Our Precarious Habitat

Fifteen Years Later

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Foreword

In his *Politics of Pollution,** J. Clarence Davies III asked the question: What is pollution? It was not a rhetorical question. "The very definition of pollution," he wrote, "hinges on politics." That immediately subverts objectivity and places scientists on precarious ground. He went on to note that "pollution can not be defined with any scientific or mathematical finality. The definition hinges on the concept of human use. . . . It is dependent," he continued, "on the public's decision as to what it wants to make of the environment." If there was a homogeneous public, the problem would take on manageable proportions. Again, falling back on the political content, Davies remarks that "it becomes a political decision, a voicing by the community of its concept of the public interest." And finally, "underlying much popular discussion is the idea that pollution is the artificial befouling of the pure state of the environment. This is reflected in the many appeals to return our air—or water or soil—to its 'natural state'."

Unfortunately, I must concur that this concept of pollution appears to describe contemporary longing. Few ask what pure water or air is, or when if ever such a condition existed. Or, if it is even necessary or desirable. One must wonder what period in human history is being alluded to or longed for. Whatever, it bespeaks a time when things must have been better. To ask, better than what?, only prolongs the unanswerable.

For my purpose, it is not necessary to pursue this line of inquiry. I believe, with the benefit of hindsight, that both ideas can exist cheek by jowl as it were; a yearning for a primeval Garden of Eden, as well as an understanding that the real world is not just liveable but is in fact a remarkably healthy place. One is neither required to be an incurable optimist no oblivious of the problems that require attention, to make that statement.

* Pegasus-Bobbs-Merrill Co. Inc., 1975.

It is this second belief that is being staunchly resisted. It does not fit well with elitist notions of a "military/industrial complex," whose polluting excesses must surely be taking its dismal toll in human lives and health.

Fortunately, I am not so presumptuous as to believe that this single volume can change all that. However, I do believe in the Buddhist injunction that "a journey of a thousand miles begins with a single step." Therefore, my purpose in writing this book is to provide readers with a broad spectrum of accurate and reliable information which can assist in placing attitudes and beliefs about environmental impacts in clearer perspective.

Questions are raised throughout the book. They require discussion. Most are questions with which communities, state, and the federal government will have to come to grips sooner or later. Sooner is far better than later.

Unfortunately, science majors, both undergraduates and graduates, often find too many of the questions baffling. They are unprepared to deal with the economic, social, political, and psychological ramifications inherent in all environmental issues. They are often surprised to learn that these concerns, more often than not, take primacy over "hard" data. That is a fundamental lesson. And speaking of "hard" data, I have dealt at length with this in Chapter 15 and additionally in other chapters. It is a subject that cries out for extensive exploration.

Although this book can be entered at any point, concepts such as risk assessment, safety, and hazard, along with the translation of data obtained from animal studies projected to the human condition, are discussed in several chapters. Thus, the fullest understanding will come from a close reading of the entire book—or judicious use of the index.

In the current argot, my "bottom line" is mobilization—of public opinion—away from the fixed position it has assumed since *Silent Spring*.* My interest in taking on the subject after a hiatus of 14 years proceeds from the felt need to clarify issues that continue to bedevil us. I wanted to place before readers a tableau of evidence which would motivate them to initiate questioning. At that point, inquisitive minds may proceed to discover the real world: come to appreciate rather than fear it. Such a body of knowledge cuts against the "it is alleged" type of commentary so rampant today. It is too easy to repeat and accept environmental banalities. Some favorites are: "We are being slowly poisoned to death. Perhaps not so slowly." "Our lives hang in a precarious balance" and "We are ticking bombs" are other favorites. Questioning current environmental myths is an idea whose time has come.

I would also be delighted to hear or learn that as a consequence of reflecting on the ideas and statements in this book—incorporating the

* Rachel Carson, *Silent Spring*, Houghton Mifflin, Boston, 1962.

best available data—that people begin to question, to say "wait a minute, what's the evidence for that?" "Run that by me again" would be another appropriate response. That is what we need—questions, lots of questions—and accountability on the part of speakers and writers. A healthy skepticism is far more preferable than passive acceptance of much of the nonsense served up as our daily fare.

I believe too that the fever and emotion running so high during the 1970s has cooled. By the 1980s it was apparent that the predictions of the "Apocalyptics" was so much rhetoric. With their prognostications of fatal consequences for planet Earth, they held a viselike grip on center stage. In his polemic, "There Isn't Much Time,"* George Wald, an otherwise eminent physiologist and Nobel Laureate, wrote the following: "All humanity now suffers from a series of exceedingly threatening new developments, all coming to a head at about the same time—close to the year 2000. I am one of those scientists who try as we will, hope as we do, that something in our view of things is wrong still find it difficult to see how the human race will get itself much past the year 2000. So there isn't much time."

Wald was deadly serious, and he saw no way out. "Though we already know enough to cope with all our major problems," He said, "I don't know one of those major problems that we can begin to cope with while *maximizing profits* [italics his]. And a society like ours which puts maximization of profits above all other considersations, is therefore heading for destruction."

At this point he warmed to his subject. "I still have young children at home," he indicated, "and I teach about 200 magnificent young people at Harvard. Though I desperately want to, I can not find any asurance that they will be in physical existence ten (1985), twenty (1995), twenty-five years (2000) from now." He truly believed life in the United States was hopeless, about to become extinct.

For Professor Wald, corporations were the villians. "I believe our so-called free world is now wholly controlled by such multinational super-enterprises as General Motors, Exxon, The Chase Manhattan Bank, ITT, Dutch Shell and British Petroleum." According to Wald, this power elite was "leading our society rapidly towards disaster."

Unfortunately, the remarks of the President of the National Academy of Sciences were lost on Wald. In the midst of the environmental "panic" of the 1970s, Dr. Philip Handler stated that "the nations of the world may yet pay a dreadful price for the behavior of scientists who depart from fact to indulge in hyperboles."

By the 1980s it was clear that evidence supporting predictions of doom and destruction was baseless.

* Progressive 39: 12 (1975).

Perhaps the approach of the millenium offers a period of pause, during which the scientific data obtained over the past 20 years can be assessed calmly. The substantially increased life span and life expectancy at birth are facts of life, at variance with much popular and preferred belief. Perhaps too, it is time "to march to a different drummer."

I believe this book provides that much needed assessment of the most up-to-date scientific findings concerning the impact of potential environmental risk factors on human health.

MELVIN A. BENARDE, PH.D.

Princeton, New Jersey
January 1989

Preface

Our Precarious Habitat departs from traditional treatment of environmental issues by apportioning in-depth scrutiny—including the known human health effects—to a group of specific problems. It eschews rhetoric and polemics, which unfortunately can insinuate themselves to the detriment of these vital issues. Instead, this book marshals the best available epidemiologic evidence to support relationships and conclusions about each of the issues considered.

This book emphasizes the need to go beyond simplistic associations. This is vital in order to establish the untoward effects of the many environmental concerns faced by our communities. Indicated too is the need for an interdisciplinary approach, if our many complex problems are to be solved. Such an approach mandates the participation of economists, political scientists, and communications experts along with an array of biological and chemical specialists. It may come as a surprise to some people to learn that economists, sociologists, and political scientists may have more to contribute by way of appropriate *management* of our many and diverse problems than the so-called hard scientists.

Given that faculty members seek to tailor their instructional goals to the particular needs of their students, the issues in this book can be pursued from either biochemical processes or their relationships to the economic and political realities existing in all communities.

Each chapter contains material permitting the instructor to deal with the topic on a variety of levels. Instructors should find its framework helpful in developing student projects, oral and written reports, as well as stimulating active classroom discussion—especially as it involves the panoply of disciplines that must impinge on rational decisionmaking. Furthermore, this book can be entered at any chapter—although links to other chapters are frequently indicated.

Depending on the approach taken, *Our Precarious Habitat* can be used at either the graduate or undergraduate level.

M.A.B.

Acknowledgment

It used to be said that "behind every great man, there is a great woman." Books are like that, but even more so. While I'm hardly so gauche as to claim greatness for what I've written, I do claim the behind-the-scenes involvement of many wonderful people—many, but not all, women.

For his insistence that a revised edition of *Our Precarious Habitat* was long overdue, Dr. Irwin Suffet, a collegue at Drexel University's Environmental Studies Institute, must be given pride of place; up front, at the head of the line. I was stubborn. But he continued to urge, and his urgings bore fruit. I'm glad he didn't give up on me.

Vivian Price came into my life one Saturday afternoon. A friend, Jens Glysing-Jensen, responding to my plea for top-notch secretarial assistance, suggested his former personal secretary. Vivian was extraordinary. Not only was she an accomplished typist, but she could spell. From often illegible scrawls, she produced a gem of a manuscript. I suspect that she and her husband Fred, a dandy human being, are glad this one is over. I brought chapters and sections of chapters at all hours, weekends and holidays. The neighbors must surely have wondered.

Diedre Harper and her co-workers at the Hagerty Library's interlibrary Loan Division, Drexel University, along with the efficient staff of the Science and Technology Division, helped me every step of the way, as did Betsy Tabas and Vicki Newton, of the Temple University library. I know they are all relieved this episode is over.

For some authors, the only good editor is a dead editor. David Huttco, my editor at W.W. Norton, and, thank goodness, very much alive, was not just a good editor, he was a great one. If Dr. Suffet is "at the head of the line," David is all over it. He had that uncanny ability to see in terms of organizational frameworks, to ask the right questions, and offer appropriate alternatives. David has my gratitude.

That lightning can strike twice became apparent when Jim Smith, Senior Editor at Wiley, took on and guided *OPH* to fruition. His support,

knowledge, and understanding paved the way from manuscript to opus. And Rosalyn Farkas, Senior Production Editor, introduced me to a higher order of the copy editing and production craft. There cannot be too much praise for her efforts. Kudos for the technical quality of this book belong to her.

And for my wife, Anita, there will be a special place in heaven: for her uncomplaining lost weekends and holidays, for understanding that "the den" was off-limits–an untouchable mess that could go uncleaned for months on end—and for never questioning those visits to Vivian's.

Contents

1

Webs of Causation: The Environment as a System

All things by immortal power
near or far
hiddenly
To each other linked are,
That thou canst not stir a flower
Without troubling of a star
—Francis Thompson

Sir Percival Dinsmoor had to go on a long business trip. He left his wife and home in the care of his faithful servant, Putnam, and left for a remote area. After several months, he returned to a city, whereupon he placed a call to Putnam.

"How is everything?" he asked.

"Fine," replied the trusted employee. "Everything is just fine, except the cat died."

"The cat died!" exclaimed Sir Percival. "What happened to him?"

"Well," came the answer, "he was kicked by the horse when it ran out of the barn."

"How did the horse get out of the barn?"

"The wall fell down," answered the servant.

"What made the wall fall down?" asked Sir Percival, puzzled, for his barn had been well built.

"The fire," replied his man.

"What fire?"

"The barn burned down," said the servant.

"How did the barn catch fire?" asked the man, shocked.
"From the house."
"My God," said Sir Percival, "how did the house catch fire?"
"From the curtains."
"And how did the curtains catch fire?"
"From the oil lamps in the bedroom."
"What were oil lamps doing in the bedroom?" the man asked, since their bedroom was fully electric.
"We put them there for the funeral," said the servant.
"Whose funeral?" gasped the man.
"Your wife's," said the servant.

An ecologist reading this anecdote would surely smile. That the deaths of Sir Percival's cat and his wife are related fits snugly into the ecologist's concept that all things are interrelated.

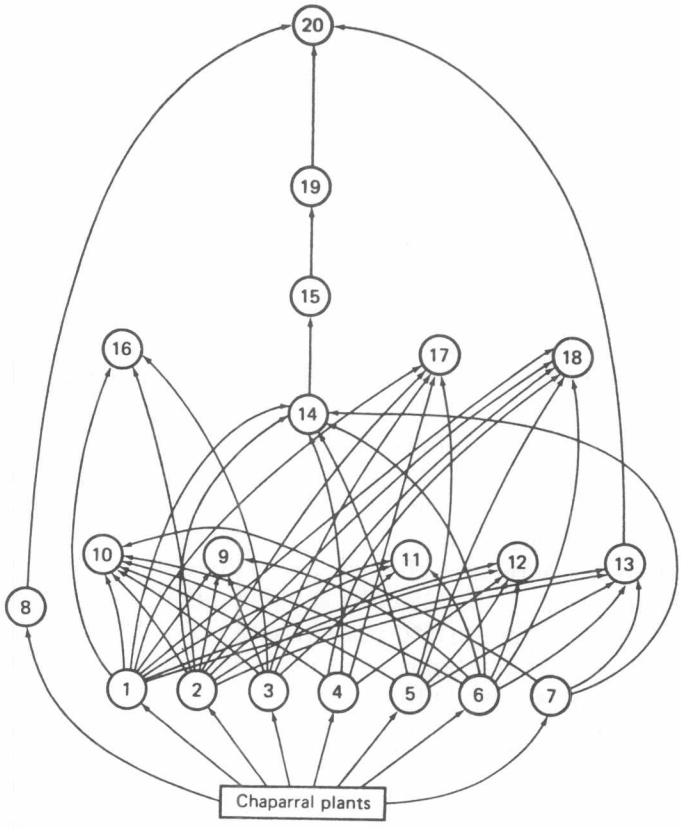
Biologists, but especially ecologists, refer to aggregations of links as an ecosystem, which usually consists of all living species in an area and their surrounding physical environment. However, for ease of management or purposes of investigation, scientists set arbitrary boundaries.

The multiple relationships among the different populations within a community (the biological portion of an ecosystem) are often referred to as a web. A well-known web is the food web, or food chain, which indicates which animals feed upon others within a community. It is another way of indicating the flow of energy within a community. Figure 1 is an example of the elaborate set of interlocking links in a food chain. In this instance that of the chaparrel.* The chaparral provides direct sustenance to a wide variety of rodents and birds, who in turn supply energy, via the chaparral, to the bobcat at the very top of the chain whose only predator is human beings.

Food webs need not be as extensive as the chaparral's. The simplest of chains exists on the arctic tundra near Point Barrow, Alaska (Figure 2). Here, the grass supplies energy to the lemming, who in turn supplies it to the snowy owl, its predator. It is simple and direct.

But food webs can also be far more complex than that of the chaparral. They generally are when we consider countrywide and global involvement. On this scale, with a complexity of overwhelming proportions, a snag in one link of the chain of events can be widely destructive. In the following section, five specific instances of this destructive power and a more general one are discussed.

* Chaparral, from the Spanish *chaparro*, meaning evergreen oak, is a community of shrubby plants widely distributed in the southwestern United States. It is especially adapted to dry, hot summers and moist winters. Arthur S. Boughey of the University of California at Irvine set out the details of the chaparral ecosystem in 1971.



1. pocket mouse
2. deer mouse (P. californianus)
3. harvest mouse
4. deer mouse (P. maniculatus)
5. meadow mouse
6. kangaroo rat
7. pack rat
8. quail
9. raccoon
10. opossum
11. striped skunk
12. weasel
13. red fox
14. gopher snake
15. king snake
16. horned owl
17. sparrow hawk
18. marsh hawk
19. road runner
20. bobcat

Figure 1. The chaparral ecosystem. Reproduced by permission of Springer-Verlag Publishing Company, New York.

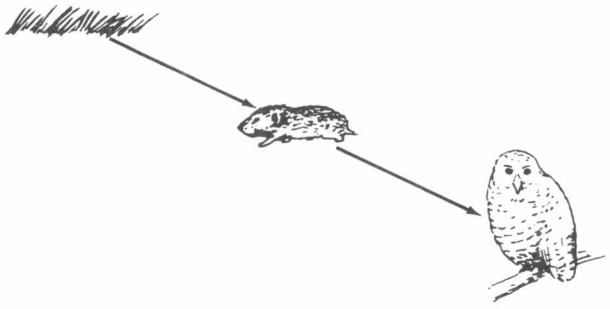


Figure 2. A simple food chain on the arctic tundra, Point Barrow, Alaska. Reproduced by permission of Holt, Rinehart and Winston, New York.

I. THE AFRICAN SAHEL: AN ECOLOGIC DISASTER

The famine currently spreading through Africa's Sahel*—an area consisting of, from west to east, Mali, Niger, Chad, the Sudan, Ethiopia, Somalia, and Djiboute—poses both an immediate and ongoing crisis of vast proportions. Hundreds of thousands of people have died and thousands more are dying of starvation, disease, and dehydration.

From our current perspective, the sub-Saharan drought of the past 15 years has been the worst in 150 years (Figures 3 and 4). In this century, 1984 and 1985 have been the driest. Although nature is often harsh and hostile, people can aggravate the misery.

The famine in Africa illuminates the deep-seated problems that threaten the future of arid lands around the world. But the outline of the impending disaster was perceived only dimly 15 years ago. Climatologists had recorded the unusually wet weather of the 1950s, as well as the decades of sparse rainfall that followed. Deserts were literally moving. But the interplay of environmental forces either had not yet been grasped or was of little concern—or both.

Desertification, a process by which the productivity of the land is ruinously degraded by human abuse and natural forces acting in concert, is an important underlying cause of the famine that has already claimed hundreds of thousands of lives and decimated cattle populations.

It may be, however, that the *primary* cause of desertification is not drought but human exploitation of lands through overcultivation, overgrazing, poor irrigation practices, and deforestation. These occurrences

* Sahel is from the Arabic *Sahel* and refers to the transition zone between the Sahara and the humid Savanna to the south. This is a region of West Africa extending from Senagal to the Sudan. It forms a belt separating the arid Sahara from tropical West Africa and it should not be confused with the northern coastal band of hills in Algeria or the northern coastal plain of Tunisia, often referred to as the North African Sahel.

Figure 3. In drought and famine stricken Mauritania, a bedouin stops at an oasis to fill an inner tube with fresh water to take to his family. Courtesy of Associated Press.

Figure 4. Goats devour remaining bits of vegetation north of Nairobi in Kenya's parched northern region. Courtesy of Associated Press.

usually follow population growth that exceeds the carrying capacity of the land, whether caused by an increase in the birth rate or by the influx of people onto marginal lands that are ill suited to support them. As the population grows, farmers are forced to till poorer and poorer lands to provide enough food. In doing so, they reduce or eliminate the fallow periods needed to regenerate the soil. Every tree is cut down for firewood or building material, thereby increasing erosion of the land by wind and water, and cattle consume the ground vegetation so that the exposed land bakes hard under the sun and loses its ability to absorb the store water (1).

With the increase in soil temperature, the vital microorganisms needed for adequate plant growth are destroyed. Particularly affected are the nitrogen-fixing bacteria, without which the plant cannot complete its manufacture of food. Dust particles blown up from the denuded land scour the remaining plants or bury them. When rain does come, it runs off quickly or evaporates.

Drought and human activity are elaborately intertwined, and whether it is primarily humans or nature may not matter when the concerted efforts of both result in an ecological debacle such as this, which has been years in the developing. And this ecological debacle has direct human effects: chronic malnutrition, dehydration, and debilitating illness. These create additional stresses for a country in loss of productive workers to do the work that must be done to alleviate the situation as well as additional expense of costly medical care.

The current drought is exacerbating the negligence begun hundreds of years before. Since time immemorial camel caravans have cut down trees and bushes to make charcoal for fires and to feed camels. Settlements and military outposts have long been built atop sand dunes, causing destabilization and drift of the dunes. Commercial pressures eliminated the acacia (gum) tree forests of the western Sahel by destructive tapping.

Pacification of the Sahel by colonial powers unknowingly fostered desertification. With the cessation of incursions by raiding tribes, agricultural populations and herds of cattle, sheep, and goats expanded northward into marginal lands that had been previously closed to them. Their cattle were not adapted to the dry area sand, they required large amounts of scarce and precious water, and they often devoured perennial grasses, trampled seedlings, and compacted the soil. More recently, urbanization and transportation have allowed further encroachments on the resources of the surrounding countryside.

The current famine appears to have gained impetus by the excessive rains of the 1950s. The availability of more water than is otherwise present encouraged the expansion of both human and domestic animal populations into heretofore marginal areas. When the drought began, these lands could no longer support their population.

Even well-intentioned efforts have added to the problem. The drilling of wells to increase water supplies prompted some farmers to increase the