

The Geography of Breast Cancer

BY FRANCESCA LYMAN

WHY ARE THERE "HOT SPOTS" OF THE DISEASE IN THE UNITED STATES?

A DOGGED GROUP OF SURVIVORS, SCIENTISTS AND MAPMAKERS ARE DETERMINED TO FIND OUT



Living on the wild, craggy elbow of Cape Cod, Jane Chase feels lucky to have spent 50 years in a house facing Nantucket Sound. "We love it here," she says, looking out over a marsh at a spectacular sunset on Red River Beach, where the water gleams with kayakers, sailors and fishermen.

It wasn't until a few years ago, when a community effort was launched to understand the strangely high rate of breast cancer on Cape Cod, that the mother of six considered her South

Harwich, Mass., home to be anything other than a bucolic haven.

The two-time breast cancer survivor, who was 57 when first diagnosed in 1991, might never have linked her disease to the environment had she not joined a local cancer group and later enlisted in a household health study. She then learned that her classic colonial garrison house harbored lurking toxins, and that her idyllic neighborhood had likely been aerially sprayed with now-banned organochlorine pesticides such as DDT.

“People still feel that clearly something other than genetics is going on. It’s in our air, water and food.”

—geographer Scott Carlin

“I don’t remember the sprayings of the *mash*,” says Chase (resting on the word *marsh* with a Massachusetts-flattened inflection), “except to know they happened and then were stopped at some point. You live in such a special place, you can’t imagine that there might be some towns here with higher pollution than in the city of Boston, simply because of prevailing winds and chemical sprayings.”

Cape Cod, with a breast cancer rate 20 percent higher than the rest of Massachusetts, is just one of several places around the United States with the dubious distinction of being a “hot spot” on our nation’s increasingly lit-up breast cancer map. It’s joined by Long Island, Marin County and San Francisco—places where controversy has brewed for years—and newly emerging areas such as Washington state and Florida.

A large cluster of elevated mortality rates for breast cancer, extending from the Mid-Atlantic through the Northeastern states and west to the Great Lakes, has been apparent for many years, according to National Cancer Institute research published in the *American Journal of Epidemiology*. In the Northeast, rates are about 16 percent higher than the rest of the U.S. and in the smaller swath from New York City to Philadelphia rates are 7.4 percent higher than the rest of the Northeast.

The reasons for variable rates of the disease are not well understood, according to Deborah Winn of the National Cancer Institute. But what is clear is that the discovery of hot spots both in the United States and around the world have sparked a new breast-cancer environmental movement, with strong local advocacy groups as well as new national groups. Could these cases of breast cancer be caused by conditions in the places where they occur—in the land, air, water and our food?

Long Island activists began drawing their own maps in 1992, pinpointing neighbors’ homes as if they were battlefield targets. Lorraine Pace, founder and co-president of Long Island-based Breast Cancer Help Inc., remembers getting a call from Bella Abzug, who was holding a women’s conference on the environment, asking her to “bring those maps to City Hall”—thus introducing what became a new tool in the activists’ arsenal. Ironically, says Pace, Abzug herself was diagnosed with breast cancer several months after.

As more hot spots were identified, each touched off a surge of interest. “When a group of advocates got their

hands on an incidence and mortality report from Northern California,” says Janice Barlow of the Marin County-based group Zero Breast Cancer (formerly Marin Breast Cancer Watch), “it began an arc of advocacy that spread across the Bay Area.”

On Cape Cod, women “called on researchers, like ourselves, to begin studying the problem,” says Julia Brody of Silent Spring Institute, in Newton, Mass. Long Island activists went to Congress for research funding to investigate possible environmental factors.

“They felt there was a bias in the scientific literature toward ‘known risk factors’ for the disease, and that these tend to reside with the personal [factors]—like [use of] alcohol, tobacco and birth control,” says Scott Carlin, a geographer at Long Island University, who helped Huntington (Long Island) Breast Cancer Coalition create community maps to study their area. “And there’s not an equally well-studied and known list of risk factors in the environmental spheres.”

Even state governments have gotten into the act. New York, Massachusetts and California have mounted efforts to better track breast cancer rates and evaluate whether specific environmental factors might be causing them.

The first flurry of environmental studies, however, proved disappointing. As *Artemis*, the journal of the Johns Hopkins Breast Cancer Center, wrote in 2001, “Unfortunately, direct associations between specific environmental factors and such cancer clusters have been maddeningly inconclusive.”

The next year, the long-awaited Long Island Breast Cancer Research Study failed to find a link between the breast cancer hot spot and organochlorine pesticides. “And that’s been a big disappointment to many women here,” says Carlin. “People still feel that clearly something other than genetics is going on. It’s in our air, water and food.”

Activists and scientists have not stopped pursuing the environmental questions, though. Far from it: Interest in environmental factors is *growing*, says Kevin Donegan of the Breast Cancer Fund (BCF), one of several national breast cancer advocacy groups that formed in the 1990s. “Our own polls show an overwhelming majority of people believe that pollution of various kinds is driving this disease,” he says.

So the question remains: Can that belief be translated into scientific evidence?



Left: Lorraine Pace (left), founder and co-president of Long Island-based Breast Cancer Help Inc., points out a breast cancer incidence map in 1997 to Lee Grant, producer and director of a Lifetime Television documentary on breast cancer. Right: Bella Abzug in 1995, after becoming active in the environmental movement against breast cancer and being diagnosed with the disease herself.

In 2006, some 270,000 U.S. women—and men, too, since a small percentage are prone—will learn that they have some form of breast cancer, the secondmost common cancer in women. The American Cancer Society predicts that, of those cases, more than 40,000 will die of the disease in 2006. Worldwide, an estimated 1.2 million people will be diagnosed with breast cancer this year, but women living in North America maintain the highest rate of the disease.

Breast cancer is what scientists call “multifactorial,” in that a variety of genetic, environmental and lifestyle factors are thought to play a role. The American Cancer Society attributes 5 to 10 percent of the risk of developing the disease to genetic predisposition. Another substantial component of the risk has been linked to reproductive/hormonal factors, such as earlier menarche, later menopause, waiting longer to have children and having few (if any) children.

But these “known” risk factors leave much unexplained. So researchers have also looked to diet, lifestyle (smoking, exercise, alcohol) and exposure to environmental toxins in the air, water and food. In the view of establishment groups such as the American Cancer Society and the NCI, however, the environment is an unlikely reason for the

Instead, they point to demographics, access to mammography (the more available it is, the more breast cancer is diagnosed) and reproductive factors. For many breast cancer activists, this lack of attention to the physical environment is frustrating. And certainly, Jane Chase, with her large family of six kids and young age at motherhood, is living proof that having children early and often is no guarantee of being *protected* from breast cancer.

“One of the reasons that the U.S. is lagging in understanding about the environmental causes of the disease is that those don’t get nearly enough attention or research dollars,” says Jeanne Rizzo, director of the BCF. “This generation is getting sicker rather than healthier, and we need to understand why.”

Federal funding for breast cancer research since 1991 has totaled \$6.8 billion, according to BCF’s 2006 report, *State of the Evidence*, but only a small percentage of that has been directed toward studying environmental connections to the disease. Nonetheless researchers have begun testing theories on whether the skyrocketing rates of breast



For example, Richard G. Stevens, a cancer researcher at the University of Connecticut Health Center in Farmington, has explored exposure to artificial “light at night” as a potential risk factor. This theory, he says, is supported by epidemiological studies that have found increased breast cancer among women who do shift work at night, such as nurses and high-tech workers.

Another active area of study is the role of sunlight and vitamin D, since scientists have found higher rates of cancer at higher (and thus less sunny) geographic latitudes. “One interesting hypothesis is the lack of sunlight here in the Pacific Northwest, which has been linked to lack of vitamin D,” says Juliet VanEenwyk, Ph.D., public-health epidemiologist with the Washington state Department of Health. “Oregon is usually right up there in the [high rate of breast cancer] statistics with [Washington].”

Other researchers have long theorized that chronic exposure to a number of widespread and persistent industrial chemicals may explain the continuing increase in many cancers in industrial countries (including those of Western Europe). That may be one important factor in the development of breast cancer, says Dr. Robert Hiatt, a professor of epidemiology and biostatistics at the University of California, San Francisco: “Although women are much the same biologically, there’s such a vast disparity in breast cancer rates between the U.S. and Europe, and Southeast Asia—by a magnitude of as much as fivefold. It can’t be [solely] genetic.”

Studies have found, too, that when women in developing countries, particularly in Asia, migrate to industrialized areas, their cancer rates rise within a generation. Some researchers maintain that this trend may be blamed on Western diets, while others argue that it reflects the advent of many new synthetic chemicals after World War II, including petrochemicals and plastics. These chemicals’ presence in the environment has leapt 350-fold in the last five decades, according to Theo Colborn, Dianne Dumanoski and John Peterson Myers in *Our Stolen Future: Are We Threatening Our Own Fertility, Intelligence, and Survival?—A Scientific Detective Story* (Dutton Books, 1996). They argue that since many of these chemicals are hormone-disrupting, they may well contribute to the rise in reproductive cancers and other chronic diseases.

But it is difficult, if not impossible, for epidemiologists who track diseases to pin down the precise array of factors that cause them. Like other cancers, breast cancer has a long latency period—typically 20 or more years—and before it can be detected, people have moved, died or been exposed to other factors that promote or retard the disease.

Enter the mapmakers. An exciting new tool of epidemiological researchers, including those studying the environmental triggers for breast cancer, is the Geographic Information Systems (GIS). GIS is a computer-aided system that

makes it possible to combine and integrate, and then display (most commonly as a map) geographically referenced information that is otherwise difficult to correlate.


Geographic mapping of diseases goes back at least a century and a half to public-health researchers like John Snow, who in 1855 famously traced London cholera outbreaks to a pump over a contaminated water source. Sophisticated GIS maps can reconstruct past exposures to contaminants, allowing researchers to hone in on particularly vulnerable life stages for cancer, such as fetal development, infancy and puberty.

“Geographic data can add another dimension to the mix,” says Silent Spring’s Brody, “because it can answer questions about the environment that women can’t answer for themselves—like whether their neighborhood was sprayed for gypsy moths.”

In one study, which looked at pesticides and breast cancer on Cape Cod, researchers using GIS maps found that those who had lived on the Cape for five or more years had a higher risk of breast cancer than those who hadn’t. Women who had lived there for 25 to 30 years had the greatest odds for developing the disease.

On Long Island, one key geographic finding was that residents living within a mile of hazardous waste sites containing organochlorines (which include DDT and dioxin) had higher rates of breast cancer. And last year, researchers at SUNY Buffalo reconstructed a group of nonsmoking women’s lifetime exposures to PAHs (polycyclic aromatic hydrocarbons, chemicals formed by incomplete burning) in auto exhaust, and found key correlations to breast cancer rates.

Back in Cape Cod, Jane Chase now eagerly follows the results of recent studies looking into her own local environment. Researchers from Boston University found that the chemical perchloroethylene (PCE), which had accidentally leached into the upper Cape Cod water supply, was associated with a small to moderate increase in breast cancer. Another study, released by University of Massachusetts-Lowell and the Boston University School of Public Health, found that childhood cancer cases in the Cape Cod area increased 21 percent between 1975 and 1998.

An aerial photograph of a landscape, possibly a coastal area, with topographic contour lines overlaid in blue. The contours are labeled with numbers: 1200, 1300, 1300, 1400, and 1400. A blue arrow points upwards from the bottom of the page towards the center of the map. The text of the article is overlaid on the left side of the image.

Sophisticated GIS maps can reconstruct past exposures to contaminants, allowing researchers to hone in on particularly vulnerable life stages for cancer, such as fetal development, infancy and puberty.

Not all of the U.S. hot spots may reveal as strong a body of environmental evidence as that emerging from Cape Cod. But many other studies are now under way, both in Long Island and in California.

“We want to find out: Does living near areas with high agricultural use lead to higher rates of breast cancer?” says Peggy Reynolds, a cancer epidemiologist at Northern California Cancer Center. “If only we could go back in a time machine and capture key data.” Reynolds says she is now looking at how regional differences in exposures to toxic air pollutants in California affect breast cancer risk, using geo-coded data.

Meanwhile, Janice Barlow’s Zero Breast Cancer group awaits results of a study looking at the soils of Marin County, which may reveal the potential for human exposures to heavy metals from mining, like cadmium, which has recently been linked to breast cancer. The ongoing government-sponsored “Sister Study” may also be revealing: It’s gathering a multitude of data—from blood, urine and toenail clippings to household dust—in order to analyze the role of environmental exposures and lifestyle factors in the development of breast cancer.

In the meantime, many quote the mantra of a Huntington breast cancer group: “Prevention is the cure.” “The best solution now is to phase out those products and processes that we know cause health problems,” says Donegan of the Breast Cancer Fund. He argues for creating new standards in the marketplace that will phase out chemicals and other hazards before we have to wait for 95 percent scientific proof of their danger.

A few cities and counties have already adopted “toxics reduction” or “precautionary” purchasing laws to encourage products that are free from cancer-causing chemicals—so that less of the bad substances will enter our homes, be dumped in our landfills and pollute our air and water. These concerted efforts are essential, say advocates, since individual efforts can’t go very far in tackling the large environmental problems.

Jane Chase says she’s particularly concerned for those women living in the higher-risk hot spots, like her six children and nine grandchildren on Cape Cod. “Instead of just focusing on treating and curing those who are unfortunately afflicted now,” says Chase, “we need to learn about all of the factors that are triggering and promoting this disease so that we can prevent it from attacking future generations.”

FRANCESCA LYMAN is the author of MSNBC’s award-winning “Your Environment” column and has written two books, *The Greenhouse Trap* (Beacon Press, 1990) and *Inside the Dzanga-Sangha Rainforest: Exploring the Heart of Central Africa* (Workman Publishing, 1998).