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Dust in the Wind: **Fallout from Africa May Be** **Killing Coral Reefs an Ocean Away**

by John C. Ryan

Excerpted from January/February 2002 WORLD WATCH magazine

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1776 Massachusetts Ave., NW
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Coughing her way downriver on a slow boat to Timbuktu, Ginger Garrison is a little out of her element. As Bozo tribesmen pull catfish from the Niger River and boatmen pole their dugout canoes through the midday gloom, the strong winter wind known as the harmattan lifts clouds of fine red dust into the air, and into the eyes and lungs of people throughout the dry North African region known as the Sahel.

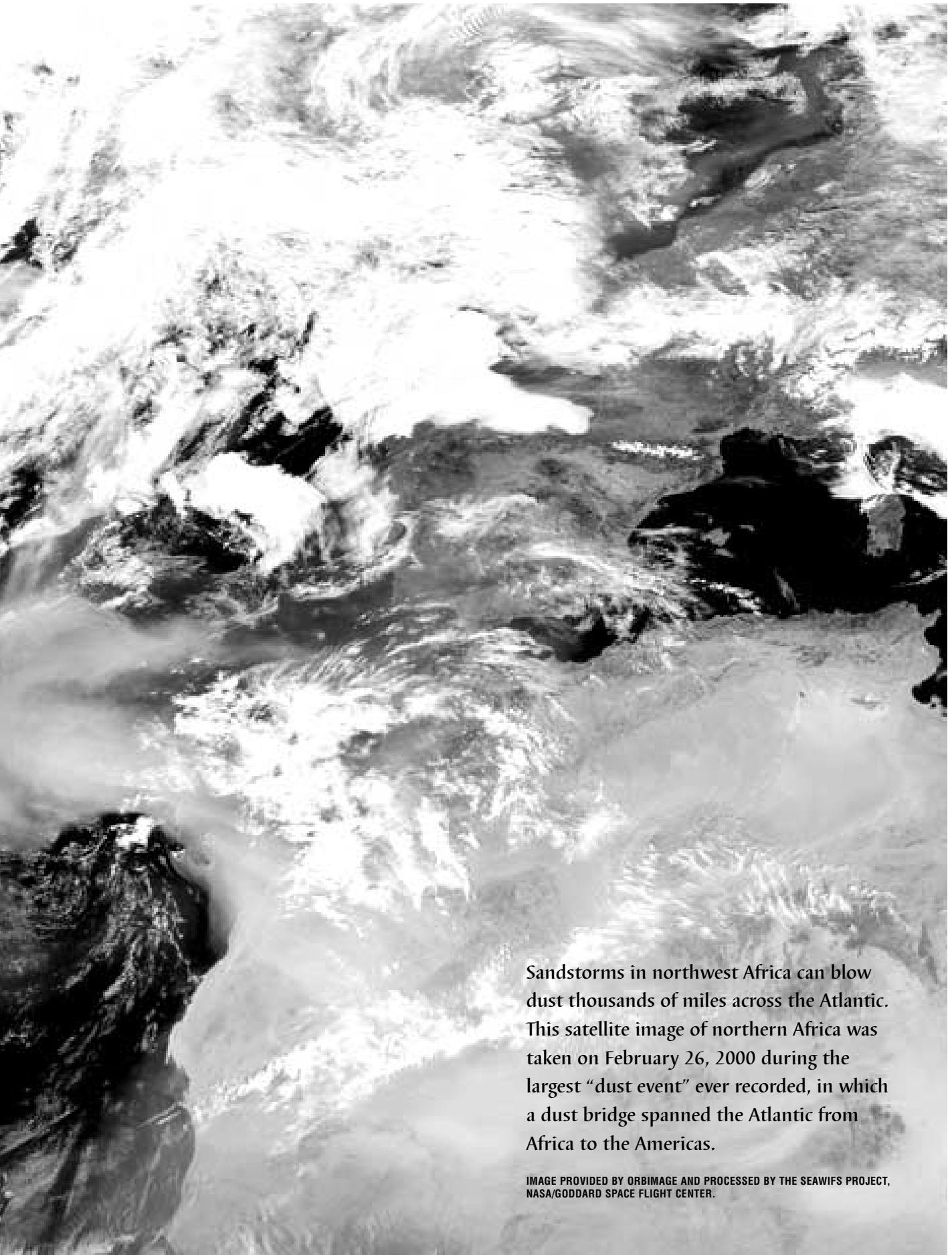
The only breathing difficulty Garrison, a marine ecologist, usually has to worry about is emptying her scuba tank too fast in the gin-clear, bathtub-warm waters of Virgin Islands National Park in the U.S. Virgin Islands. Garrison, a U.S. Geological Survey (USGS) researcher whose work has focused for nearly 20 years on Caribbean coral reefs, has come here to Mali seeking a source of one of the most widespread ecological collapses ever documented.

An ocean away from the Sahel, coral reef ecosystems around the Caribbean are dying, and scientists are beginning to think that dust from Africa is playing a major role in their collapse. Overfishing, sedimentation, and direct damage from boats and divers, among other threats, have combined with pathogens, climate changes, and hurricanes to severely degrade reefs around the region. Diseases and bleaching have decimated once-dominant species like staghorn and elkhorn corals, longspine sea urchins, and sea fans. Few species or sites have recovered, and carpets of algae—flourishing in the aftermath of overfishing and die-offs of sea urchins and other algae-eaters—now dominate many Caribbean reefs.

Yet researchers remain puzzled by the decline of reefs in apparently pristine stretches of the Caribbean, far from the usual suspects behind coral decline. “We really don’t understand why this is happening on a regional level, and it’s happening not only in areas where there are a lot of people, it’s also happening on remote reefs. Why?” asks Garrison.

Ever since Charles Darwin noted “the falling of impalpably fine dust” while crossing the Atlantic during his famous scientific voyage aboard the *Beagle*, seafarers and researchers have observed African particulates far out to sea. But most studies of atmospheric dust have focused on its





Sandstorms in northwest Africa can blow dust thousands of miles across the Atlantic. This satellite image of northern Africa was taken on February 26, 2000 during the largest “dust event” ever recorded, in which a dust bridge spanned the Atlantic from Africa to the Americas.

IMAGE PROVIDED BY ORBIMAGE AND PROCESSED BY THE SEAWIFS PROJECT, NASA/GODDARD SPACE FLIGHT CENTER.



potential impacts on the global climate. Only recently have researchers begun exploring the possibility that the hundreds of millions of tons of African topsoil blown by prevailing winds to the Caribbean each year might be having direct, harmful effects on ecosystems and people there.

Dust reaching the opposite shore of the Atlantic is nothing new. Haze from the Sahel occasionally reduces visibility and reddens sunsets from Miami to Caracas, and is the source of up to half the particulates in Miami's summertime air. Pre-Columbian pottery in the Bahamas is made of windborne deposits of African clay; orchids and other epiphytes growing in the rainforest canopy of the Amazon depend on African dust for a large share of their nutrients.

Joseph Prospero of the University of Miami has tracked dust falling on Barbados, at the far eastern edge of the Caribbean, since 1965. He discovered a sharp increase in dustfall around 1970, coinciding with the onset of prolonged drought in North Africa. The changed African climate, combined with widespread overgrazing of livestock and the spread of destructive, often export-oriented farming practices in the Sahel, were sending vastly greater quantities of exposed soil into the sky. In peak years, winds now drop four times more dust on Barbados than they did before 1970. Satellite photos of the largest dust event ever recorded, in February

2000, show a continuous dust bridge connecting Africa and the Americas.

In the late 1990s, Gene Shinn and other researchers with USGS noted that benchmark events in the prolonged, Caribbean-wide decline of coral reefs—like the arrival of coral black band disease in 1973, mass dieoffs of staghorn and elkhorn corals and sea urchins in 1983, and coral bleaching beginning in 1987—occurred during peak dust years.

Researchers have since found a variety of live bacteria and fungus in dust hitting the Caribbean, defying conventional wisdom among microbiologists that microbes could not survive a five-day trip three miles up in the atmosphere. "Swarms of live locusts made it all the way across alive in 1988 and landed in the Windward Islands," Shinn says. "If one-inch grasshoppers can make it, I imagine almost anything can make it." A 2001 study by USGS researchers found that the number of viable fungus and bacteria in Caribbean air is two to three times higher during dust events than during normal weather conditions.

Although the vast majority of diseases afflicting coral have not been identified (beyond descriptions of the symptoms they cause), scientists have linked dust to at least one specific coral-killing microbe. Garriet Smith and colleagues at the University of South Carolina have identified the pathogen behind the mass die-offs of sea fans, the graceful soft corals

of the Caribbean, as *Aspergillus sydowii*—a soil fungus that does not reproduce in salt water. In the very first sample of airborne dust from the Virgin Islands that Ginger Garrison sent to Smith, he found live *Aspergillus sydowii* in its pathogenic form, among many other microorganisms. The fungal disease may also enter the sea in local runoff from deforested areas, but dust studies have established African dust storms as its most plausible source on isolated reefs and near small islands with no forests and little runoff.

In addition to carrying living hitchhikers, clouds of African dust bring intense pulses of nutrients like iron and nitrates that may be stimulating harmful algal blooms and the rapid growth of both coral-smothering algae and microbes that cause coral diseases. Microbiologist Hans Paerl of the University of North Carolina calls the dust—composed of aluminum, silicon, iron, phosphates, nitrates, and sulfates—“Geritol for bugs.”

The dust is not so healthy for humans, if only because the fine particles irritate the respiratory tract and can lodge themselves deep in lung tissue. Researchers have barely begun looking into the health effects of overseas African dust but already have some provocative findings. For example, they have found pesticides banned for use in the United States mixed in with dust particles too small for human lungs to expel. “When they have locust plagues in Africa, we get chlordane and DDT that we can’t use here anymore, but it comes back to us on the wind,” Shinn says.

There may be other unhealthy substances adhering to the particles as well: some studies suggest the dust carries high concentrations of beryllium-7, a radioactive isotope that appears to adhere to dust particles as they travel through the atmosphere. While seeking medical care for her respiratory tract infection in Mali’s capital of Bamako, Ginger Garrison asked around and found that lung problems are terribly common in Mali during the dust season. After the seasonal floods of the Niger River recede and its banks dry, mud—mixed with raw sewage, human and animal waste, and miscellaneous garbage left behind—turns to dust. “Microbes, synthetic organics, pharmaceuticals, antibiotics, you name it,” Garrison explains. “Then the winds come, and it’s a perfect avenue to take those substances aloft, often north toward Europe or west toward the United States.” She also observed the ubiquitous garbage burning and wonders what carcinogens, endocrine disrupters, or heavy metals from garbage burning might also find their way into the atmosphere with dust. She hopes to set up a second monitoring station near Bamako to look for heavy metals and synthetic chemicals like DDT, in addition to the station she set up in late 2000 for monitoring microbe levels in dust.

Africa is not the only source of dust that affects faraway places. Nutrients from the deserts of northwestern China sustain Hawaiian rainforests growing on weathered soils. Chinese haze has long afflicted residents of Japan and Korea, where the yellow dust, laden with pollutants picked up from Chinese cities it passes over, is called “the gate-crasher of Spring.” South Korean officials suspect that the dust may have been the source of a recent outbreak of foot-and-mouth disease among cattle along Korea’s west coast. Last Spring, Korea suffered through 20 days of unhealthy haze from abroad, the longest yellow dust spell there in 40 years. Chinese dust even caused hazy sunsets around the western United States for several days in April 2000. The Chinese, Japanese, and South Korean governments have launched a program to revegetate dust-generating lands in China, and researchers from around the Pacific Rim have begun intensive studies of Chinese dust and its impacts.

To date, the dust blowing from Africa—unlike Chinese dust—has attracted little attention as a public health issue. The desertification (severe degradation of arid and semi-arid lands) that exacerbates dust formation also has serious economic and human consequences close to home: one in six people in Mali have become environmental refugees, forced to leave their land as it turns to dust. Despite the massive amount of land claimed by expanding desertification each year, the phenomenon receives only infrequent attention, perhaps because the effects seldom seem to transcend international borders. These new studies of well-traveled dust may turn that impression on its head.

Given all the locally generated pollution in the Caribbean, it’s understandable that African dust is on few people’s radar screens. But reversing the decline of the region’s once flourishing underwater ecosystems may be impossible without investing more effort in stabilizing the wind-whipped lands of northern Africa.

“It’s just another example of how small the Earth is, and how so many things are interconnected: global processes mixed up with how people live their lives,” says Garrison. The mounting evidence of damaging fallout thousands of miles from sources of dust may help convince the rest of the world to pay more attention again to the forgotten, dusty corners of planet Earth. “Maybe we’re not quite as isolated as we thought from areas with major health problems,” says Garrison. “And maybe we should be more concerned about the welfare of people and the land in these far away places.”

Former Worldwatch Institute researcher John C. Ryan is a Fellow of the New America Foundation and author of *State of the Northwest 2000*.