BOOKS: ENVIRONMENT

A Convincing Call for Conservation

Norman Myers

The Future of Life
by Edward O. Wilson
Knopf, New York, 2002. 254 pp. $22, C$33. ISBN 0-679-45078-5.

In any start-of-the-new-year review of how we are getting along with our world, a front-rank issue is surely the accelerating loss of biodiversity on a grand scale. There is much evidence that we are in the opening phase of a mass extinction of species, one on a scale that would match any such episode since the demise of the dinosaurs and other Late Cretaceous taxa 65 million years ago. If this extinction spasm is allowed to proceed largely unchecked, humanity will be left with a biotically impoverished planet for several million years before evolution can generate replacement species to match today's abundance and variety.

With this potential for long-term effects, the loss of biodiversity is an environmental threat in a class of its own. Yet it remains virtually ignored by our political leaders. True, the Rio Earth Summit in 1992 came up with a global Convention on Biological Diversity, which at least placed the issue on political radar screens. Despite some scattered remedial measures since Rio, however, the biotic crisis has continued to gain momentum. Species are disappearing faster than ever, at a rate conceivably 1000 times greater than in pre-human times. Looking back a few decades hence, will this loss of biodiversity not count as the single most significant issue of our era?

All this is spelled out in graphic terms in Edward O. Wilson's *The Future of Life*. The distinguished Harvard biologist opens his latest book with an account of life's capacity to occupy virtually every available niche on Earth. He describes "extremophiles," species adapted to the limits of biological tolerance. These include photosynthetic bacteria, microscopic invertebrates, fungi, and mites that inhabit the cold and dry environment of Antarctica; specialized microbes that flourish in volcanic hydrothermal vents on the ocean floor with water temperatures around boiling point; and marine organisms that survive at depths with pressures 1000 times greater than at the surface. Still other species prosper at altitudes much higher than Mount Everest. Such findings on "ultra habitats" prompt Wilson to speculate substantively on the scope for extraterrestrial life.

CREDIT: ISABELLA KIRKLAND

Memorial bouquet? Isabella Kirkland's *Descendent* (1999) depicts 61 globally endangered species.

The book then surveys our astonishing ignorance of life's panoply. We have only a vague idea of how many species exist, with estimates ranging from under 10 million to over 100 million. To date, biologists have formally described fewer than 2 million of them, and with the current rates of exploration and extinction we shall never have more than best-guess approximations.

Having demonstrated the unanticipated glory of life's variety, Wilson goes on to describe the underestimated threats to species and ecosystems. He reviews the survival bottlenecks that biodiversity faces in a world undergoing environmental disruptions on a planetary scale. It is a world where nature is making what Wilson designates as "last stands" in locations ranging from Hawaii to Mauritius and from Vancouver Island to deepest Amazonia. All of this is recounted with the stylistic brio that has earned Wilson two Pulitzer Prizes for previous books. Much of the story will not be new to biologists, but despite my three decades of working on biodiversity, I not only learned much but found *The Future of Life* to be the most lucid and vivid account I have come across in scores of books on the topic.

Wilson then assesses what is at stake for us in the precipitous decline of biodiversity. He presents numerous examples of what species contribute to our well-being by providing start-point materials for medicines, foods, and other products of our daily round. He emphasizes the huge array of environmental services supplied gratis by biodiversity, which include nutrient cycling, the formation and enrichment of soils, the detoxification of pollutants and other forms of waste, the provision of freshwater, the regulation of the atmosphere and climate, and the stability of ecosystems. (Some of these services are supplied by biomass as much as biodiversity, a facet that is left aside.) Equally valuable, Wilson postulates, is our sense of biophilia, "the innate tendency to focus upon life...and to affiliate with [it] emotionally." This is tough territory, open to much critical comment, but Wilson presents his case with persuasive conviction as well as calculation.

Lastly, Wilson asks what it would cost to save the planet's current biodiversity, principally through the protection of large expanses of key habitats. He offers a big-picture action agenda together with a few "best judgment" budgets. The price to buy out loggers (a prime source of damage) in tropical forests of Amazonia, Congo, and New Guinea would total $5 billion. To protect one-tenth of Amazonia from all threats would cost a mere $250 million, an amount equal to the bill for the failed Pathfinder probe to Mars (which was sent with the primary purpose of seeking new forms of life).

As an illustration of "silver bullet" conservation strategies, which contrast with across-the-board efforts, Wilson cites biodiversity hotspots, areas with exceptional concentrations of endemic species facing exceptional threat of habitat destruction. These 25 localities, covering only 1.4% of Earth's land surface, contain the last remaining habitats of 44% of the planet's plant species and 35% of terrestrial vertebrate species. They represent ecosystems that have already lost at least 70%, and many have lost 90%, of their original vegetation. Although the hotspot strategy has already attracted $700 million, supporters remain far short of the $25 billion estimated to complete the efforts. Protection of these hotspots would knock a huge hole in the current extinction problem.

This tightly targeted strategy apart, Wilson

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goes far toward asserting that we have reached the point where we can save biodiversity only by saving the biosphere. Protected areas serve to shelter biodiversity from threats—principally growth in human numbers and human activities that are becoming more threatening with every passing day. Therefore, beyond our need to expand the protected-areas networks, we need many more efforts to resist the overarching threats. Hotspots are only part, not even half, of the overall challenge. Among the many steps required to safeguard the biosphere, we must push back the deserts, replant the forests, preserve water supplies, reduce pollution, restore topsoil, and stabilize climate. Fortunately, these are all measures that we should be taking for all manner of additional good reasons. In short, the agenda Wilson advocates offers a win-win outcome.

When I saw the book's title, I thought Wilson was addressing an emergent new dimension to our current biotic crisis. Not only will the crisis eliminate large numbers of species, but it looks set to deplete the capacity of evolution to generate replacement taxa. This prospect should give pause to conservation planners. The networks of protected areas that are the focus of their efforts reflect present distributions of species, and this approach does not always protect future evolutionary processes. In a long-term perspective extending over the next several million years, we should surely assign equal priority to retaining evolution's capacity to restore the damage of the next few decades. Like all other books that address the preservation of biodiversity, Wilson's account does not broach this fundamental factor.

The Future of Life is vintage Wilson. After his three earlier books on biodiversity, one might wonder if the author has anything fresh to say. The answer is yes. Stacks. Wilson not only tells us how biodiversity is threatened, he shows us how we can relieve many of the threats. It all makes for another tour de force.

BOOKS: CHEMISTRY

The Elements of an Education

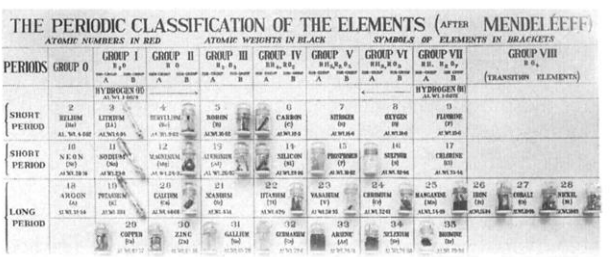
Leo P. Kadanoff

Oliver Sacks is a physician, scientist, and author known for his fascinating stories of people coping with amazing neurological disabilities. In *Uncle Tungsten*, he recounts his scientific boyhood in Britain during the period around World War II. Sacks was born into a large and close-knit family, and he was surrounded by relatives who made science both their work and their hobby. This memoir focuses on the traumas of his separation from family during the war, his fears of insanity, and the redemption he achieved through throwing himself into scientific studies. As Sacks tells his own personal and scientific life story, he also recounts the histories of his family and of the science of chemistry.

Uncle Tungsten
Memories of a Chemical Boyhood
by Oliver Sacks

Knopf, New York, 2001. 350 pp. $25. ISBN 0-375-40448-1. Picador (Macmillan), London. £17.00. ISBN 0-330-39027-9.

The early part of the book describes young Oliver's extensive and foolhardy chemical experiments. In a home basement laboratory, he acquaints himself with the properties of the different chemical elements by the classic processes of mixing and boiling, exploding and burning, and feeling and tasting and smelling. He is aided and abetted by a supportive family, especially his many uncles practicing science and engineering. The "Uncle Tungsten" of the title had created a firm that produced incandescent bulbs with tungsten filaments, and which he ran as businessman, inventor, and scientist. He and his nephew are both particularly taken with the properties of metallic tungsten. This uncle provides not only encouragement for chemical investigations, but also metallic samples, chemical reagents, and scientific instruments. Supportive parents—both are quite thoughtful physicians—provide lab space, a very necessary exhaust hood, and apparently inexhaustible patience. In this way, our young scientist-to-be becomes acquainted with most of the chemical elements and many of their more dramatic chemical properties.



Transforming table. The display of Mendeleev's periodic table at London's Science Museum showed Sacks how science can organize the results of experience and altered his life.

Oliver Sacks badly needs his world of chemistry. He finds much of his boyhood surroundings insupportably oppressive. During the bombing of London, the Sacks children were sent away to country schools where Oliver found sadism, loneliness, and an awful sense of abandonment. So upon returning home, he throws himself into science to escape a world that he has found to be largely intolerable.

The book's climax comes between chapters 15 and 16. At the end of chapter 15, Michael—the author's closest sibling—becomes psychotic and delusional. Oliver believes this illness to be the result of their shared wartime experiences and thinks that he is going the same way himself. But then, at the beginning of chapter 16, he enters the Science Museum in South Kensington, London, which had been closed during the war. There he encounters the museum's giant periodic table, which covers an entire wall at the top of the stairs. He realizes at once that the table enables him to order and organize the knowledge gained in his basement lab and from visits to his uncle's factories. For the first time, Sacks was able to feel not only the richness and diversity of the chemical world, but also science's capacity for giving structure to the results of experience. For a young man at wit's end, this organizing experience hit with all the force of being born again. In the book he recollects, "Seeing the table, 'getting' it, altered my life....it was real, a key to the universe."

Consequently, in 1945 Sacks extends his interest from the practical chemistry of the laboratory to the books of the museum library. He begins to learn about the history of chemistry. From his first point of reference, Mendeleev and the periodic table, he reaches back to older organizing principles in chemistry, particularly to Dalton's atomic theory. This autobiography presents Sacks's memories of learning the chemistry of 1945, but recounts this process with his wisdom and experience as of 2001. For example, he can say of Sir Humphry Davy (1778–1829) that "it was Davy's personality that appealed to me...filled with the exuberance and enthusiasm of a boy, with a wonderful adventurousness and sometime dangerous impulsiveness—he was always at the point of going too far—and it was this which captured my imagination above all." Of course, it is exactly these qualities in Sacks which make this book, and his other writings about science, exciting and unique.

Readers, from practicing scientists to intellectually curious high school students, can expect to appreciate the colorful life story recounted, the interesting person revealed, and the excellent history of chemistry retold. But please, dear parents, don't encourage your children to try the experiments, and don't think that *Uncle Tungsten* provides a primer for raising young scientists.

CREDIT: SCIENCE AND SOCIETY PICTURE LIBRARY/SCIENCE MUSEUM, LONDON

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