**Part 7** in an ongoing series about our realignment, as models of reality shift from being analog to being digital.

*The environmental sensing station in New York's Black Rock Forest consists of a wind-speed and -direction monitor, a device that measure solar radiation, and one that tracks the air's temperature and its relative humidity. Soil temperature and barometric readings are also collected, and all the information is fed into a computerized data-logger for downloading. Several feet away, one bin collects and measures precipitation and another records the acid deposition of rain or snow. Below, images from the Environmental Simulation Center at New York's New School for Social Research help residents of West Milford, New Jersey, envision what their town will look and feel like once new businesses arrive and new houses are built.*
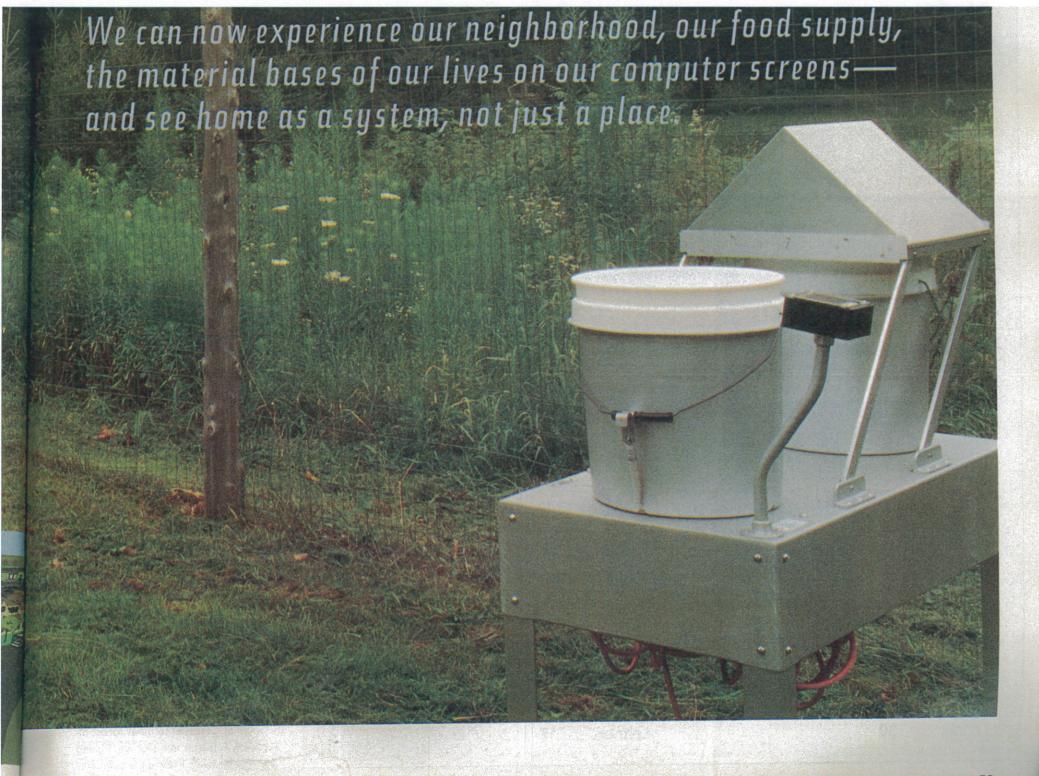
by Andrea Moed  I'm accustomed to gauging the weather from inside various tall buildings where I live and work by raising the window slightly and thrusting a hand through the security bars. With palm open toward the skies, I try to imagine how the atmosphere assailing my fingers would feel to the rest of my body, were I to venture outside. Now, thanks to the Internet, I need never stick my hand out a window again. With my high-bandwidth connection to the information superhighway, I am more likely to point to the bookmarked page on the World Wide Web that displays the current New York City weather, connecting me to my environment in bland prose and degrees Fahrenheit. If I'm lucky, the local weather-cam might be on, with its continuously refreshed view out over the Manhattan skyline. Then, I don't even have to raise the blinds. Of course, the weather conditions of dozens of cities and towns are just as accessible as New York's. In effect, I can stick my hand out and see how it feels in Honolulu, if I like.

I have wondered more than once if this weather-surfing isn't a frivolous use of what media critic Marshall McLuhan called "the extensions of man." Like armchair tours of historic houses and virtual shopping malls, worldwide weather sites seem like telecommunications for its own sake, yet another sign of the placelessness upon which the Internet insists. Yet the more I browse the weather elsewhere, the more keenly aware I am of my own location. "Temperature, 94 degrees. Humidity, 95 percent," reads one entry; when I calibrate the numbers with the oppressive heaviness of the air, I am hit with a profound sense of place—the sense of being stuck here. At 85 degrees and 90 percent humidity, Westhampton, a mere 72 miles away, might as well be Honolulu.

Part of the ongoing rhythm of living in the city is the periodic desire to get out. New Yorkers typically come around to this in the summer, as the air grows thick, noisy, and grim. Meanwhile, the local magazines and produce bins are filled with hints of the mildness that lies just hours up the Hudson River from here: the fields where the tomatoes and strawberries are grown, the quiet meadows where the wildflowers sold at the greenmarket are picked ▶ 54

# sensurround

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illegally, the fragrant woods where backpackers go for weekend getaways and the aptly named Fresh Air Fund sends needy kids to camp. As advocates of sustainable urbanism would remind us, New York City is part of the Hudson River bioregion, its well-being dependent on the preservation of less developed areas further up the river. All year round, the upper Hudson River and Valley is the source of a significant portion of the city's fresh food. But only in the summer does the city feel its need for the country with such blistering clarity.

The Hudson Highlands region has an especially long history as a haven for urban escapists. Fifty miles north of Manhattan, its vistas of ancient mountains descending 1,000 feet to the river have been sites of inspiration, therapy, and profit for landscape painters, convalescing patients, and wealthy landowners, among others. In the 1960s, when the local utility threatened to scar the face of a Hudson River gorge with an ill-placed power plant, these boosters for scenery launched a protest that lasted more than a decade, blocked the construction of the plant, and got nationwide attention as a harbinger of the new environmental activism. Since then, the urbanites coming here have been as concerned with preserving the highlands as they are with fleeing the city, founding institutions such as Scenic Hudson, the Museum of the Hudson Highlands, and more recently, the Black Rock Forest Consortium. The consortium is a group of public and private schools and research institutions that manage Black Rock Forest, a beautifully preserved 3,750-acre area in the heart of the highlands. Its members use the forest as a field site for science and environmental education at all levels, from elementary to postgraduate. For the many children who visit every year, Black Rock provides that typical experience—the seasonal field trip to where "nature" is.

The education that goes on at Black Rock is far from typical, however. Consortium schools, such as Manhattan's Columbia University and the private school Dalton, bring students there for intensive programs, from solo hikes to video shoots. Tellingly, Black Rock is one of the world's few forests with its own Web site (http://www.nltl. columbia.edu/Groups/BRF/home.html). The site is now home to the Black Rock Consortium's latest project, the Virtual Forest Initiative (VFI).

Rather than a virtual reality demo of trees, the Virtual Forest is Black Rock Forest itself, as transmitted by two environmental sensing stations, one set up in a lowland field and another on a ridge-top. Each station is a tripod-mounted, solar-powered assembly of automated equipment that is constantly extracting data from the natural world around it. A thermometer and a buried soil probe take the air and ground temperatures; a solar cell measures the sun's radiation; a canister collects rainfall; and an object resembling a toy propeller plane gauges wind speed. Measurements are taken every few minutes, then transmitted by radio to the office of Black Rock Forest director William Schuster, where each week the data is transferred to a spreadsheet and sent down to the Dalton School's New Lab for Teaching and Learning, to be posted on the Web. As a result, data that can be gathered only through close-range observation of the forest is made available to anyone with a computer.

The purpose of the Virtual Forest Initiative is to make the forest a permanent presence, and not just a field trip, for students. "As a city school, we don't get to the forest enough," says Rachel Packman, who coordinates the VFI from the New Lab at Dalton. "We wanted to create a context for the visit." In particular, consortium edu-

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Soon after Packman and I spoke, I took my own field trip upriver to see how the expanding virtuality of Black Rock Forest was affecting the experience of actually being there. I drove to the town of Cornwall to meet forest director Bill Schuster in his office. Pulling into the driveway, I saw a pleasant rur-

al retreat with an eight-foot tower of mechanical equipment out back—one of the environmental sensor stations. "Some satellite dish," I imagined the neighbors saying.
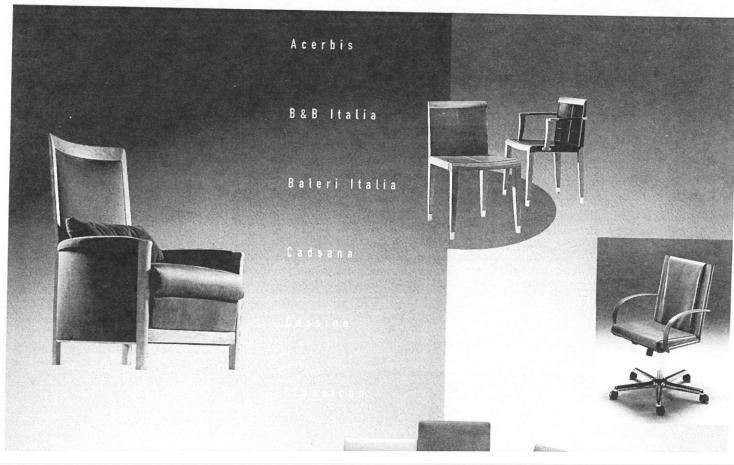
Inside, I found Schuster and his assistant, Aaron Kimple, surrounded by more than 100 years of forest data, including temperature, humidity, rainfall, and other vital statistics. Huge file cabinets filled with paper represent the late 1800s through 1995; two computers represent the past two years. Kimple, who collates the sensor data for the Web site, showed me how the information looks as it streams in. On his screen was an array of compasses, thermometers, and other gauges. Every minute or so, the gauges moved, reflecting the new measurements that had just been transmitted. Kimple, at his desk, can observe the Virtual Forest in real time: for example, if a cloud passes in front of the sun, he will almost immediately see a lower solar radiation measurement. The Web site users are not as lucky: they can't see the data until a week after it's recorded, and then it appears as a static table of facts. Eventually, the Black Rock Consortium hopes to provide instant access to the sensors. To make the data a bit more manageable, BRC president Frank Moretti and a team of educators are designing The Visualizer, a piece of software that will let teachers turn any subset of the information into a graph, a chart, or other visual aid. An initial demonstration of this software appeared on the computer nearby. It featured an image of each sensor station and graphs showing how real-time data links will let students sitting in their classrooms experience subtle shifts in forest conditions, such as changes in wind speed. On the screen,

Black Rock and its hiking trails are hard to find. "We try not to put up too many signs around here," says Schuster. In fact, the value of the Virtual Forest depends on the remoteness of the real one. The ridge-top sensor station (which I failed to locate after circling the site twice) provides useful data about the ridge-top because both remain mostly undisturbed. In this sense, the principles behind the VFI are radically opposed to those driving exurban development around this region and the U.S. The Virtual Forest keeps the city and its population at arm's length, marking the woods as a place you visit and study, not one that you live in. At the same time, the VFI integrates Black Rock into another bur-geoning local economy: the information business. By publishing on the Web, the Black Rock Consortium hopes to provide raw material for school curricula and to generate interest and funding for projects. On these terms, the forest is now as productive a site as the average office in Manhattan's Silicon Alley...and not a twig has been touched. Data, it seems, is the ultimate sustainable harvest.

A more daunting challenge for sustainability activists is to influence people's behavior in the larger, material economy. The Earth Environmental Group (EEG), in collaboration with Public Market Partners (a nonprofit that helps governments and developers find public markets), is working to-wards this goal through the Hudson Valley Sustainable Cuisine Web site. Along with monitoring data on environmental conditions in the Hudson River bioregion, the site will present practical examples of how those living there might act to improve conditions. Aside from advocating sustainable shopping to consumers, the site will also provide practical advice to farmers, who are among the most avid users of the Internet. For example, the site will initially feature the apple orchards of Elizabeth Ryan, a proponent of sustainable agriculture. Text and images will describe Ryan's techniques for cultivating her 42 varieties of apples. This information will be accompanied by recipes using the ▶ 57



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As Schuster led me outside to see the lowland sensor station, I asked him how environmental monitoring was done before the Virtual Forest Initiative. He pointed back down the road to a single bucket on a post. Every day of his 35-year tenure, the forest's former director measured the rain in that bucket. Today, automation has distilled this ritual of environmental stewardship to a blip on a computerized console. But sensor data collection is only part of the work of monitoring the forest. Equally necessary "curatorial data"—measuring the numbers and welfare of plants and animals that live there—must still be collected by people. (Indeed, a recent issue of the forest's newsletter called for volunteers to go into the woodland's habitats to watch for snakes.)

Later, as I hiked up a nearby hill in search of the ridge-top sensor station, I wondered whether the VFI will really bring the forest closer to the city. Save for its World Wide Web presence, Black Rock does not welcome the wide public. Its on-site programs serve a small community, and its managers want to keep it that way. Unlike nearby Bear Mountain State Park,

## mixed media

apples, which are sold in New York City greenmarkets.

As EEG director Jean Gardner explains, the site is based on Earthscore, a methodology, developed by artist Paul Ryan, that uses media to cultivate sustainability. Gardner, who is also a professor at the Parsons School of Design and a consultant for the Virtual Forest Initiative at the Dalton School's New Lab, believes that Web sites, television, and other media can be part of a "circuit of learning and action" that teaches us to live more sustainably. In this case, bioregional conditions in the Hudson Valley affect how the apples are grown, which affects how their cultivation is presented on the Web site. This presentation can influence how farmers choose to cultivate their land and how Valley inhabitants choose to buy food—for example, it can motivate people to buy local produce. For this circuit to function, viewers of the Web site must link their own welfare with that of the apple-growing and -eating community. Once they "define themselves in," says Gardner, the information can change the way entire communities use natural resources. To this end, Gardner advocates a new, incremental kind of urban planning, flexible enough to respond to constant streams of real-time data feedback from the natural world. At the moment, however, it is hard to see how the passive and individualized experience of environmental monitoring on the Web could foster this kind of rapid response and collective action.
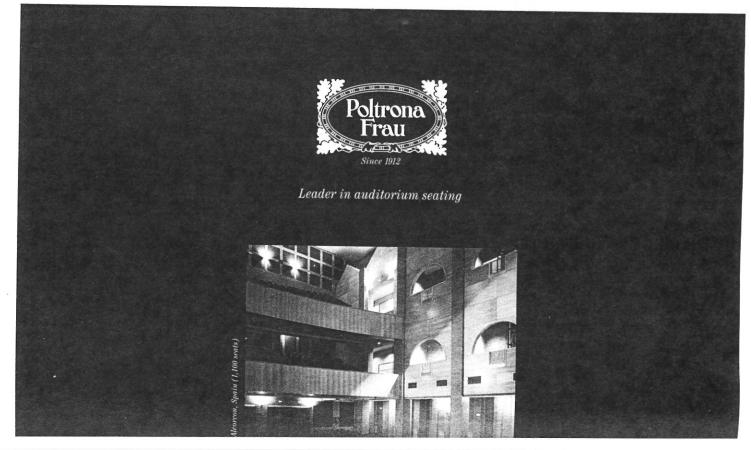
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ford village center that would both satisfy the town's need for more homes and businesses and direct development pressure away from the wetlands and watershed areas. As Kwartler explained, his street-level tours enabled town representatives to discuss and experience different layouts and housing densities. Similarly, to determine how much sun residents of the neighborhood surrounding Manhattan's Riverside South development would get, Kwartler created animations of the shadows cast in the course of the day by the area's existing and proposed buildings. From these programs, it's easy to see how environmental simulation could become a standard tool for sustainable urban design.

Meeting with these widely diverse activists, I have seen New York City and the Hudson Valley bioregion represented on the computer screen in ways that have put my habitual weather-watching into a new context. The experience of finding my neighborhood, my food supply, the material bases of my life rendered in software has led me to see home as a system as well as a place. It is a view that has never before been possible, but for Jean Gardner, it is no less connected to "nature" than the gorgeous views of the Hudson that motivated the environmentalists of the Sixties. "Electricity, in the form of lighting and electrons, is as 'natural' as the water we drink and the air we breathe," she wrote to me in

electronic mail. "It is this natural phenomenon of electricity that we are experiencing, mediated by computer monitors or TV screens, when we look at maps, visualizations, and scenarios." Clearly, it's too late for us to imagine a life in nature without these media. But it is also too early for us to know whether the impulses they send will yield enlightened planning and action, or just an enhanced view of neglect.

*Throughout 1996* ANDREA MOED *examines the world of Mixed Media. The entire series will form the core of a special, 11th issue of* Metropolis, *to be published on-line. Until then, visit our home page at* http://www.metropolismag.com.

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Environmental advocates are also working to bring sustainability issues to long-term city planning. Here's where the growing discipline of environmental simulation comes into play. At computing labs like the Environmental Simulation Center at New York's New School for Social Research, every bit of available information about a region can be loaded into an electronic data bank and used to create a big-screen, walk-though model of a particular place, which can be manipulated by community groups and planners to predict and simulate the results of a development plan for that place. To help people understand the consequences of zoning, density requirements, and other decisions, ESC director Michael Kwartler says that it's best to show them as literal a picture as possible. Rather than numbers, gauges, or even graphs, "visualization" for Kwartler means landscapes, houses, streets, and people. He produces these elements using a software "kit of parts," which converts architectural measurements into stacked cube structures, and traffic data into cars on the road. He even "dresses" the buildings in vernacular detailing so that his simulation looks like home. When I visited Kwartler at the center, he showed me a model of West Milford, a township in rural New Jersey. The Regional Plan Association, which works to improve planning in the tri-state area, sought his help in devising a plan for a new West Mil-



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