

Space Junk

"The Junkyard in Orbit" by Bhupendra Jasani and Martin Rees, in *The Bulletin of the Atomic Scientists* (Oct. 1989), 6042 S. Kimbark, Chicago, Ill. 60637.

Space may be the Final Frontier, but it is also fast becoming the Ultimate Junkyard.

In addition to the roughly 350 active satellites orbiting the Earth in "inner space," there are some 7,000 hefty pieces of space garbage—including upper stages of launchers, booster motors, and dead satellites. Far more hazardous are the 30,000–70,000 pieces of junk, ranging in size from one to 10 centimeters, that are too small to track from Earth. These include fragments of exploded satellites, screwdrivers left behind by absent-minded astronauts, and assorted other detritus. Then there are billions of even smaller bits and pieces from the same sources.

It's an accident that's not waiting to happen, write Jasani and Rees, researchers at

Britain's Royal United Services Institute and its Institute of Astronomy, respectively. In July 1983, for example, the U.S. space shuttle *Challenger* was hit by a speck of paint (0.2 millimeter in size) that chipped one of its windows. Several mysterious satellite failures over the years may well have been caused by collisions with space trash. It is only good luck that no lives have yet been lost, the authors say.

Jasani and Rees favor a treaty among the space-faring nations to stop the expansion of Earth's Junk Belt. Much of the space junk is needlessly lost in space: spent rockets are left in orbit, and defunct satellites are frequently blown up for security reasons. In the future, such leftovers could be safely returned to Earth.

RESOURCES & ENVIRONMENT

Apocalypse: The Sequel

"The End of Nature" by Bill McKibben, in *The New Yorker* (Sept. 11, 1989), 25 W. 43rd St., New York, N.Y. 10036, and "A Reconnaissance-Level Inventory of the Amount of Wilderness Remaining in the World" by J. Michael McCloskey and Heather Spalding, in *Ambio* (No. 4, 1989), Pergamon Press, Maxwell House, Fairview Park, Elmsford, N.Y. 10523.

"I believe that we are at the end of nature," announces Bill McKibben, a frequent contributor to the *New Yorker*. "The rain will still fall and the sun will still shine," he says, but as the greenhouse effect inevitably reshapes the earth's climate, and the face of the world itself, "our sense of nature as eternal and separate" will be overturned.

Automobiles, industrial smokestacks, coal-burning powerplants, and the burning of forestland in Brazil and British Columbia all contribute to the build-up of carbon dioxide in the atmosphere that is chiefly responsible for the greenhouse effect. There is little doubt, McKibben asserts, that the average global temperature will increase by three to 10 degrees Fahrenheit within the next 80 years.

The change in climate and its impact on

the landscape—forests will retreat, deserts grow—will transform the very workings of the world. Heat waves and hurricanes, for instance, will no longer be seen as "natural" occurrences but man-made phenomena. The idea of nature as an untamed force, "such as man never inhabits," as Thoreau put it, will cease to exist.

As McKibben observes, environmentalists have warned of various global ecological catastrophes ever since Rachel Carson's famous *Silent Spring* (1962). He tends to agree with those optimists, such as economist Julian Simon, who believe that human ingenuity will ultimately prevail over such challenges as pesticides, nuclear wastes, and even the greenhouse effect. But the solutions, he believes, are part of the problem. We can invent new ways to keep ourselves alive on an increas-

ingly inhospitable planet, for example, by genetically engineering "supercucumbers" to thrive in severe heat or "injecting" sulfur dioxide into the stratosphere to reflect the sun's rays back into space. But the closer we move toward finding salvation in a "macromanaged" world, the more we hasten the end of nature.

But is there any way to quantify this dire forecast?

As it happens, McCloskey and Spalding, chairman and researcher, respectively, at the Sierra Club, recently completed a survey of the world's remaining wilderness. They report that one-third of the globe

(about 19 million square miles) still belongs to nature. However, 41 percent is found in the Arctic or Antarctic and only 20 percent in the temperate regions. Most of the settled continents, except Europe, are between one-quarter and one-third wilderness. The United States is only five percent wilderness; nearly two-thirds of Canada, one-third of the Soviet Union, and one-quarter of China remain wild.

Of the dwindling stock of wilderness, less than 20 percent is being protected. But there is still a chance, these authors believe, "to maintain some measure of balance between 'man and nature.'"

Water Wars

"Trouble on Tap" by Sandra Postel, in *World*Watch* (Sept.-Oct. 1989), 1776 Mass. Ave. N.W., Washington, D.C. 20036.

Like the proverbial free lunch, the bottomless well is becoming a thing of the past. From the American West to the North China Plain, governments are struggling to come to terms with the fact that there is only so much water to go around.

The situation is most severe in the arid Middle East, reports Postel, a vice president of the Worldwatch Institute. Israel's Meir Ben-Meir, former minister of agriculture, predicts that a war over water is "unavoidable if the people of the region are not clever enough to discuss a mutual solution to the problem of water scarcity." Egypt's foreign minister, Boutros Ghali, fears a war over access to the waters of the Nile. Rapidly growing Egypt, which relies on the Nile for virtually all of its water, has water-sharing agreements with Sudan, where the Blue and White Niles meet, but not with other nations farther upstream. What happens when upstream users such as Ethiopia and Tanzania begin drawing on Nile headwaters more heavily?

In India, the problem is not so much scarcity as poor management of water. The government has spent \$12 billion on dams to capture runoff during the June-September monsoon season, but it has also allowed massive deforestation in many watersheds. As a result, underground aquifers are not being replenished.

Now, many neighborhoods in New Delhi receive running water only sporadically.

Mismanagement of a different sort plagues the Soviet Union. To irrigate the orchards and cotton fields on the fertile plains of Soviet Central Asia, Moscow has tapped two rivers that feed the Aral Sea. As the Aral shrinks, drying salt is swept by the wind onto nearby farmland, where it settles like a poison. Restoring the sea to its pre-1960 condition would require a 60 percent reduction in land under irrigation, a loss worth \$30 billion annually.

"Common to these tales of shortage is the near-universal failure to value water properly," says Postel. Allowing users to buy and sell water rights, as they now can in much of the American West, is part of the solution. That will encourage a more rational use of water in places like California, where irrigated cattle pastures consume as much water as all of the state's 28 million residents. (Even the Soviet Union is planning to begin charging water users by 1991.) Conservation should also increase. Lining irrigation canals with impermeable materials, drip irrigation, and other techniques can cut farm water use by 20 to 30 percent. A California conservation effort is expected to save enough water to serve 800,000 people. (In the United States, a family of four consumes about