and not polluting saves money in the long run. And a clean image—one attained by, say avoiding oil spills and other environmental disasters—reduces criticism from employees, consumers and government.

Some examples: Wal-Mart has found ways of saving a lot of money by increasing fuel efficiency, cutting down on energy use, decreasing material used for packaging, etc. Coca-Cola has found that its very survival depends on being deeply concerned with water scarcity, energy, climate change and agriculture. One company goal is to make its plants water neutral by returning to the environment the amount of water it uses. It is also committed to helping conservation efforts on seven of the world’s river basins. Then there is Chevron. Notes Diamond:

Not even in any national park have I seen such environmental protection as I encountered in five visits to new Chevron-managed oil fields in Papua New Guinea.

Chevron has a horror of oil spills for good reasons: First they are very expensive to clean up. Second, clean practices reduce the risk that local landowners become angry, sue for damages and close the fields. Third, clean operations brings an advantage in bidding for jobs in other countries. Finally, environmental practices of which employees are proud raises morale, helps with recruitment and increases the time workers stay with the company. All this leads to the question: if sound environmental practices are so inherently advantageous, why is there still widespread resistance to them? And why doesn’t self-interest play a more prominent role in corporation ecological policy and behavior? No simple answers here. While Jared Diamond seems optimistic about the corporate role in determining the future health of our planetary environment, James Hansen, speaking out of his experience in dealing with the corporate world as well as government, remains skeptical. If we take Hansen’s experience as our guide (see his recent book *Storms of My Grandchildren*) the jury is still out on the all-important question of whether or not our business world will take the necessary steps towards overcoming the present “business as usual” attitude which is simply to burn all the coal and oil in the ground. This, Hansen fears, could reach and surpass those “tipping points” leading to an uncontrollable and disastrous disruption of our earthly climate.

Another positive development is mentioned by Speth *The Bridge at the Edge of the World* (pp. 150-152). Corporations are clearly taking steps to “green” their operations and products beyond what is required by government. One major factor driving this trend is the greening of the American people. They are increasingly demanding that corporations operate in ways that show concern for the environment. For example, as noted in the article “The Evolution of an Oil Giant,” *U.S. News and World Report*, April, 2010 (p. 39-40), some shareholders are making their concerns for the environment known. And, of all places, with Exxon. Descendants of John D. Rockefeller, for some time, have been pushing the oil giant to invest more in renewable energy, to study the impact of carbon emissions on developing countries and to consider that the pollution associated with oil threatens the company, the shareholders, and the environment. So far, however, these sentiments have not been persuasive to the majority of shareholders or the officers setting corporate policy.

With this greening there is also growing a demand for new, cleaner technologies such as wind machines. GE is now the leading producer of wind machines in this country. Another factor is shifting public opinion. A recent survey found that huge majorities in every country polled favored tougher regulations to protect the environment. Increasingly businesses have embraced the “sustainable enterprise” concept to the extent that CSR (corporate social responsibility) has become an established acronym. The threat of global warming is also a key driving force in this demand.

Summing all this up, Speth notes: *The Bridge at the Edge of the World* (p.176):

Corporate greening is thus driven by green consumerism, by lenders and investors, and insurers worried about risks both environmental and financial; by the blame and shame campaigns of NGOs; by existing government regulations and the prospect of future regulation at home and abroad, by sales opportunities opened up by new green

products and technology; and by the general need to improve corporate standing as good citizens.

How far this will take us towards genuine corporate ecological responsibility remains an open question. This leads into another problem often mentioned under the category of “green washing.” James Hansen provides a good definition, *Storms of My Grandchildren* (p. 9):

Expressing concern about global warming and the environment while taking no actions to actually stabilize climate or preserve the environment.

In other words pretending to be genuinely concerned without doing anything beyond business as usual. This greenwashing is all too prevalent today in our corporate world. We are left with another possibility: bringing about changes in corporate structure to guarantee a more ecologically responsible behavior. This, of course, is not a likely possibility considering the power corporations enjoy in today’s America. Perhaps this is no more outlandish when one considers that our present crisis in global warming is the most intractable and potentially deadly crisis of all human history for which there is no precedent whatever. Yet there is another alternative equally unprecedented. That is a change in our human attitudes and values so fundamental that it calls for a change in human consciousness; something akin to a religious conversion. Religious conversions do happen and they are not that rare. In future essays I will examine this possibility of transformative experiences especially in light of the new cosmology worked out by our modern science. I believe that this wondrous cosmology provides a spiritual way forward to a sustainable future.

Chapter 6

Global Warming

Report of the IPCC (Intergovernmental panel on climate change) and the Public Response

Just what is the cause of global warming? To answer that question one must know something about the “greenhouse effect.” What is that? First, the sun’s radiation warms the earth, but the earth’s surface reflects about 30% of this warming back into space. Something else is at work—although our atmosphere is mostly nitrogen and oxygen, there are several other gases such as methane, carbon dioxide, and water vapor that function as heat trapping gases that prevent the escape of infra-red radiation from earth’s surface where it converts that radiant energy into heat. It is this “greenhouse effect” that maintains our earth temperature at present levels. The importance of this “greenhouse effect” is underlined by a glance at the history of our planet.

During the early period of our earth’s history the luminosity of our sun was only 70% of what it is today. This would naturally lead to the conclusion that early in earth’s history, our earth would have been completely covered with ice. Temperatures would have been about 60 degrees Fahrenheit cooler than today. Yet evidence gathered by geologists indicate that it was covered mostly by water. This curious fact was referred to by astronomers as the “faint young star paradox.” How come this apparent paradox? The answer is recounted by Henry Pollack in his book *A World Without Ice* (pp. 55–56). Earth’s history began with the good fortune of forming far enough from the sun to allow the existence of liquid water yet not so far away to become covered with ice. And this situation (referred to by astronomers as the “goldilocks planet” situation (neither too hot or too cold) has generally prevailed ever since. How was this possible? Initially the earth’s atmosphere was almost all nitrogen, hydrogen and carbon. Some hydrogen combined with carbon to form methane, a potent greenhouse gas which acted as a greenhouse blanket to maintain a temperature allowing the presence of liquid water. Then another factor came into play. Plant life developed and with plant life came photosynthesis and the production of carbon dioxide, which became the earth’s major greenhouse gas. This series of chemical events constitute the answer to the “faint young star paradox.”

Although the reality was far more complex it is this “greenhouse effect” that has maintained our earth surface to a temperature range conducive to life familiar to us. Eventually, Homo sapiens created the “industrial revolution” through the burning of fossil fuels. This and the growth of world population to about seven billion, produced enough greenhouse gases to bring about our present global warming crisis. For a while this went quite unnoticed. That is, until Svante Aarhenius at the University of Uppsala (1884) did the first calculations of the possible effects of man’s increasing production of carbon dioxide. On the basis of his figures he went on to predict that average global temperatures would rise as much as 9 degrees Fahrenheit if the amount of carbon dioxide in the atmosphere doubled over preindustrial levels. He further predicted that heat waves would reach into the 120s and 130s; seas would rise several feet and crops would wither. With a few exceptions nobody paid any attention to such speculation. Those few who did tended to believe that the ocean would soak up any such problems caused by increasing carbon dioxide. As Bill McKibben put it in *End of Nature* (p. 8) “The oceans were an infinite sink, down in which to pour the problem.” So it went, until Charles David Keeling invented a device for measuring the carbon content of the atmosphere and began taking measurements atop Mauna Loa in Hawaii. As Pollard informs us in his book *A World Without Ice* (p.183) Keelings’ line graph (now become famous) revealed an increase in carbon dioxide concentrations in the atmosphere from 315 parts per million in 1958 to 390 parts per million in 2009—an increase of 22 percent. More alarming—his graph revealed that the carbon dioxide content in the atmosphere was progressively accelerating.

Needless to say, such findings galvanized the attention of the scientific community. It all came to focus with the issuance of the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) the world body of more than 2500 leading climate scientists. This report concluded that the temperature of the earth was not only rising, there was a 90% certainty that this warming was due mainly to human activities.

This report was based not only on an enormous number of observations over several years but with a multi-leveled review process involving literally thousands of scientists both within climatology and beyond. To avoid getting into too much detail I include a statement made by one of the participating members of the IPCC—Henry Pollack, professor of geophysics at the University of Michigan. With his colleagues and Al Gore, he shared a Nobel for the work of the IPCC. This is from his book *A World Without Ice* (p. 129):

The reason I have gone to great lengths to describe this review process is to make clear that , in the end , the IPCC report is a document that must, by any measure, be deemed conservative. The review process weeds out unbounded speculation, problematic science and untested hypotheses. It carefully evaluates and states the uncertainties at every step of the way. In the end what results is a lowest common denominator consensus of what the science is telling us.

One might hope that with these thousands of climatologists from all over the world forging conclusions based on so much data, that this would settle the matter. Not at all. In fact this IPCC report has let loose an unending barrage of criticism and attacks of every conceivable kind including charges of “junk science,” bad interpretation, theory not fact, etc. Every imaginable line of attack has been employed to cast doubt on the validity of the report. No need for me to go into detail, there are plenty of sources. For the most exhaustive coverage I recommend Stephen Schneider’s book *Science As a Contact Sport: Inside The Battle to Save Earth’s Climate*.

When you examine the fault lines of this conflict you quickly sense what is going on. The lion’s share of denials are clearly

political and/or money driven. For example, fossil fuel interests have spent untold millions on their denial campaigns, much of it deliberate misinformation. Legislators representing fossil fuel interests are implacably opposed to any kind of wind or solar competition and refuse even to take global warming seriously. But the most extraordinary denial showing the extent to which money and politics can subvert even common sense is the charge (made seriously it seems) by senator Inhofe of coal and oil rich Oklahoma that this whole business of global warming is nothing more than an elaborate hoax cooked up by climatologists. Another fault line is religious. A significant portion of our people are fundamentalists who read Genesis literally. They therefore don't believe in evolution. Naturally these folks don't like or trust scientists generally let alone an idea as alien and disturbing as global warming. Another fault line—Homo sapiens is a creature fairly hard wired to think only about the present and to ignore future possibilities. Finally, a consumerist narcissistic culture like ours is inherently disinclined to consider any kind of sacrifice now for the mitigation of possibly dire future events even for the lives of their children and grandchildren. Add all these things up and you have a depressing picture of why our country, although having led the world in the production of greenhouse gases, is presently among the very last to be willing to take any meaningful steps to deal with the problem.

Yet who can we blame for this grim environmental threat? Yes, we and our forebears created it with this richest of all civilizations. But we had no idea of what we were doing. That is, until the awful truth dawned upon us. And now that we know what we have done and are still doing we are no longer innocent bystanders. From now on we are all complicit enablers in what Bill McKibben has described as bringing about the “end of nature.” And that nature we were given will never be the same. It is gone. Yet this same nature which gave us our lives also evolved our big brains. This gives us the freedom to act and anticipate the future. It is also a trait of our nature that if we act to mitigate the damage we have done then this taking action will generate hope. As thinkers such as Jared Diamond, Lester Brown and Bill McKibben assure us, we can mitigate the worst effects of global warming if we act before it is too late. Therefore, our responsibility is to determine what each of us do and start doing it.

Computer Models—How Good are They?

We hear a lot about computer models supposedly able to predict long term climate trends concerning global warming. What are these models and how dependable are they? We turn first to one of the best known modeling centers—the Goddard Institute for Space Studies (GISS) at Columbia University. Our guide through this complicated subject will be Elizabeth Kolbert in her book *Field Notes From a Catastrophe: Man, Nature, and Climate Change* (pp. 99-112). She is a journalist whom Bill McKibben regards as offering the best summary of the complexities of climate change. GISS is an outpost of NASA which employs about 150 people most of whom spend their days working on calculations that may or may not end up being incorporated into the institutes' climate model. These deal with the behavior of the atmosphere, some with oceans, others on vegetation and clouds. All these algorithms (systems of numerals) when combined must yield results consistent with the real world. Of course it must be cautioned that these algorithms are only approximations of an infinitely complex reality. GISS's director James Hansen, is a cautious person, fully aware of this limitation. Yet by the early 1980s he had gained enough confidence in his model to begin making a series of increasingly audacious predictions. For example he forecast that “carbon dioxide warming would emerge from the background noise of natural climate variability around the year 2000 (p. 101).

More on the formation of climate models: GISS divides the whole world into a series of boxes. Thirty-three hundred and twelve cover the entire earth's surface. This pattern is repeated twenty times moving up through the atmosphere. Each box might contain dozens of algorithms. In the real world each box could contain an infinite number of features—lakes, forests, etc. In the computer the elements in each box are reduced to a set of properties expressed as numerical approximations. To get an idea of the complexities involved, if the model run is supposed to deal with the next hundred years this would call for more than a quadrillion separate operations. A single run of the GISS model done on a supercomputer usually takes about a month. How good is such an attempt to predict the distant future? One early criticism: Isn't science based on observations of present phenomenon, not on things which haven't happened yet? But what about weather prediction which always goes beyond the present?

It works pretty well up to a point. The trouble is as pointed out by James Gleick in his book *Chaos*, weather exhibits the traits of a chaos system. This vastly complicates long range prediction. But as Gleick finds in his book there are long range regularities at work even in a chaos system.

Let it be said there is no certainty in any empirical assertion. Science does not function on certainties. It deals only with degrees of probability. If there is sufficient evidence, an empirical assertion has validity until disproved through lack of supporting data. The climate model folks would never claim certainty through their methodology. They claim only probability within a certain range. There are however several ways they can test their results to minimize their lack of certainty and increase the probable validity of their results. One is to see how accurate these results fit with natural processes in the short run. There are other tests—models are often run into the past to see how accurately they reproduce trends or events that have already been observed. For example, following the eruption of Mount Pinatubo global temperatures fell by half a degree. Then they began to climb again. As Hansen noted, their model had succeeded in simulating this effect to within nine hundredths of a degree; in his view a pretty good test. Another test lies in the comparison with GISS's results with those of other major modeling centers. For example, GISS' forecast of future temperature rise is on the low end (4.9 degrees F) compared with other major modeling centers. The Hadley Center model run by the British Med Office from the same conditions predicted a rise of 6.3 degrees F. Japan's National Institute for Environmental Studies predicted a rise of 7.7 degrees F. So although estimates varied they were all within the same ball park. Again we should emphasize that none of these projections are based upon all the possible algorithms in natural processes. Nature is far too complex for that. So if claims of definitive proof is made by any of these climate modeling centers without any mention of uncertainties or probabilities such claims are to be viewed with suspicion. As Henry

Pollack (an IPCC member) points out, following computer models with unwavering rigidity can lead to disaster, as was the case with the sudden collapse of our economic system in 2008. *A World Without Ice* (p. 242). Yet, these computer models used and interpreted properly, are invaluable.

Finally there are questions to be raised concerning an important aspect of the IPCC decision making process. One is their search for consensus by systematically eliminating extreme projections. Apparently Pollack was accurate in describing IPCC's conclusions as "conservative." As Lester Brown notes in his book *Plan B4.0* (p. 58)

Unfortunately, during the several years since the study was completed, both global CO2 emissions and atmospheric CO2 concentrations have exceeded those in the IPCC's worst case scenarios.

Another question lies in their assumption of a future world climate of gradual, steady change. As more and more climatologists are finding in their analysis of ice cores from the Greenland ice sheet, there are possible tipping points out there that could perhaps trigger rapid, violent and drastic changes of world climate. The IPCC by too avidly seeking consensus could be missing the proverbial elephant in the living room. As Richard Alley comments in his book *The Two Mile Time Machine* the last several thousand years during which human civilization developed were a very unusual period of stable, benign climate not at all typical of earth's history. Here's his comment: (p. 83)

Climate in the past has been wildly variable, with larger, faster changes than anything industrial or agricultural humans have ever faced. . . . It often jumps suddenly to very different conditions, rather than changing gradually. Somebody has suggested that you might think of the climate as a drunk. When left alone, it sits, when forced to move it staggers.

In my next essay I will deal with the implications of the unexpected rapidity of the thawing of the ice sheets of Greenland, Eastern and Western Antarctica. What is going on looks unsustainable to our civilization as we have come to know it.

A World without Ice? It is Melting Faster than Anticipated

"We are on the precipice of Climate system tipping points beyond which there is no redemption." —James Hansen, director, NASA Goddard Institutes for Space Studies, New York, December 2005

In my last essay I discussed the question of the reliability of climate modeling especially for long range predictability of earth's climate. I ended with a reference to our climate's record of frequent violent change contrasted to our present period of several thousand years of relatively benign stability. To illustrate this history of rapid change I now take a brief backward look at the end of our last ice age about 13,000 years ago to a period called the Younger Dryas era. As Fred Pearce tells it in his book *With Speed and Violence* (pp. 48–154) the last ice age was finally drawing to a close. Everywhere the climate was warming. You can imagine how our forebears felt about this. Then suddenly, almost overnight this welcome warming went into reverse. For 300 years the earth was plunged back into an ice age. This is revealed in ice core analysis. While perhaps only a few degrees cooler in southern latitudes, temperatures fell as much as 28 degrees further north. Then, after 1300 years, another reversal came even more suddenly (perhaps within a few decades), bringing a final ending of the last ice age. None of these sudden shifts are easily explainable. Nobody knows for sure why they happened. Further, analysts of the Greenland ice core chronology like Richard Alley claim this warming could have happened within a single year! Anyway, this sudden lurch of earth's climate led to a period of benign stability previously unknown which we still enjoy today. To be sure there have been some minor changes—for example the "Little ice age" that drove the Danes out of Greenland and previous to that a medieval warm period. But these were minor changes compared to the shifts associated with the coming and going of the Younger Dryas.

Fast forward now to our own century. I lead off with a passage from Fred Pearce's *With Speed and Violence* (p. 46)

Over three days in March 2002, there occurred one of the most dramatic alterations to the map of Antarctica since the end of the last ice age. . . . A shelf of floating ice larger than Luxembourg and some 650 feet thick, which had been attached to the peninsula for thousands of years, shattered like a huge pane of glass. It broke into hundreds of pieces, each of them a huge iceberg that floated away into the South Atlantic.

What happened was not a complete surprise. It had long been observed that warming waters had been eating away at the undersides and edges of what was called the Larsen B ice shelf. Yet nothing prepared the glaciologists for the stunning violence and rapidity of what happened. Also ominous was the observation by Richard Alley (well known glaciologist of the University of Pennsylvania) that what had been going on with Larsen B was in many ways a mirror of processes also under way in Greenland. Further, the glaciers that once discharged their ice onto the Larsen B shelf are now flowing into the sea eight times faster than before the shelf collapsed. To be sure, glaciers all over the world are melting. Yet in such critical areas as Greenland and Antarctica the melting and destabilizing of these giant ice sheets is proceeding far faster than thought possible only a few years ago. And of course, this brings up the question of rising sea levels. On the recent WGBH NOVA production "Extreme Ice" the estimate was that from the warming of the ocean plus the melting of the world's glaciers and the melting along the edges of the Greenland and Antarctic ice sheets, total ocean rise over the next century would total about three feet. This looks increasingly understated. There is no certainty of course, but here is Fred Pearce's comment at the end of chapter eight of *With Speed and Violence* (p. 48):

With the Ross Sea being the main outlet for several of the largest glaciers of the West Antarctic ice sheet, which contains enough ice to raise sea levels by 6 yards, the stakes are rising.

The possibilities are daunting, especially for the Antarctic ice sheet. One glaciologist, John Mercer, warned that if the protective ice shelves along the edges of the ice melted away (assuming a temperature rise of 9 degrees) this would leave the entire West Antarctica ice sheet vulnerable to destruction. This would bring several yards of additional sea rise. This is speculation but well within the realm of possibility.

Turning to Greenland, climatologists are worried about that, too. For many centuries this vast ice sheet has been regarded as stable and invulnerable with accumulation on one hand and loss to melting on the other being in balance. Even if warming did take hold, it was thought, it would be a thousand years before Greenland loses a significant amount of ice. Yes, lakes and ponds have been forming on its surface during summer, but it would take centuries before this surface water could make its way down to the bedrock and in any way destabilize the ice sheet. And it is an enormous ice sheet left over from the last glacial age. Greenland, by the way is 1600 miles long, 600 miles wide and two miles deep.

Yet what is going on there is happening so fast that five years ago seems a different world. Recently, the famed climatologist and former head of NASA, Jim Hansen, remarked that Greenland is on a "slippery road to hell" (p. 40 of *With Speed and Violence*). Now, it seems, those lakes and ponds which have long formed on the surface of Greenland's ice, instead of taking a couple of centuries to work their way down to the bottom of the ice sheet, drain down to the bedrock in a matter of minutes. More and more water is flowing into the interior of the ice sheet. There it forms underground rivers on the bedrock which lubricate the ice, hastening its movement along the rocky bottom towards the ocean.

Jim Hansen fears that such melting threatens to destabilize large parts of the ice sheet on time scales measured in years or decades not millennia. On NOVA's recent program "Extreme Ice" they told of camping near one of these lakes (three miles long and several feet deep) and waking up in the morning to find it gone. The instruments they had left in the lake told them it had drained down to the rock bottom in just 40 minutes! Writes Fred Pearce (pp. 44-45):

The picture, then, is of great flows of ice draining out of Greenland, lubricated by growing volumes of meltwater draining from the surface to the base of the ice sheet and uncorked by melting ice shelves at the coast. All this is new and frightening, "The whole Greenland hydrological system has become more vigorous, more hyperactive," says Box (Jason Box is another glaciologist of Ohio State). "It is a very non-linear response to global warming, with exponential increases in the loss of ice. . . . Even five years ago we didn't know about this." Alley agrees. "Building an ice sheet takes a long time—many thousands of years," says Hansen. . . . "But destroying it, we now realize, is a wet process, spurred by positive feedbacks, and once under way it can be explosively rapid."

For added perspective it must be pointed out that it will take several decades for the added warming effect of greenhouse emissions already sent into the atmosphere to make itself fully felt. In other words things are going to get a lot warmer and there is nothing we can do about it. More perspective: Greenland alone holds enough ice to potentially raise ocean levels 23 feet. That would destroy all our coastal cities, Florida and many low lying countries. And don't forget the inherently unpredictable and sudden climate changes which differentiate the usual behavior of our climate from the unusually benign period of the last 10,000 years. How long is our luck going to last? We are presently pushing that luck for all it is worth. The record from the Vostok ice cores shows that CO2 levels are unprecedented in the last 420,000 years. The previous high of 299 parts per million was reached around 325,000 years ago. According to Kolbert's book *Field Notes From a Catastrophe* (p. 130) geologists believe that the last time CO2 levels were comparable to today's was three and a half million years ago during what is known as the mid-Pliocene warm period.

Global Warming

There has been a flood of denials and disbelief in our country about global warming—the same country with 5% of the world's population but generating about 25% of CO2 emissions. Let's consider the facts about global warming that scientists have amassed to support their case that world temperature is indeed on the rise. First a bit of history: The following is gleaned from Henry Pollack's book *A World Without Ice*. First came the invention of accurate instruments to measure climate temperature with reliability, accuracy and uniformity. In 1724 Daniel Fahrenheit invented an instrument whose measurements of temperature still bear his name. Decades later in 1744 Anders Celsius came up with his own scale. These two instruments are still in use today, with 180 degrees Fahrenheit and 100 degrees Celsius separating the freezing and boiling point of water. Therefore each Fahrenheit degree is five ninths as much as each degree Celsius. Incidentally, United States is the only major country that still uses the Fahrenheit scale.

Just what is the evidence on which climatologists base their claim that our planetary climate is indeed rising? How credible is their claim? First came the results of a world-wide system of measurements including oceans and land surface. And not just the surface but the depths of its rock and oceans. Uncounted millions of them over many years. Here's one example of how these observations were made: There is a resort at Mohonk Mountain House about eighty miles north of New York City where a meteorological observatory is located. Every day since 1896 all kinds of data have been collected daily. Result: the average temperature has risen 2.7 degrees Fahrenheit and the growing season has been extended by ten days. The result of literally millions of thermometer readings over some 150 years all over the world show that the earth's surface has on average warmed about 1.8 degrees Fahrenheit. Further, the warming rate has been accelerating.

Another approach centers on what is going on within nature itself. Here is a sampling: Flowering plants are now blooming

earlier in the spring. Birds are laying their eggs earlier. They are also delaying their migrations. Insects have begun to move up mountains to escape warming conditions in the lowlands. Millions of trees in the west are being attacked and killed by beetles because the temperatures are no longer cool enough to kill them off during the winter. Fish populations in lakes are also changing. Cold water species such as walleye and trout are being gradually replaced by warmer water bass and bluegills. The entire breeding cycle of black guillemots north of the Arctic Circle has shifted to more than 10 days earlier in the Arctic summer. Also, eleven of the last twelve years have been the warmest in the instrumental record of global surface temperatures since 1850.

Pollack suggests that perhaps the most sensitive of nature's own thermometers is ice. For example, the tundra in northern areas of Alaska, Canada and Siberia is all in various stages of melting. Buildings on its surface are sagging or tilting. Roads built over it are becoming impassable. Trees growing on it are falling over or dying. If only that was the worst of it. Climatologists fear that this frozen layer of earth many feet thick could rapidly emit a lot more greenhouse gases than that produced by human activities. Then there are the world's glaciers and the enormous ice sheets of Western Antarctica and Greenland which took thousands of years to form. These ice accumulations are now melting all over the world much more rapidly than previously predicted by the climate models of the IPCC. And this melting is being assiduously studied and calibrated by air and on earth's surface with precision instruments by climate scientists. The finding: almost everywhere they look melting is faster than expected.

All this has prompted many skeptics to abandon their first trench of denial and to fall back into a second trench—denying that human activities have had anything to do with this warming trend. So what about the IPCC's conclusion that this warming has been brought about by us and not some kind of natural climatic cycle? Three reasons are worth citing here. The first comes from ice core analysis taken from Greenland's ice sheet. This analysis allows researchers to read earth's temperatures and gaseous composition thousands of years into the past. Two striking conclusions here: With the exception of our own benign and relatively constant temperatures from 10,000 years ago to our present (during which human civilization was created) world temperatures have swung widely and rapidly. Secondly, and of special interest to us, world temperatures and carbon dioxide concentrations have always risen and fallen in tandem. Another reason for blaming human activities for the present warming to humanly produced CO₂ is that long ago CO₂ has been proven, in laboratory studies, to be a greenhouse gas. Back at the end of nineteenth century a Swedish chemist Svante Arrhenius learned that some gases, including CO₂ had a heat—trapping effect. He went on to predict that our burning of fossil fuels with their heat-trapping emissions of CO₂ would eventually bring on record heat waves. Of course back then nobody paid any attention. We have now raised world temperature about 1.8 degrees Fahrenheit and are already seeing increasingly violent weather events as predicted by the IPCC. Perhaps you have noticed. These changes are summarized for us in the beginning of Bill McKibbens' latest book, *Eaarth*. So there is convincing correlation between what we are doing on one hand and what is going on with our world climate on the other. A further note here worth mentioning concerning future prospects—the concentration of CO₂ now in the atmosphere exceeds that time of earth's history when temperatures were considerably higher than they are now.

The final reason to attribute today's temperature rise to human activities is that the reliability and precision of present day measuring methods together with the results of ice-core analysis give us a clear and accurate picture of just what we are doing to the atmosphere. And it is frightening. The parts per million of CO₂ in our atmosphere is steadily rising at an accelerating rate. It is now approximately 387 ppm, a concentration which today's climatologists regard as threatening possibly disastrous consequences to our planet's future climate.

To sum up, the conclusions of the IPCC and the seriousness of our situation are supported fully by our climate scientists. And the predictions of those scientists concerning ice melt and the onset of increasingly violent weather are already being realized.

Chapter 7

Possible Pathways to Sustainability

The Matter of Story

How do we proceed in the seemingly impossible task of bringing about change in human consciousness which sustainability requires? Our first step towards such a daunting transformation is to understand our present state of alienation from a sustainable relationship to our planet earth. What is so wrong with our present situation which is leading to a progressive destruction of our present environment? I believe it can be summed up as a way of thinking and behavior towards our earth solely as an external object to be exploited for human benefit. Everything is commodified and objectified.

In the words of the Jewish biblical scholar Martin Buber our earth has become simply an “It”—to which we relate to in the form of “I-It” not “I-Thou” Further, we do not see ourselves as an integral part of nature. We live on it exploiting its living and non-living resources but we are not really a part of it. And this, I submit, is a most profound alienation from a sustainable relationship. Further, this attitude of commodification of nature leads naturally into our present ideology of consumerism where the quality of life is gauged simply according to what we have rather than what we are. People try to find meaning, contentment and acceptance solely by what they consume.

In the writing of one of our major environmental thinkers lies a fundamental insight—I refer here to the thought of the cultural historian Thomas Berry. In his books *The Great Work* and *The Dream of the Earth* he speaks of the experience of sacredness, awe and wonder concerning our earth relationship. In particular he makes frequent use of the word “numinous.” What is the meaning of that word and what is its origin? It is explored in a classic work. *The Idea of the Holy* by the biblical scholar Rudolf Otto. Here he describes an experience beyond reason, beyond conceptualization, yet including a whole galaxy of emotions such as wonder, awe, even terror, fascination, mysteriousness, overpoweringness, urgency, etc. As he suggests, this experience (which he summarizes as “holiness”) lies at the heart of all major religions. And in these religions it is seen as an awareness of the presence of the divine or “god.” Further, this experience cannot be limited to mere emotion. It is “noetic” in the sense that it is an experience of ultimate reality or being. More specifically it is an experience of the ultimate power of being—of that power that enables all things to be. This is not a mystical experience requiring some sort of disciplined regimen. Rather it is open to anyone capable of momentary meditation upon the presence of that mysterious power of being that pervades our earthly environment. Yet, if one pays attention to it, it can become a transforming experience. I am not a stranger to it. Yet I have not read anybody who has so eloquently described it as Paul Brockelman, University Professor of Religious Studies and Professor of Philosophy at the University of New Hampshire. I refer here to his book *Cosmology and Creation*. I begin by relating an experience Brockelman shares with his readers on p. 69 ff. of his book. It happened during the late afternoon on the edge of Lake Waushakum in Stirling, Massachusetts.

I had been sitting there for a while, not thinking of anything particular, when suddenly I felt a rush of wonder at the spectacle before me. I don't mean here in the sense of wonder about the solution of a problem or wondering about how to solve a puzzle There was nothing about problem solving—or for that matter anything hypothetical or even intellectual-about it. On the contrary it was a feeling or mood of astonishment, a sense of how strange and weird life is as I contemplated the sheer existence of it all, including me. . . . And all this is happening on a planet circling the sun at hardly imaginable speed, in a solar system hurtling through space, and within a galaxy of incredible immensity. . . . Hovering about the experience was an awareness of mystery . . . Mystery here . . . isn't something thought or reasoned to, but part of the experience of Wonder itself. . . . My experience of wonder, that day, was at its core a noticing of reality itself, not this or that real thing, but the existence, the actuality, the is-ness I want to say, of everything.

As he goes on to draw out further implications of this experience, he also reports a sense of dependence on this all-encompassing unfolding and mysterious reality within the experience of wonder. There was also a sense of gratitude for being, a sense of thankfulness for the good fortune that he happened to be, that he was present and participating in the extraordinary gift that life is. In his words:

Finally, the experience contained within it an impetus to live fully in the light of that giftedness, to live fully aware of it as much as possible.

What we have here is a powerful alternative to the present state of alienation so prominent in today's world with its lack of meaning and spiritual depth. The element of inclusion in an all-encompassing reality is especially significant. For it must be said that one of the essential elements of a sustainable relationship with nature is the full realization of how thoroughly we Homo sapiens are a part of life and non-life. We enjoy a measure of transcendence over nature yet in a larger sense we are one with it. As Neil Shubin makes clear in his fascinating book *Your Inner Fish; a journey into the 3.5 billion-Year History of the Human Body*, (p. 115):

The recipe that builds our bodies has been passed down, and modified, for eons. We may not look much like sea anemones, and jellyfish, but the recipe that builds us is a more intricate version of the one that builds them.

As Sean Carroll reminds us in his book *Endless Forms Most Beautiful*, we Homo sapiens share the same genes with all other living things including fruit flies and bacteria. We share the same physical processes with all the rest of living forms. Our bodies

are composed entirely of atoms and molecules forged from hydrogen and helium under tremendous heat and pressure in the interiors of stars billions of years ago.

It is apparent that Berry's use of that word "numinous," the experience of which is so eloquently described by Brockelman, points to a widely accessible way towards sustainability—towards a richly meaningful human outlook beyond alienation, towards a life which views living and non-living nature with reverence and awe. By the same token it liberates one from the lure of that mindless consumerism that values life according to having rather than being—that insatiable greed for stuff that is fueling global warming. All this makes Thomas Berry's use of that word "numinous" so revelatory of the foundation of his thought. It is also key to understanding one of the deeper levels of alienation of so much of today's thinking and experience. It reminds us that after all is said and done, the greatest loss of modern consciousness is the revelatory power of nature—a medium of revelation of the divine where nature is seen as sacred rather than something to plunder and exploit.

It is ironic that this alienation issues directly from that dangerous gift of evolution—namely our double relation to nature. On one hand we are creatures of our physical environment like all the rest of living forms. Yet we are endowed with the capacity to transcend this dimension through self-consciousness. The evolution of our big brains bestows a measure of freedom over the physical restraints that govern all other forms of life. With this transcendence comes the power of objectification which makes possible the great achievements of our race—science and technology. Yet this same capacity comes with a price—a psychic separation from what is objectified—what Martin Buber described as an I-It relationship. And so we objectify our environment with the risk of losing sight of our immersion in it. The highest achievements of our civilization bring with it the possible loss of our spiritual health and wholeness. And with it our grasp of sustainability on this planet. The irony here is that the greatest gift of evolution has become the greatest threat of our undoing. Were the ancient Greeks correct in suspecting that achieving civilization inevitably incurs divine retribution? Of course this is a tragic view of life not shared with our modern world. Biblical writers such as the Yahwist (Gen. 2) gave us the Garden of Eden story in which pretensions of divinity led inevitably to alienation from God. Yet there is always the freedom of "repent" (to change) bringing new life and a restoration of appropriate God-human relations. A final note of hope: we Homo sapiens have the capacity to learn from humanity's past mistakes. So sustainability remains a live option for us if we but learn the lessons of past history. Let us go forward then, with hope held firmly in mind.

The Critique of the "Old Story"

Concerning the possibilities available to us in transcending our present state of alienation from nature, here's a suggestion from one of the wisest observers of our present predicament—the cultural historian Thomas Berry. This from his book *The Dream of the Earth* (p. 123):

It's all a question of story. We are in trouble just now because we do not have a good story. We are between stories. The old story, the account of how the world came to be and how we fit into it, is no longer effective. Yet, we have not learned the new story. Our traditional story of the universe sustained us for a long period of time. It shaped our emotional attitudes, provided us with life purposes and energized action. It consecrated suffering and integrated knowledge. We awoke in the morning and knew where we were. We could answer the questions of our children. We could identify crime; punish aggressors. Everything was taken care of because the story was there. It did not necessarily make people good, nor did it take away the pains and stupidities of life or make for unfailing warmth in human association. It did provide a context in which life could function in a meaningful manner.

What he is referring to, of course, is Genesis. Because of the enormous cultural influence of this book in our past as well as into our present our way forward towards a sustainable future leads right through this origin story. We must come to terms with its widespread influence on current thinking and where it has contributed to our contemporary ecological morass—not simply to denigrate or dismiss it but to critique it. We must understand why we need a "new Story." In this quest we find help and guidance from Theodore Hiebert, Professor of Old Testament at McCormack Theological Seminary. He has authored an essay "The human vocation: Origins and Transformation in Christian Traditions" as his contribution to a conference on Christianity and Ecology sponsored by Harvard University. He begins by noting that the image of human vocation in the world of nature has been an image of dominion drawn ultimately from the biblical story of creation in Genesis 1. Bear in mind that biblical scholars have long known through linguistic analysis that there are two accounts of creation in the first three chapters of Genesis by two different authors—one is called the "Priestly" writer in Genesis 1 and the other the "Yahwist" in Genesis 2-3 (so called because he refers to God as "Yahweh"). Here is the Priestly version in Genesis 1:

So God created humankind in his image. In the image of God he created them, male and female he created them. God blest them and God said to them, "be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth."

As powerful and authoritative as these verses have been down through the ages, Hiebert wants to emphasize this image of dominion is only one of many perspectives on the human role in the natural world. He also wants to clarify the particular cultural setting of this famous passage. He reminds us that this passage was part of a larger account of creation by what historical scholarship refers to as the Priestly writer. And inevitably it reflects a priestly way of life, in particular the potent power of authority they exercised in ancient Israel. That is, they exercised dominance over the cultural and religious life of their time, and they believed they had been given this power of dominion by God, the same God that exercised dominion over all creation. This is not all. As Hiebert points out, the priestly role of dominion is amplified when humans are said to be created in God's

image. This directly parallels the priestly role as the mediator of God's presence on earth.

But when we turn to the Yahwist's account of creation (Genesis 2-3) we find a description as starkly different as night from day. Here is Professor Hiebert's summation of the Yahwist's narrative which portrays the human as a farmer caring for the farm. Humanity is not created in God's image but out of arable soil, the same soil cultivated in the growing of grains, vineyards and orchards. *Christianity and Ecology* (p. 139)

By being made from arable soil, the human being is not distinguished from other forms of life but identified with them. Plants (Gen. 2:9) and animals (2:19) are both produced by God out of the same arable soil from which the first human being was made...Receiving the breath of life (2:7) does not grant the first human being a soul or spiritual character different from the animals, since this breath is the physical breath of all animate life. (cf. Gen 7:22).

And what instructions are given to these farmers: to care for the garden (or earth) not to dominate but to care for the garden. As if to repudiate the priestly writer's idea of dominion—an obvious invitation to hubris, the Yahwist gives us the famous Garden of Eden story which constitutes a warning to all human pretensions to divinity. We must observe our inherent human limits. Ecologically the Yahwist gives us much more. Its vision of humanity includes several insights essential to a sustainable ecological vision of human nature. These include his insistence of *Homo sapiens* identity with all forms of life, the fundamental need for humility and a sense of limits of our technological and scientific powers (Garden of Eden story) the interconnectedness and interdependence of all things (the first law of ecology) and the love of soil and farming from which comes the bread of life. How tragic that the dominion motif of the priestly writer has so dominated western thought! It fed right into the relentless extractive assault on nature which characterized the excesses of the industrial revolution and set us on the present path towards environment disaster. On the other hand the Yahwist account of creation which is so hospitable to our contemporary ecological concerns, has been almost completely ignored.

Further, there is no authenticity in trying to soften the hard edges of the Priestly meaning and intent by reinterpreting his words by stressing such terms as “stewardship” as some environmentalists have done. As Theodore Hiebert has made clear with his analysis of the Hebrew, these words translated “subdued” and “have dominion” are fraught with power (see his essay p. 137). For example, when it comes to the exercise of kingly rule over Israel's enemies (PS.110:2) this language of dominion is used to describe military conquest. It is combined with such terms as “destroy” and “break down.” This should make it unmistakably clear that when we transfer these passages out of their original cultural and theological matrix and apply them to our own contemporary environmental situation, we are left with nothing but naked power and exploitation. In other words, nature is simply and purely (to use the language of the Hebrew scholar Martin Buber) an I-It to be mastered and controlled for human uses and purposes. Of course, it must be said that we could not even exist on this planet without making some use of nature as an I-It: that is, as a source of sustenance and resource for human life and civilization. The problem is how to strike a balance between reverence for nature as I-Thou on one hand and as an I-It source of life on the other. This much is clear: if we can learn to live in communion with nature as some indigenous peoples have done rather than trying to master and control it, the way to sustainability remains open (see Thomas Berry's *The Dream of the Earth* (p. 189). Attempting to master, dominate and control nature at the exclusion of all numinous impulses will utterly alienate us from our source of life, render sustainability impossible and lead to our undoing. Finally, it must be said that these priestly dominion passages must be utterly repudiated on sound ecological grounds for what they are, an irrelevant and destructive hangover bequeathed to us by a biblical literalism. In face of the seriousness of our environmental problems culminating in global warming, the tenacious attachment of traditional Christianity to the priestly insistence on domination over nature and its life-forms seems incredible, not to mention the cruelties inflicted for centuries on the rest of animal life forms on the grounds that unlike us they have no souls. I refer to that insistence by the priestly writer that we humans, unlike the animals, were supposedly made in “God's image.”

While the continuing influence of the priestly account of creation in Christianity renders its influence ecologically negative, what about Christian theology? What effect has that had on our present environmental problems? Helpful here is the thinking of Sallie McFague, Distinguished Theologian in Residence at the Vancouver School of Theology in British Columbia and former Professor of Theology at Vanderbilt Divinity School. I have found her to be ecologically head and shoulders above other theologians I have so far encountered on environmental matters. She insists that all our traditions of Christian theology are dispensable if they have nothing to say about the greatest spiritual crisis of human history—global warming. I shall turn to her latest book *A New Climate For Theology: God, the World, and Global Warming*. Here in her overview of the history of Christian theology she isolates four basic models: the deistic model, the dialogic model, the monarchical model, and the agential model. Not to go into detail here but the invariable result of her survey is that, without exception, these various models do not portray God as vitally or directly concerned with the treatment of our natural world. That is, ecologically speaking, with these models God has nothing significant to say concerning our natural world or our treatment of it. In view of McFague's critique the following question posed by Thomas Berry in his book *The Dream of the Earth* (p. 80) would seem justified.

This may well be the reason, at this time, when threatened in the very source of our sense of the divine and in our sacramental forms, there is no sustained religious protest or moral judgment concerned with the industrial assault on the earth, the degradation of its life systems, or the threatened extinction of its most elaborate of life expression. Even more important: why did this process develop in a civilization that emerged out of a biblical—Christian matrix?

As a retired clergyman from that tradition I do not enter lightly into serious judgments concerning this faith's responsibility for our present environmental crisis. But I do not doubt that the Christian faith shares deeply in the cause of our pres-

ent environmental predicament. Yet there is another issue which takes us to the heart of this tradition, a criticism shared by McFague and Berry. Here's Berry's comment *The Dream of The Earth* (pp. 126 ff.)

Redemption mystique became the overwhelming form of Christian experience. Such excessive emphasis on redemption, to the neglect of the revelatory import of the natural world, had from the beginning been one of the possibilities in Christian development. Creation became increasingly less important.

Why this heavy emphasis on redemption? It all has to do with the centrality in Christianity from its inception of a historical figure Jesus of Nazareth as the primary means of salvation. And as McFague suggests this emphasis reflects the Western and Christian emphasis on time and history and its ignoring of our place in nature. And to the extent that this centering of redemption on a historical person diverted attention away from the health of our planet earth, this particular view of redemption must share the blame for our past and present deterioration of the environment. This in no way means there is an irreconcilable conflict between Christianity and ecological care of the earth. As one theologian has said we should love the earth as we love Jesus. An ecologically minded Christianity is perfectly possible but long overdue.

To underscore her belief that Christianity and a literate ecology can go hand in hand, McFague reframes her model of God (citing Augustine's *Confessions*) to make it relevant to our world of climate change. This view sees God as the source of all existence and the power that enables all things to be and who is ever present and imminent in the whole creation. Her theological suggestion is that we view the universe as God's body. To counter the usual horror of pantheism (reflecting the past influence of Neo-Platonic philosophy and later the split between matter and spirit espoused by Rene Descarte), McFague makes it clear that the universe as God's body is neither straight forward pantheism nor does it denigrate matter in relation to spirit. Rather, God in our universe is likened to the mind in our bodies. This translates into God as being both radically imminent and transcendent. Finally, this is how she deals with redemption in relation to ecological concerns: *A New Climate for Theology* (p. 73): Here she speaks for herself:

This is not a description of creation (there are no descriptions); neither is it necessarily the only model. It is, however, one model that is commensurate with the central Christian affirmation that God is with us in the flesh of Jesus Christ, and it is a model that is particularly appropriate for interpreting the Christian doctrine of creation in our time of climate change. . . . We find God in caring for the garden, in loving the earth well: this becomes our vocation, our central task. Climate change, then becomes a major religious, a major Christian issue.

Finally, while we have acknowledged the negative elements of Christianity's ecological legacy, our critique would be egregiously incomplete without mentioning a very important positive contribution to our quest for sustainability—the cry for social justice so prominent in the prophetic writings of the Hebrew scriptures. For this cry translated into today's world of global warming is an essential dimension of a sustainable world. It is no accident that our environment is most devastated where poor people live. Indeed, one of the greatest human problems of today is the exploitation of natural resources by the rich at the expense of the poor. Such ongoing injustice is clearly unsustainable. As theologian Rosemary Radford Ruether reminds us in her article in the November 1978 issue of *The Christian Century*, it is the message of the Hebrew prophets that such a situation is a rank violation of the divine covenant between God and creation calling forth this from Isaiah 24:5:

The earth lies polluted under its inhabitants; for they have transgressed laws, violated the statutes, broken the everlasting covenant.

The prophet Amos echoes the same theme with his famous call for ecojustice (5:24) with these famous words:

. . . Let justice roll down like waters, and righteousness like an everflowing stream.

This call for eco-justice for the poor is an essential element of any sustainable human future.

The "New Story" of Scientific Cosmology

It is evident that the "old story" of our origins in Genesis no longer works for large segments of our present population, especially our scientists and intellectuals. And secularity is on the rise. This is also reflected in the contemporary split between science and religion. And, of course, there are millions of our people who read the Bible literally and who do not like scientists for whom evolution is fundamental. Yet, we have before us today a "new story," a cosmology of origins even more embracing and infinitely more detailed than the old story. And it can inspire just as much wonder and awe as the old story of Genesis. Furthermore it contains a powerful ecological message about just who we are and how we should treat our planet earth. This "new Genesis" is fashioned from the latest insights of empirical science. I refer to scientific cosmology which can function for modern thought as our old Genesis functioned for pre-scientific thinking. Here is the bare-bones account:

About 15 billion years ago an astonishing event occurred. An Infinitely small and hot particle began a rapid expansion. There was no "before" as both space and time emerged with this expansion. This remarkable event was the emergence of something radically new—of existence itself which we can only talk about metaphorically. During the first microseconds there emerged the four fundamental forces—the strong force, the weak force, electromagnetism and gravity. Also during these microseconds there emerged hydrogen and helium. Guided here by the narrative on pp. 56ff of Paul Brockelman's book *Cosmol-*

ogy and Creation, as this hot soup further cooled somewhere around 300,000 years after the initial expansion, dense clouds of matter formed. Because it was uneven galaxies formed. About five billion years after the initial expansion these galaxies (which numbered about fifty billion) each formed bodies of billions of stars. From these nuclear furnaces formed what we know as suns. Forged in the interiors of these nuclear furnaces and subsequently spewed out in the rest of the universe as some of these stars exploded (supernovas) came all the various elements of which we are made.

Between five and six billion years ago a supernova exploded in the Orion arm of our Milky Way galaxy. This triggered the nuclear ignition of our sun and the formation of our solar system including our planet earth. After our earth had cooled sufficiently evolution began with the emergence of life about three and a half billion years ago. About 200,000 years ago Homo sapiens began to evolve. Some 10,000 years ago the earth's climate had become sufficiently stable for human civilization to establish itself.

Let us turn now to some of the implications of this fabulous new story for a sustainable way forward. This does not necessarily mean completely discarding the old story. For many, it can enrich the old story while the story in Genesis can still provide richness and depth to the new story. This is especially true of the Yahwist's material in Genesis 2. Further, both old and new stories affirm that all things are interrelated and co-dependent and that we Homo sapiens are part and parcel of one seamless web of life. And as one meditates upon this grand vision of modern cosmology, the awe and wonder elicited by it can bring forth what can only be described as a religious transformational experience. For it is a cosmology which fully inspires a spiritual response. And by the same token it can generate values essential to human love and reverence towards this unspeakably beautiful and astonishing world in which we find ourselves. And I submit that this is the kind of human consciousness essential to the sustainability so lacking today. So our "new story" provided by our modern scientific cosmology offers a way forward to bringing a transformation of consciousness away from our present alienation.

I have concluded that our present mode of existence with its heedless plundering of the earth's resources, fueled by the insatiable greed and egocentricity of consumerism, seemingly calls for the impossible—a thorough transvaluation of values akin to a religious conversion. Yet this forbidding prospect is not uncommon. Life among those in the world's religions are full of such conversions. So it is not unrealistic to hope for such conversions concerning our relation to nature and the rest of the cosmos. But what could bring about such a conversion? We have a powerful example in Professor Paul Brockelman's book *Cosmology and Creation*. Further it is clear in his book that his transformative experience is not unique. At its basis there is a kind of new Genesis that provides the kind of vision that will perform an essentially spiritual function of telling us just who we are, how we got here and how we should relate to nature.

Let us now address the question of how this scientific cosmology can serve to transform our values and consequently our relation to the universe. With Brockelman as our guide let us mention some of the factors that may lead us from our present alienated state of an I-It to an I-Thou relationship with nature. Speaking in terms of religious awe, Brockelman cites the miracle of our universe emerging mysteriously out of a quantum vacuum. *Cosmology and Creation* (p. 55):

Everything, then, is essentially connected to everything else while at the same time (both as species and as individuals) remarkably different and not reducible to its parts. This new cosmology narratively enfoldes these novel eruptions into a single, interrelated plot or network of dependencies. My point is not that God fills the explanatory gaps of emergence, but rather that the sheer fecund eruption into existence of novelty leaves anyone who perceives it in a state of awe and wonder at the mysterious creative force that animates it.

As Brockelman suggests, in this scientific cosmology we have a narrative which is at once a creation story which helps us to see how we fit into it and also how to live in it. Brockelman here cites this from the work of Thomas Berry: *Cosmology and Creation* (p. 63)

Since religious experience emerges from a sense of the awesome aspects of the natural world about us, our religious consciousness is consistently related to a cosmology telling us the story of how things came to be in the beginning, how they came to be as they are, and the role of the human in enabling the universe in its earthly manifestations to continue the mysterious course of its creative self-expression.

Perhaps one of the most critical insights into our present state of alienation is the new scientific cosmology's thoroughness in integrating us into the fabric of the universe. It is eloquently expressed by Brockelman's citation from Dennis Overbye *Cosmology and Creation* (p. 76):

What could be closer to the flavor of myth than the notion that the universe did in fact appear, perhaps out of nothing; that the atoms in our bones and blood were formed in stars light-years away and billions of years ago; or that the even more ancient of which those atoms are composed are fossils of barely comprehensible energies and forces that existed during the first microseconds of creation? We are all artifacts of the universe, walking reminders of the ultimate mystery. We are walking dust, walking stardust.

Another essential element in all this is the sense of wonder elicited from contemplation of the sheer miracle and grandeur of this unfolding of our infinite universe into its many myriad forms. I dwell on this for it is an essential aspect of a transforming process that can take us from alienation to a new state of consciousness filled with an awareness of life as a continuing experience of the sheer mystery of existence. This sense of wonder is not a noetic experience in the usual epistemological sense.

Neither can it be described as simply emotional although it engages our emotions. Rather it is a self-validating awareness of that power of being that enables all things to be. Call it God if you will. The point is that it is a transformation of values, bringing a change in consciousness essential to our treating nature with reverence making sustainability possible.

As mentioned earlier this sense of awe and wonder while at the basis of all religions is available to all who have the alertness and openness to the ongoing miracle of nature and the limitless universe. Brockelman cites this from an essay by Rachael Carson entitled "The Sense of Wonder," *Cosmology and Creation* (p. 117)

What is the value of preserving and strengthening this sense of awe and wonder, this recognition of something beyond the boundaries of human existence? Is the exploration of the natural world just a pleasant way to pass the golden hours of childhood or is there something deeper? I am sure there is something deeper, something lasting and significant.

There is the experience of the scholar and missionary Albert Schweitzer as he journeyed through the African jungle and was struck by the awareness of the universal will to live. It was this awareness that lead him to adopt reverence for all life for the rest of his days.

Another quality which constitutes an essential aspect of this transformation is the moral judgment of intrinsic value that this unspeakably impressive spectacle of our infinite universe generates within us. Indeed, we are reminded of those words in Genesis where God, upon finishing his work of the four stages of creation, declares that "it was good" (Genesis 1:10). Compare that with the typical modern outlook where nature is simply an object to be exploited for human ends. Or, as Brockelman put it, "whose value is merely extrinsic, valuable only as an object to the degree that they have utility for humans." *Cosmology and Creation* (p. 165).

The sense of exultation and joy at being an integral part of the cosmos is expressed in these words from a grateful Brockelman: *Cosmology and Creation* (p. 148)

Accompanying the wondrous perception of the immense and awesome encompassing reality which is the universe is a sense of belonging to a wider and deeper reality beyond our shifting , practical daily concerns and a sense of gratitude that we are not only a part of this immense drama, but thank God, aware of it!

Also clear is the affirmation of meaning. Or, as Martin Buber put it in his work *I And Thou* (p. 110) this kind of experience is what he would call awareness of the Eternal Thou. Writes Buber:

It makes life heavier, but heavier with meaning. Secondly, there is the inexpressible confirmation of meaning. Meaning is assured. Nothing can any longer be meaningless. The question about the meaning of life is no longer there. But were it there it would not have to be answered. Thirdly, this meaning is not that of "another life," but that of this life of ours, not of a world "yonder" but that of this life of ours, and it desires its confirmation in this life, and in relation to this world.

In conclusion, I have examined several aspects of our present culture under the rubric of sustainability and without exception found them unsustainable. I have also found that what is called for in seeking sustainability is a sea change of the human outlook comparable to a religious conversion, a transformative experience leading to a new kind of consciousness compatible with an enduring human presence on our planet. Under the guidance of such thinkers as Thomas Berry and Paul Brockelman I have found a possible way forward in light of our new scientific cosmology. It has the capacity of leading to a numinous experience of awe and wonder resulting in ethical transformation. In Brockelman's words: *Cosmology and Creation* (P. 171)

Rather than an appeal to theoretical principles the transformation ethical model which flows from the new cosmology is an ethics based on actual experience and persistent character formed in light of reality itself. Like the sermon on the mount it is an ethics of love and compassion rather than rules and duties.

His mention of love and compassion and the sermon on the mount echoes my own conclusions concerning the quest for a pathway to sustainability. Namely that the conclusion of such a quest must be spiritual in character. As Sallie McFague rightly insists, global sustainability is ultimately a religious quest involving the human experience of wonder and awe before the mysterious power of being which we encounter in every aspect of life. A religious and spiritual matter, yes. But I am not speaking here of an experience confined to organized religion. I am speaking of what Thomas Berry frequently alludes to as the awareness of the numinous quality of our experience of nature as a means of revelation of ultimate reality. And this is accessible to everyone. And it is one means of overcoming our present state of alienation from nature and reversing our present course towards environmental disaster.

CONCLUSION

To conclude this survey of the challenges and ways to an enduring sustainability, it is important to focus on our human hopes and possibilities for a future quality of life that makes this possible. This writer does not believe in the possibility of progress toward a utopia but rather in the achievement of a level of justice and liberty for all. In such a society earth's resources are utilized such that we can pass on to our descendants the essential glories of this good earth. It is obvious that our human race is capable of an enormous range of behaviors, all the way from violence, hatred, competition, and greed, to love, tenderness, compassion, and cooperation. Which of these qualities will prevail at any given time and place in history will always remain an open question. Concerning our own time, the thinking of David C. Korten in his recent book, *When Corporations Rule the World* illustrates perhaps the greatest threat to sustainability in our time. Speaking of the contemporary power of the corporate world, he writes: (pp. 248-249)

... The Ecological Revolution is less a class struggle than a struggle of people against a rogue economic system that diminishes our humanity and threatens our collective survival by organizing societies around the pursuit of material gratification. We made a virtue of social dysfunction and diminished the quality of our living.

As Korten emphasizes, a healthy sustainable society is one that is organized to hold its elements of violence and greed in check while promoting qualities of cooperation, compassion, and social justice. The consumerism so prevalent in today's society and which has been assiduously fostered by our corporate culture is so devoted to egocentric materialistic values, greed and profit that it cannot encourage the social values of cooperation, empathy, compassion and devotion to the common good—qualities essential to an enduring sustainability.

Another major threat to sustainability today is the dominance of our human capacity of reason and the neglect of other more benign elements of human sensibility. Speaking of reason, the great achievements of our modern age lie in the domain of science and technology. While these have made the productivity and wealth of today's culture possible, they also made possible the blood baths of our two world wars and the advent and continuing menace of atomic destruction. The history of our western culture amply demonstrates the inherent difficulty in reaching and sustaining a balance between these two aspects of our human psychic life. We have seen the coming and going of the Age of Reason, to be followed by the age of romanticism which temporarily eclipsed the Age of Reason. What about our modern age? Out of the continuing failure to integrate these two dualities has recently emerged the primacy of what Bill McKibben has called "hyper-individualism" (*Deep Ecology*, pp. 97 ff). This is an extreme form of individualism pervading modern life from the highest cultural levels right down to the most ordinary details of life. And this exaltation of the individual with its attendant worship of material possessions blossomed right into that consumerism which helped bring on global warming.

What is the answer to this extreme egocentric individualism? Obviously it cannot offer any real human satisfaction or enduring meaning. McKibben's answer includes the recovery of lost community: a community in which human beings can relate deeply to each other and rediscover some of life's deepest meaning and fulfillment. To do this there must be a turning away from the dogma of perpetual economic growth and a turning towards various forms of "localism" which can offer an abundance of human interaction and relationships. Rising above the lure of materialism is central here. Writes McKibben in *Deep Economy* (p. 102):

We've been well and truly sold on the idea of the individual, 55% of Americans under the age of thirty think they will end up being rich. And if you're going to be rich what do you need anyone else for? You can see the political results of looking out for Number One in the deterioration of all the institutions of our common life.

With this call for a rebuilding of human community is mentioned the possible role of organized religion. As McKibben notes, people who participate in religious communities have deeper relationships than those who don't (p 109). Relevant here is Jesus's maxim "Love your God, and love your neighbor as yourself."

Another way to community and a shift away from "hyper-individualism" is a turning towards economics more local in scale. Farming locally is one option leading to the reinvigoration of lost rural communities. This brings up one of the leading features of contemporary America—the industrial farm model. Notable here are the findings of the book by Fraser and Rimas, *Empires of Food*. The result of their research yielded the following grim conclusion—the fall of every past empire was rooted in the exhaustion of the soil upon which they depended for their food. Secondly, this prospect faces us also unless we take stringent steps to preserve our own soil productivity. What makes these conclusions so unsettling is the practice of our present industrial farm system. It stresses vast monocultures with annual enormous infusions of nitrogen and pesticides, a method which seems tailor made to exhaust our soils productivity. While there can be no sudden and complete transformation of our present industrial farm model to something more "local" nevertheless there is today a gradual trend in motion to gradually replace this system with smaller, diversified organic farm methods which enrich the soil, and require much less fossil fuel for transportation.

We have mentioned two ways the "hyper-individual" can find a level of transcendence enabling one to achieve a sustainable balance between reason on one hand and the qualities of love, empathy, compassion, cooperation on the other—the "localism" of community and the meaning of organized religion. There is a third way—the wonder and meaning made available by the cosmology of modern science. It is featured in Paul Brockelman's thoughtful book *Cosmology and Creation*. As he suggests, we have in this cosmology a kind of "new story" which the cultural historian Thomas Berry sees as a necessary corrective

of the “old story” of human origins in the biblical Genesis. The traditional Genesis with its “old story” is no longer meaningful to many in our secular, scientific age. This “new story” of modern cosmology can well serve as a worthy and relevant inspiration of meaning, wonder and awe with its vision of human origins and the revelatory power of nature, overcoming the present alienation from nature. This vision can show the way to a truly ecological and therefore sustainable view of our ultimate origins and how we should relate to the natural world. It can elicit our reverence and awe in face of the mysteries of existence without necessarily relinquishing any of the cherished meanings of traditional religion. This “new story” will enable us to treat nature as a “Thou” rather than simply an “It” leading us to make use of nature’s resources necessary to human culture while at the same time maintaining a posture of reverence and wonder appropriate to an enduring sustainability.

About the Author

Dr. Jones began his higher education with a Bachelor of Science in Chemistry at Tufts, followed by a Master of Arts in teaching at Tufts Graduate School. He studied philosophy at Harvard University, obtained a Bachelor of Divinity at Andover-Newton and finally a Ph.D. in Philosophy of Religion from Columbia Graduate School. His career includes pastoral ministry and college teaching. He has had an abiding interest in science and its relation to religion.

