

**THE FOREST AND THE SEA**

**Marston Bates**



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*A Look  
at the  
Economy of Nature  
and the  
Ecology of Man*

# **The Forest and the Sea**

**Marston Bates**

*With a New Introduction  
by Loren Eiseley*



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## **The Forest and the Sea**

*This book is dedicated to the students of Zoology 235 at the University of Michigan. They have contributed greatly to my education; have given me continuing friendships; and have provided an assurance that, as far as the next generation is concerned, the future is in good hands.*

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# **Editors' Preface**

One day in the 1940s, as a biologist named Marston Bates worked at the top of a ladder that reached some 80 feet into the arboreal canopy of the South American rain forest, a surprising thought flashed through his mind. Although his treetop post was fairly hot and several hundred miles inland, Bates found himself thinking of the sea. This vision was brought on not by a longing for a cooler place but by a fresh scientific notion—a suddenly sharpened awareness of the parallel behavior of marine and woodland creatures. More than a decade after that moment of insight, Bates's idea developed into *The Forest and the Sea*, a deceptively entertaining book which may someday alter man's view of the world around him.

Across the pages of this book march endless parades of strange and wonderful creatures: mosquitoes that rise and sink in the depths of the forest like plankton in the sea; fish that travel over land; barracuda that lurk in the black waters of night; army ants more "devastatingly fierce" than any other imaginable predator. A honeybee sees things in invisible ultraviolet light, and a monkey fresh from its native habitat learns to steal spec-



tacles from strangers' noses and make an omelet on the ceiling. But *The Forest and the Sea* is far more than merely a kaleidoscopic adventure or a clever comparison of fowldom with fishdom: it is a mature and creative expression of humanity's place in nature.

At the time Bates entertained the germinal idea which led to the title of this book, he was well on his way to becoming one of history's most knowledgeable experts on the distinctive manners and morals of one of the world's most unlovable inhabitants, the mosquito. Indeed, he was in the treetops when the idea struck him because he was investigating a high-flying species of this insect. He had earlier spent five years studying malarial mosquitoes in Albania and Egypt, and was now in the midst of an eight-year stay in a remote spot of Colombia to investigate the role of the pest in jungle yellow fever. The consequence, in 1949, was Bates's first book, *The Natural History of Mosquitoes*, a thoroughgoing scientific exploration of mosquito behavior. It was immediately acclaimed as a fundamental contribution to science. Among other things, it dramatized by implication how man's hopes of controlling his environment could be dashed if he ignored the actual relationships between different species. (For example, Bates demonstrated why the Rockefeller Foundation's early hope of eradicating jungle yellow fever simply by suppressing it in population centers was a forlorn dream: in the treetops, in the absence of man, certain mosquitoes kept the virus alive by spreading it among monkeys.)

Addressed to other scientists, that first volume merely hinted at the importance of man's involvement in the behavior of animals and the realities of nature. *The Forest and the Sea*, spawned in the same mosquito-laden current and destined for missionary duty in the same cause of natural history, is quite different. In one sinuous flash through the literary stream it offers substance for the seeker of exotic curiosities, a lesson for the molecular biologist, philosophy for the intellectual and the wisdom of an old-fashioned naturalist for the lover of literature. The book examines the plant and animal worlds, their relationship to one another, and man's relationship to both of them.

Perhaps the broad canvas Bates employs to depict his planetary view of nature is a direct product of his lifelong dual interest in science and writing. He published his first scholarly article, "A Geometrid Larva on Grapefruit," while in high school, then as a college undergraduate tried vainly to place all manner of poetry, stories and articles with popular magazines. He has now produced nine books, including the tome on mosquitoes and *The Forest and the Sea*. He also headed a group of scientists who produced a new high school biology text (which instead of beginning with the traditional—and dull—body cell, starts out with a familiar scene from nature, a rabbit sitting beneath a raspberry bush). Altogether, more than 100,000 copies of his books have been sold, and most of the titles are still in print. *The Forest and the Sea*, originally published in 1960, has been translated into Japanese, Portuguese, Spanish, Arabic, Polish and French.

Bates has scant patience with scientists who complain that laymen do not understand them. The root of their problem, he suggests, is an uncontrollable habit of spewing out an inky cloud of Greek terms behind which any meaning can hide like an imaginary octopus. "Science remains a rather mysterious affair," he has remarked in *The Nature of Natural History*, "cultivated by special priesthood, guarded by an unintelligible jargon." In *The Forest and the Sea* he expands the point.

We are liable to fool ourselves into thinking we have produced a new thought, when we have only produced a new word. . . . Biocenosis leads easily to biomes and biochores, to ecosystems, ecotones and seres. These are all lovely words, but they don't really say anything new. The trouble is that the word-coiner, sinking blissfully into his addiction, gradually loses all communication with the outer world.

Bates is equally concerned about the fragmentation of knowledge. Biologists today are sharply split into two camps: the smaller number of them, including Bates, concentrate on the relationships among organisms or, to give the subject its learned

name, ecology; the rest have given up such time-honored pursuits in favor of a heady quest for truths at the level of the molecule. To most molecular biologists a mosquito is primarily something to be repelled by a chemical on the skin. To the ecologist, a mosquito is, among other things, an influence on the world he lives in and on its other inhabitants—including mankind. As Bates says in this book:

Man has not escaped from the biosphere. He has got into a new, unprecedented kind of relationship with the biosphere; and his success in maintaining this may well depend not only on his understanding of himself, but on his understanding of this world in which he lives. . . . It looks as though, as a part of nature, we have become a disease of nature—perhaps a fatal disease. . . . I am not advocating a return to the neolithic. . . . But long run efficiency would seem to require certain compromises with nature.

As anthropologist Loren Eiseley points out in his eloquent new introduction to this special edition, Bates has seen the implications of humanity's relationship to nature with a clarity that even Darwin failed to achieve. "Marston Bates has literally put man in his place in a way nobody before him has done," says virologist Telford H. Work of the U.S. Public Health Service Communicable Disease Center. "He has put together what biologists know in a way that every intelligent person in the world can understand. You simply cannot assess the effect this has had on key people in many walks of life."

As part of this effect, more and more people have been led by Bates to an awareness of the dangerous extent to which the human race is upsetting nature. "Surely," he says in *The Forest and the Sea*, "men who can manufacture a moon can learn to stop killing each other; men who can control infectious disease can learn to breed more thoughtfully than guinea pigs; men who can measure the universe can learn to act wisely in handling the materials of the universe."

—THE EDITORS OF TIME



# **Introduction**

**M**odern technological man increasingly sets up unexpected reverberations in his universe. More and more, a kind of dissonance is communicated from the human world of invention to the world of nature. The interlocked web of life begins to vibrate with an ever-mounting rapidity. In the most scientific age in history we are losing the ability to marvel at any but our own creations. "The great palace of nature" over which 18th Century writers exclaimed so vividly has been supplanted, in many minds, by a superficial adulation of our own short-lived cleverness.

Today the essayist in the realm of natural history frequently is ignored as an artist even though his books are widely read. Some of this indifference may arise through a feeling on the part of literary critics that they are inadequate to deal with the subject matter. Still, these same critics do not hesitate to probe the symbols inherent in the novelist's art. All too frequently, it is merely an esthetic fashion that turns them away from the man of literature whose field is science.

Marston Bates, author of *The Forest and the Sea*, is such a

man. A professional biologist of distinction, he can also make a mosquito the legitimate subject of literature. Not the least of his talents is the possession of a Baconian ability both to dilate and to contract the eye—something that great Elizabethan scholar held to be the true key to scientific observation. Bates belongs with the scientific travelers of the 19th Century, but he has returned to the jungle with the advantage of an additional century of information to draw upon; he deserves to be read with his earlier namesake, Henry Walter Bates, and with Alfred Russel Wallace.

Consider, for example, his treatment of the Amazon, which he justly calls not merely a river, but rather a kind of vast, sprawling inland sea. Here, because of the huge outpouring of fresh into oceanic waters, a curious chemical doorway has opened, one of those accidental chinks in nature through which living creatures sometimes slip, with a minimum of adaptation, from one environmental zone to another—in this case from salt water to fresh. The Amazon waters contain, as a consequence, a fresh-water dolphin and even a fresh-water sting ray—one of those strange sea bats which we do not normally expect to find nestling in such an unlikely place as a sand bar in the Andean uplands.

Bates also discusses those fascinating relatives of the pineapple known as bromeliads—plants which grow upon trees high in the forest and which catch and hold quarts of water, creating by their numbers another sort of dispersed water system far above and between the Amazonian tributaries. These plants promote the development of an insular water fauna as diverse as the evolutionary oddities which arise in the course of time on oceanic islands. The plants are really innumerable little laboratory boxes in which a kind of microevolution is going on. Or, again, Bates may dwell on comparable events taking place in the hidden waters within bamboo stems—worlds where the mosquito which frequents such places must fire its eggs with bull's-eye accuracy through tiny holes in order to reach the life-sustaining water, and where the adult,

after its transformation, has to exercise similar ingenuity in order to escape its bamboo prison.

Besides contracting his eye and mind to the microscopic dimensions necessary to make out the life history of one species of mosquito out of hundreds, Bates can dilate his mind to encompass entire geological eras, enabling him to consider, among other things, the rise of man and the follies which that restless biped threatens to inflict upon his world.

I have said that there is something in Bates's approach to the awe-inspiring diversity of life on our planet, particularly in the tropics, which compares favorably with the best scientific writing of the voyager-naturalists. They were learning about the web of life, but they had no means of realizing how quickly scientific technology and the rapidity of human increase were destined to alter the wild places of the earth.

With one or two exceptions, the 19th Century scientists saw man's evolutionary rise as a natural event impossible to control consciously. They seem not to have visualized the possibility that man himself might direct the life about him on a major scale. Not even Darwin seems to have realized that man was on the point of escaping the forces which dominate the rest of life and was about to alter the face of the planet beyond recall.

Today indissoluble detergents return to us in our drinking water, we drop radioactive wastes into the sea, oil from ships befouls the wings of sea birds. Pesticides find their way into our own tissues. The wet lands that nourish wild waterfowl give way to drained and "improved" land as population multiplies, while radioactive strontium from atomic explosions pollutes our milk and enters our bones. Superhighways increasingly thrust the green world under cement. As Bates remarks, yellow-fever mosquitoes descended from the treetops when the woodcutters came. And always, everywhere, as the human swarm proliferates, sanitary engineering grows more difficult, water more precious, and by the same token, unpolluted water more difficult to come by.

In recent times, however, a persistent few have raised their voices, not alone against the reckless consumption of irreplaceable resources, but also against the whole philosophy that man can stand totally apart from nature. He cannot array himself against the old green world that made him and escape unscathed from her embrace. Man, too, is part of nature; he, too, draws his energy from the sunlight on the leaf; he, too, feels comfort in walking under the quiet of great trees at evening.

It is one of the terrors of our urbanized civilization that within it arises the man totally alienated from nature. Food comes from shelves, animals are strange things in cages before which one makes faces in the zoo. There is no surcease of noise. Daylong and nightlong, subways screech, trucks rumble, people shout. Outside is the green world, a world of little sunlit particles which, in every meadow leaf or in the wide pastures of the sea, are turning sunlight into life. Outside is the quiet, the quiet of an old rock in the sun. It is for these things that the minority has begun to express concern, to say, "Man has an ethic toward man, however badly he misuses it at times. He knows good from evil in human relationships, but toward the dust from which he came, the sunlight in his eyes, the breath that warms his lungs, he has no ethic."

Man has lived within nature until now, and taken her for granted. He has lived with nature like an unquestioning child. This is no longer enough. Man must now face the prospect of destroying nature and, in turn, being destroyed, or he must learn to protect and cherish for himself and unborn generations this beautiful planet with all its strange lifeways from which he has been granted the privilege of emerging. Marston Bates happens to be one of those farseeing people who glimpse the hope of a new pact between ourselves and mother earth. Behind the calm lucidity of *The Forest and the Sea* is the passion of one who loves life in a myriad of forms beyond his own.

There is an episode in the book which is especially revelatory of this aspect of Bates the man. Finding a strange reef creature one day on a Pacific atoll, he asked a marine biologist



what it was. "It's one of the improbable animals," his colleague replied humorously. This set Bates to thinking. Perhaps he should write an essay upon improbable creatures. But then he began to look with a new perspective upon everything. He decided the essay was impossible to produce because all the living things in the world, including those in his own back yard, were improbable. "I had to go to Micronesia," he adds ruefully, "to get this particular view of my back yard."

I can tell one more anecdote from my own store of memories. At a scientific conference full of pontificating scholars of eminence, it came Bates's turn to speak. "I don't think we know all about this matter," he said, referring to some point in genetics which involved human evolution. "I think the geneticists know a very great deal, but not that much. I think it is better if we do not fill up our ignorance with words." Doubtless I am paraphrasing from memory, but the moment has stayed with me many years. Bates was the only scientist at that gathering willing and able to say simply that for all our hard-won knowledge we were still in the midst of a great mystery.

The reader will not be long in sensing a similar deep and unpretentious sincerity in this book, for, as is true of all good writers, the man and his book are indivisible. Moreover, there is in this union something that partakes of literature and therefore of an expressed humanity which passes outward beyond the boundary of the laboratory into that world of wind and water which modern man will neglect only at his peril.

*The Forest and the Sea* contains the kind of elementary knowledge which a good wizard would strive to impart to novices setting foot on a new planet, whose mysterious forces they were inclined to ignore. Bates is warning us gently about the intricate chain of living matter of which we constitute a part, and he is saying, as did Francis Bacon over 300 years ago: "Force maketh Nature more violent in the Returne."

—LOREN EISELEY