Virtual Ecology

A Brief Environmental History of Silicon Valley

This place in sunny California, so famous for its high technology, high salaries, and campus-like office parks, is not what it seems.

by Aaron Sachs

"DUTCH" HAMANN, CITY MANAGER OF SAN JOSÉ, CALIFORNIA, from 1950 to 1970, liked to say that he put Silicon Valley on the map. Despite Hamann's success at spurring economic growth, though, the oil-executive-turned-civic-planner drew much criticism for his expansionist boosterism, for having allowed industrial parks and housing tracts to sprawl perhaps too far, blotting out Santa Clara County's former beauty. His retirement, which came just as the county's high-tech nickname started to enter the national lexicon, was celebrated not only by environmentalists but by economists as well. In September, 1970, *Business Week* ran an article about the challenge of "Correcting San José's Boomtime Mistake." But Hamann himself never doubted his legacy, insisting until his death in 1977 that the benefits of intense development would far outweigh any costs. "They say San José is going to become another Los Angeles," he noted in a 1965 interview, seeming to acknowledge his critics. "Believe me, I'm going to do everything in my power to make that come true."

Twenty years after Hamann's death, his vision has been realized. San José is booming again, and Silicon Valley is often lauded as the engine of America's economy: high tech now has just as high a profile as Hollywood. In 1997, Silicon Valley firms created some 53,000 jobs, and profits among the region's top 150 high-tech companies grew by 15 percent to $15.4 billion. City officials from around the world have been visiting the area, desperate for the secret of San José's success. And, in fact, intense cooperation between municipal governments and high-tech firms has resulted in several attempts to copy the Silicon Valley model, from Silicon Desert in Phoenix, Arizona, to Silicon Glen in Livingston, Scotland, to Silicon Plateau in Bangalore, India.

Of course, critics and skeptics have argued that the Valley's economic upsurge can't last forever, that bust always follows boom. Even the newly minted millionaires of Silicon Valley (there are two more every week) are beginning to acknowledge that they, too, may be held hostage by the cycles of history. An eventual economic downturn, however, is perhaps the least of this region's problems. Evidence is mounting that the boom-bust cycle may be quite dangerous even in good years, that economic growth as we know it may create about as many problems as it solves. While money is certainly flowing freely in Silicon Valley (the average salary of $46,000 is more than 50 percent higher than the national average), most of it is going to a relatively small social and economic elite. As a result, much of the region is becoming unaffordable for the local working-class people, many of whom are immigrants or ethnic minorities. Latinos, for example, make up 24 percent of Santa Clara County's population, but 50 percent of the county's working poor. In addition, housing is in short supply (jobs are being created about 15 times faster than housing units), and the region suffers from stultifying traffic snarls (freeway delays more than doubled between 1994 and 1996). And beneath all this burgeoning development, the soil and water are so battered by the chemicals used in high-tech manufacturing that the region now has 29 Superfund sites, giving it the densest concentration of highly hazardous waste dumps in the country.

San José is similar to Los Angeles, then, not only in terms of its internationally significant industries and economic success, but also in terms of its deep class and ethnic tensions, and the many other frustrations that accompany rapid growth—which tend to be exacerbated by the region's seemingly endless sprawl of strip malls, highways, cookie-cutter housing developments, and office parks. This troubling physical reality is one of the best-kept secrets in America: everyone has heard of Silicon Valley, but few people know what it looks like. Many East Coasters don't even know where in California it's located, as I discovered in 1996 when I told my friends and colleagues in Washington, DC, that I was moving to San José (which is right at the southern tip of the San Francisco Bay). Moreover, the images we have of high-tech companies in Silicon Valley—those offices full of bright, young engineers—rarely reflect the fact that high tech is just as much an industry as a profession, that the Valley is actually packed with manufacturing plants. But, then, transcending physical realities is an important theme in the high-tech world, especially for people promoting the Internet, which represents the industry's best bet for future economic growth. When your Web browser asks you where you want to go today, the implication is that the space you actually inhabit is irrelevant.

Nowhere is that philosophy more obvious than in Silicon Valley, especially given what Santa Clara County used to look like. Perhaps the most significant difference between Los Angeles and San José is that L.A. used to be a desert, whereas San José used to be home to some of the most fertile soil in the world, which just five decades ago produced close to 50 percent of the world's prunes, apricots, and cherries. People used to come to this area,

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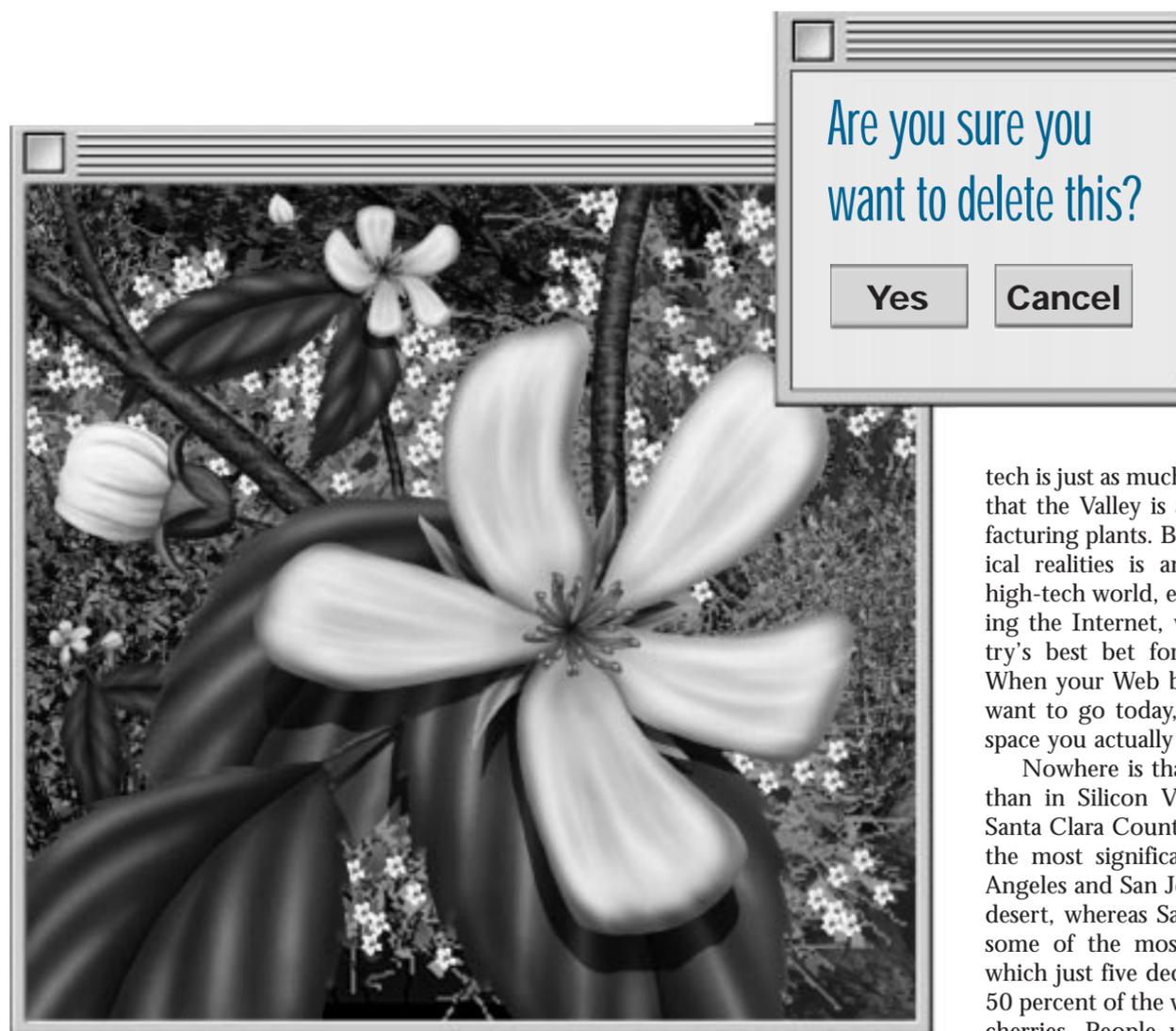
DETAIL OF COVER BY PATRICK GNAN

PALO ALTO
Hewlett-Packard
Stanford University

SUNNYVALE
Lockheed Martin
Natl. Semiconductor

SANTA CLARA
Intel

SAN JOSÉ

MOUNTAIN VIEW
Netscape

CUPERTINO
Apple Computer

GILROY

Sacramento
San Francisco
San Jose
Los Angeles
Area enlarged below.

1950   1980
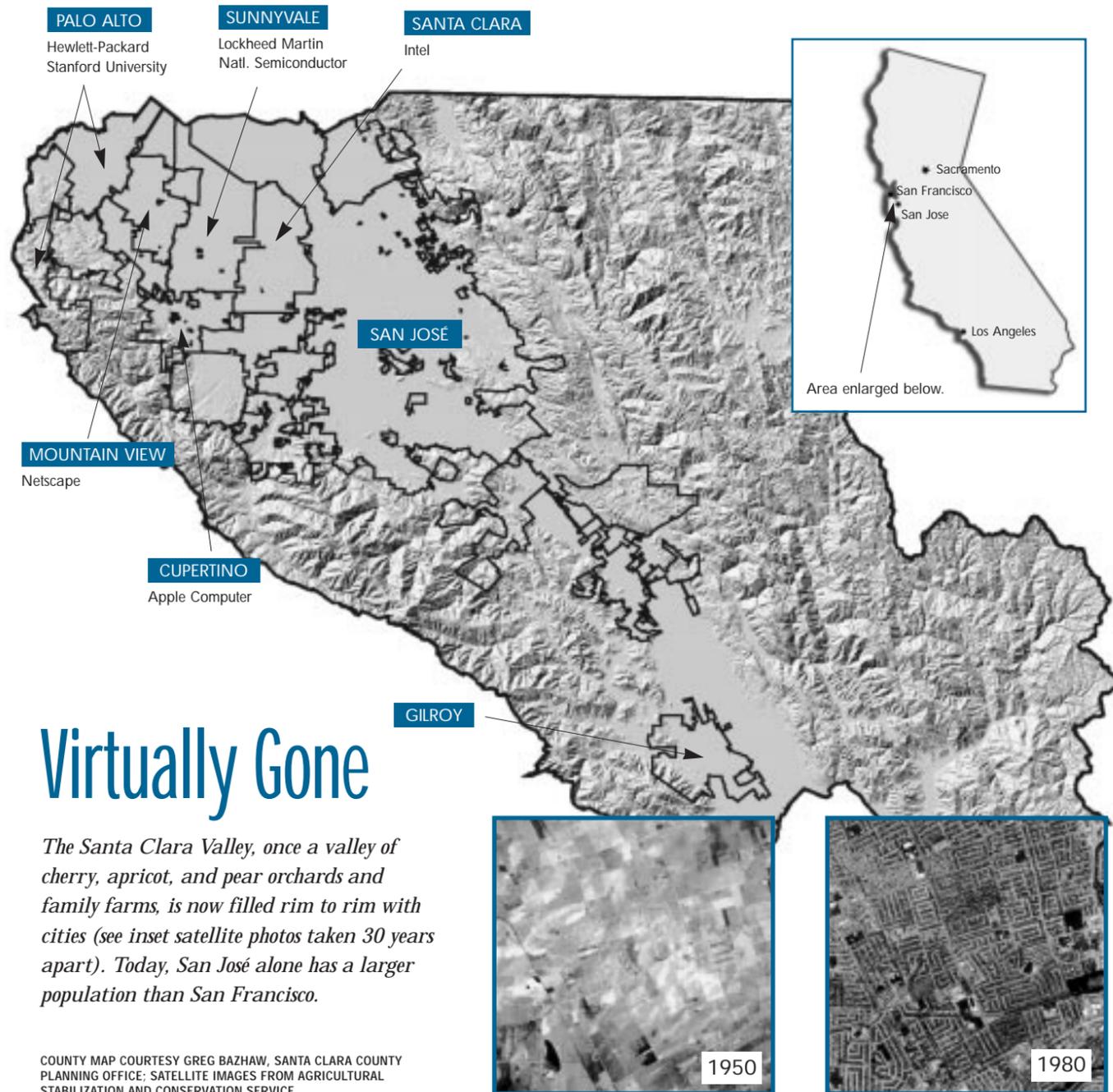
Virtually Gone

The Santa Clara Valley, once a valley of cherry, apricot, and pear orchards and family farms, is now filled rim to rim with cities (see inset satellite photos taken 30 years apart). Today, San José alone has a larger population than San Francisco.

THE HIGH-TECH VERSION OF THE AMERICAN DREAM is a compelling one: young software engineers flock to Silicon Valley in the same way that young actors and actresses flock to Hollywood, and here the "failures" still make six figures. But in Santa Clara County this new model for success came at the expense of an older version of the American Dream. The Valley of Heart's Delight had fostered a community of thriving agriculturists—one that lasted well into the 1950s. The climate and soil were perfect, and land was so widely available that many cash-poor independent farmers were able to start successful orchards, whether on a subsistence level or as profit-making enterprises.

known in the first half of this century as the Valley of Heart's Delight, not to see Research and Development facilities but to visit the orchards and go on "blossom tours." The recent history of San José represents an almost unparalleled ecological transformation, which begs a fundamental question confronting society at the end of the twentieth century: how long can we sustain economic growth without considering the relevance of our physical surroundings?

At the peak of agricultural activity, in the early 1940s, there were about 6,000 farms in the Valley. Almost all of them were small, family-run operations covering less than 50 acres each, which together made up 80 percent of the county. About half of the planted area comprised the largest near-continuous orchard the world had ever seen: some 8 million flowering trees spread over 132,000 acres. As paintings, photographs, and old-timers attest, it was an amazing sight. "For 60 miles the beautiful Santa Clara Valley unrolls south, verdant with orchards, vineyards, and groves," wrote N.D. Ford, author of *America's 50 Best Cities*, in 1956. And the fruits of the farmers' labor were like nothing you can get today at your local supermarket. "That asphalt there is covering some of the best land in the world," says Charlie Olson of Olson's Cherries, one of the last remaining fruit stands in the Valley. "What hurts me is that people don't even know how good it used to taste. They don't even know what they're missing." When I recently showed some vintage footage of the Valley's orchards to an environmental studies class I was teaching at a community college in San José, my students expressed disbelief. Most of them had never seen an orchard.

You can build an electronics plant almost anywhere, but there are truly few places on earth that could match the fertility of Santa Clara Valley in the early twentieth century. The U.S. Department of Agriculture evaluated all the land in the county and designated 32 percent of it—400 square kilometers—as Class I, the top ranking for the cultivation of fruits and vegetables. Stream systems flowing down to the San Francisco Bay from the Diablo Range and the Santa Cruz Mountains had laid down two alluvial fans in the Valley. In places, the topsoil of fine loam was 40 feet deep. Below that were water-bearing layers of gravel and clay and a huge freshwater aquifer. Nineteenth-century farmers satisfied all their irrigation needs by means of artesian wells, which gushed water straight out of the ground. Not until the early 1970s, at the peak of local computer chip manufacturing, a highly water-intensive industry, did the county have to start importing water.

Until World War II, despite a few rocky periods, the Valley was both booming and abloom. Now, all that's left of that era is a few fruit trees scattered along the freeways, a chain of Orchard Supply Hardware stores, and a strip mall called The Pruneyard, where farmers used to lay out their plums to dry in the sun. Wallace Stegner, a long-time resident of Santa Clara County, saw all of these changes first hand, and he captured this region's history succinctly in a 1984 essay. "Silicon Valley is probably a good, in many ways," he wrote. "The Valley of Heart's Delight was a glory. We should have found ways of keeping the one from destroying the other."

THE STORY OF DUTCH HAMANN'S PROUD DISREGARD of the ecological and aesthetic consequences of overdevelopment makes for an important cautionary tale. Certainly, Santa Clara County provides a particularly dramatic case study, because of the sheer inappropriateness of the industrial growth that occurred here, given the quality of the land. The speed with which that growth occurred, too, is remarkable. By 1970, when Santa Clara County was dubbed Silicon Valley, five of the seven largest semiconductor firms in the country had their headquarters here, and critics were marveling at the near-total disappearance of the orchards that had so dominated the local landscape just two decades before.

What is most significant about the way the Valley developed, though, has to do with the central role played by the electronics industry itself. Long before the invention of the Internet, the engineers of Stanford University, Hewlett-Packard, and IBM were playing tricks with physical reality, claiming that they were re-inventing industry, that high tech would beautify rather than destroy the local landscape. To an even greater extent than Hamann, it was those engineers who finally determined how this region would develop.

Once the Cold War was launched in the late 1940s, there was a steady stream of research funds flowing from the U.S. Department of Defense to almost anyone interested in electrical engineering and solid state physics. The technicians at Stanford, located in Palo Alto, at the northern tip of the Santa Clara Valley, were among the first to take advantage of the government's largess. Dean of Electrical Engineering Frederick Terman, who had been recruited to lead Harvard's Radio Research Lab during the war, moved back to Palo Alto in 1945, and a year later established the Stanford Research Institute (SRI), which he funded mainly with military contracts.

In 1951, Terman convinced the university to create the Stanford Industrial Park on land that had been earmarked for housing, arguing that the symbiosis of scholarship and industry would give the local area a world-wide reputation for technical expertise. He was right. Especially after the success of fledgling companies like Hewlett-Packard, which set up shop at Stanford Industrial Park in 1952, and Shockley Transistor, the first semiconductor company, Terman was able to lure the giants of the field to Santa Clara County: Lockheed, Sylvania, General Electric, IBM, and Westinghouse all came to the Valley in the 1940s and 50s to take advantage of the free-flowing ideas and money. Today, virtually all of the key players in the high-tech world—except for arch-enemy Microsoft—reside within the Valley's borders.

In just a few years, then, Santa Clara County had gone from supplying America's fruit bowls to supply-

ing America's arsenals. Until Intel's invention of the microprocessor in 1971, high tech was essentially a tool of the Space Race and the military industrial complex. As of 1965, the Pentagon purchased 70 percent of all the integrated circuits manufactured in the United States. In 1967, 60 percent of Silicon Valley's electronics employees were working on defense contracts, designing ever-smaller, more highly automated guidance and delivery systems for missiles. Terman and his colleagues felt no qualms about applying their research to weapons of mass destruction. From the beginning, though, they were determined to transcend the standard realities of industrial development.

The very phrase "industrial park," oxymoronic as it is, reveals Terman's desire to transform the Valley into an employment center that could rival San Francisco and Oakland—but without the soot and rowdy laborers. In 1956, Stanford's business manager, Alf E. Brandin, went on record explaining that Stanford Industrial Park was designed to "attract a better class of workers." Terman himself had seen the major industrial cities on the East Coast, and he wanted nothing to do with them: high tech was to be a clean, white-collar industry, fed by the nation's finest engineering departments—which, at the time, consisted almost entirely of well-to-do white males. By the time Silicon Valley got its name, Stanford Industrial Park had become Stanford Research Park, and its companies had to follow strict building codes, which included "complete concealment" of things like smokestacks, generators, transformers, ducts, storage tanks, and air conditioning equipment. Even now, many new offices and factories in the Valley are laid out on a "campus," so as to evoke the pastoral feel of places like Stanford.

Sprawling office parks and industrial campuses, however, not only take up massive amounts of space in their attempts to appear suburban—they also distract workers and residents from the real consequences of industrial activities. Stanford Research Park conceals not only its ductwork but its actual manufacturing plants, which form the heart of high tech. No industry, after all, can survive on research alone. In fact, while manufacturing was shrinking around the country in the postwar era, as America gradually shifted over to a service-dominated economy, it was growing fast in Santa Clara County. Here, the percentage of employees working in manufacturing increased from 15 percent in 1940 to 35 percent in 1980 (nationwide, the figure had dipped to 21 percent). And while the industry continued catering to its technical professionals, its behind-the-scenes production workers were the ones paying the price for high tech's dependence on toxic chemicals.

In 1970, 70 percent of the production workers in the electronics industry were women, about half of whom were minorities, mostly Mexican-Americans and Filipino-Americans who had migrated to San José as Southern California agriculture became more mechanized. As high levels of employee illness—from headaches to miscarriages to cancer—soon revealed, the hydrocarbon solvents used to clean semiconductors were no safer than the pesticides soaking the fields of vegetables down south. On average, according to Graydon Larrabee of Texas Instruments, making one 15-centimeter silicon wafer—the building-block for a few dozen chips—requires 9 kilograms of liquid chemicals and 6 cubic meters of gases, as well as 8,610 liters of water. In so-called "clean rooms," where elaborate circuitry is etched onto the wafers, production workers never breathe in any dust, but they are regularly exposed to known carcinogens like dichloroethylene.

In any case, a few palm trees and heavily watered lawns interspersed among huge, homogeneous office buildings and manufacturing plants do not exactly comprise a park. Terman and his associates may have avoided recreating the heavy industrial landscapes of towns like Pittsburgh and Detroit, but high-tech industries ended up using so much space in the Valley that there was little room left over either for housing or for true green spaces. Starting with Palo Alto and moving progressively southward, each town in Santa Clara County devoted more and more land to industry, and Stanford Industrial Park essentially replicated itself several times over—each time spurring the construction of new expressways and strip malls in neighboring areas. The municipal governments of Mountain View, Sunnyvale, Cupertino, Santa Clara, and San José all courted high-tech firms relentlessly, in order to increase their tax base: profit-making companies are worth much more to a city than houses or apartment buildings.

In many cases, just as Stanford had done, these cities offered firms newly rezoned land that had originally been intended for housing, often bending rules in order to make the offers more attractive. In 1966, for example, 65 percent of the approved applications for rezoning in San José did not conform to the city's regulations, according to a study by the Stanford Environmental Law Society. Between 1965 and 1975, the number of housing units accommodated by the zoning plans of the county's major cities actually decreased from 978,000 to 561,000—while the number of jobs in the county increased by about 150 percent. Meanwhile, by 1970, San José had only 3.2 hectares of open space per 1,000 residents, half of which consisted of school playgrounds—compared to 14.2 hectares per 1,000 people in San Francisco and 28.7 per 1,000 in Washington, DC. And in Palo Alto, which had a daily influx of some 60,000 electronics workers in the mid-70s, the municipal government felt so threatened that it restricted access to the town's beautiful Foothills Park: to this day only Palo Alto residents are allowed inside.

It is no coincidence that the effacement of the Valley of Heart's Delight occurred during Dutch Hamann's tenure as City Manager of San José. Between 1950 and 1970, he annexed 1,377 parcels of land, and San José's urbanized area increased from 17 square miles to a sprawling 135 square miles, while the city's population increased from 95,000 to 460,000. Hamann's land-use policies and a rubber-stamp city council were the driving forces behind the elimination of green space in the Valley's largest city; contractors, developers, and businesses grew richer during his term in office, but at the expense of residents, since city services—sewers and schools as well as parks—could not keep pace with growth.

Frederick Terman, though, had just as much influence as Hamann, and he was more of a visionary. While Hamann was expanding madly and trumpeting his city's "appointment with destiny," Terman was quietly establishing his "community of technical scholars," bequeathing real power to his heirs in the form of unprecedented economic opportunity. The 20 electronics firms clustered around Stanford Industrial Park in 1951 had become 800 by 1974, and they determined the everyday realities of the region—economically, socially, and ecologically. Terman's seeds had scattered and multiplied, forming the industrial equivalent of a monoculture plantation. As Annalee Saxenian, author of *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, has argued, it is rare to find a place where the character of development is "so clearly attributable to a particular sector," but that is the case in Santa Clara County—for better and for worse.

THE COVER STORY OF *NEWSWEEK* ON NOVEMBER 9, 1998 was devoted to "the explosion of Silicon Valley wanna-bes, both domestic and overseas, that have already begun transforming cities, regions and, in some cases, entire countries." Titled "The Hot New Tech Cities," the article confirmed the extent to which the Silicon Valley model has captured the world's imagination. But it offered few hints of the model's troubling track record. An unanswered question still hovers in the smog over Silicon Valley: has high tech's influence over this region's development truly improved the local people's long-term quality of life? And on a larger scale, does this industry's impact on society at large warrant the kind of uncritical embrace it has received from investors and developers? Here in the valley, as the negative aspects of unbridled growth become more apparent, the debate will continue to rage. It would seem that no one could dispute the benefits of living in a place where the unemployment rate is consistently below 3 per-

cent. Yet the cost of living is so high here that even the gainfully employed have reason to complain. In 1997, according to the estimate of the local Emergency Housing Consortium, 20,000 employed, tax-paying citizens of Santa Clara County were forced to leave their homes and solicit beds at homeless shelters because of excessive rent hikes.

The jobs-housing imbalance in Silicon Valley is perhaps the most obvious symptom that economic growth here has reached cancerous levels. Local high-tech com-

The Santa Clara Valley is
To those who hold it dear
A veritable Paradise
Each season of the year.
One loves it best in April
When the fruit trees are in bloom;
And a mass of snowy blossoms
Yield a subtle sweet perfume.
When orchard after orchard
Is spread before the eyes
With the whitest of white blossoms
'Neath the bluest of blue skies.
Nobody could paint the picture
No pen describe the sight
That one can find in April
In "The Valley of the Heart's Delight."

Clara Louise Lawrence, "The Valley
of the Heart's Delight" (1931)

panies are getting so big that they are threatening to kill off their municipal hosts. In the past three years, Santa Clara County firms added 126,005 employees, a 15.2 percent increase. Meanwhile, housing increased by a mere 1.3 percent, as the county added just 7,154 new units. Those who try renting bump up against a 1.4 percent vacancy rate (anything under 15 percent is considered tight). And, of course, scarcity has driven residential costs through the roof—assuming you are lucky enough to have one over your head. Santa Clara County now has the highest median sale price for new houses in all of America: at $316,250, it's 155 percent higher than the national average, and unaffordable for about 70

percent of the county's population. Meanwhile, rents have doubled since 1990.

This region's international reputation for affluence is justified, in other words, but the wealth isn't trickling down. And, as in Los Angeles, conspicuous consumption on the part of elites is spurring resentment among the Valley's working classes. Since 1990, wage rates for the poorest 25 percent of the Valley's workers have actually decreased by 14 percent. Meanwhile, between 1987 and 1997, though the

Population Growth in San Jose and Santa Clara County, 1940–1998		
	San Jose	Santa Clara County
1940	68,000	175,000
1950	95,000	291,000
1960	204,000	642,000
1970	460,000	1,065,000
1980	629,000	1,295,000
1990	782,000	1,498,000
1998	894,000	1,680,000

average household income rose from $85,741 to $101,010, the median household income stayed constant: it was only the top half of income earners who got richer. In other words, those new, expensive homes are going to wealthy engineers, mostly white males, who move to this area to take high-paying jobs.

Some poorer people, meanwhile, are either being squeezed out or packed into ghettos. And impoverished production workers, besides being exposed to chemical vapors in clean rooms, generally have few benefits and little job security. High-tech firms in Silicon Valley use temporary employees at a rate that is three times the national average, and several companies run seminars for managers on how to prevent unionizing efforts in their plants. There are currently no active unions at local electronics firms. Even if the Valley is blessed with continued material success, it seems likely that either the region's social and economic diversity will gradually disappear, or tensions will begin to erupt. In the spring of 1997, at the end of San José's Cinco de Mayo celebration, there was an outbreak of violence and looting that for many Californians evoked the class and race wars of Los Angeles.

Poor workers who opt to keep their jobs in Silicon Valley but who cannot afford to live here end up paying the additional cost of commuting every day, sometimes more than 80 miles each way. And they are joined in the traffic jams by all the software engineers and electronics executives who could have afforded the Valley but simply couldn't find space. Even within Santa Clara County, commutes have been bad for a long time. San José was the one city with room to expand during the region's period of heaviest industrial development, so that's where most of the housing is: with 894,000 people, it now has an even larger population (by 13 percent) than San Francisco. But most of the jobs remain clustered around Stanford, in the northern part of the county. These days, traveling the 20 miles from south San José to Palo Alto can take up to two hours in the morning, since San Joseans are competing not only with each other but with commuters who have been forced to live even further south, in Gilroy or even San Benito County.

Next to the housing shortage, traffic is the biggest concern of Silicon Valley employees. The average speed on the freeways during rush hour has already dipped below the figure for Los Angeles County, and while the number of miles driven in L.A. has increased only 2 percent annually since 1994, here the yearly increase has been 11 percent. In 1996, the last year for which data are available, local drivers experienced an average of 20,500 hours of delays per day—without taking construction or accidents into consideration. And no amount of money can fix the problem. "Look at L.A.," says Mike Evanhoe, Director of Santa Clara County's Congestion Management Program, urging politicians to heed the lessons of history and demography. "We just cannot build enough lanes fast enough to accommodate our growth." Even businesses have begun complaining about traffic. According to the Metropolitan Transportation Commission, local freeway delays are costing Valley companies $3.4 billion a year.

In addition, heavy commutes create smog—as do the high-tech facilities to which employees are commuting, even if façades hide the smokestacks. Federal Clean-Air regulations and state-wide improvements in car standards have eased this problem considerably in the past 15 years, but there are still many days when you can't see through the haze to the nearby hills. Moreover, as a report by the Santa Clara County Strategic Visions Steering Committee explains, emissions reductions are quickly being "outweighed by the growing number of commuters."

A similar trend is at work with regard to the region's water pollution problems. Chip manufacturers are coming up with innovative techniques that reduce the amount of toxic waste emitted per unit

produced; but production is still increasing in the Valley (even though some manufacturing and most assembly plants have relocated to developing countries), so overall pollution levels are still rising as well. Indeed, one of the most important lessons other communities can learn from the history of Silicon Valley is that high tech is not a clean industry.

Ever since the infamous 1982 leak at San José's Fairchild Semiconductor plant, as Lenny Siegel and John Markoff have shown in their book, *The High Cost of High Tech*, Silicon Valley companies have struggled to maintain their pristine image. Countless poisoned wells, leaking chemical tanks, and illegal sludge dumps have been discovered in the past 15 years. The underground plume of pollution from one IBM facility extends for three miles and has shut down 17 public wells. In some cases, even the most sophisticated cleanup methods have had only partial success; when trichloroethylene (TCE), for instance, has time to settle into an aquifer, there is no known method by which it can be completely removed. At the Fairchild factory, toxic solvents used in chip production (including trichloroethane and dichloroethylene) gradually seeped into drinking water supplies from an underground storage tank, and within a few years there were obvious cancer clusters in the neighborhood, and residents were experiencing three times the normal rate of miscarriages and birth defects. Another set of solvents, called glycol ethers, are not even detectable using normal water-testing protocols, and studies by IBM and the Semiconductor Industry Association have linked their use in clean rooms to disruptions of workers' reproductive health.

Meanwhile, high-tech sewage emissions laced with heavy metals such as cadmium, nickel, and lead have had a disastrous impact on the southern reaches of the San Francisco Bay. At the turn of the century, fishers living in shoreline communities harvested about 15 million pounds of oysters annually from the Bay, but since 1970 the entire oyster population has been too contaminated to eat.

The environmental history of this Valley, then, is not just about the loss of orchards and farms, and the replacement of an agricultural society with an industrial society. It is not simply a pastoral tragedy. It is about the impact of an almost-exclusive reliance on the high-tech industry and its capacity for economic growth. And for all those would-be Silicon Valleys around the world, it is important to note that, in terms of the residents' overall quality of life, high tech has been a mixed blessing here. Even the most successful executives are beginning to feel the need to escape, finding that even their vast fortunes cannot insulate them from urban sprawl and pollution. Lately, a back-to-the-land movement has arisen among the elites of Silicon Valley. Steve Jobs, one of the founders of Apple Computer, cleared the lot next to

his Palo Alto home and planted a small orchard. Many other executives have left the area altogether, heading up to Napa and Sonoma to grow grapes.

OVER THE LAST THREE DECADES, HIGH TECH HAS matured and come of age. Starting with Intel's microprocessor, developed for a Japanese calculator company, electronics applications have become more and more mainstream and user-friendly, ranging from those first hand-held calculators to laser surgery and the World Wide Web. Computers are helping us collect, store, organize, and process more information than ever before, facilitating scientific inquiry, global communication, political participation, and even environmental activism. I recently got an e-mail, for instance, from the Silicon Valley Toxics Coalition, one of this country's foremost eco-justice organizations,

We are participating in a massive transformation, which is accepted virtually without debate—just like the transformation of the Santa Clara Valley.

explaining that thanks to the high-tech industries' own tools and technology, citizens can now map the 178 sites in Santa Clara County where high-tech firms have polluted the local groundwater. By using a Geographic Information Systems (GIS) project accessible via the Coalition's web site, activists can even overlay contamination maps with demographic data, tracing the links between toxicity levels, race, and economic status.

Countless similar examples reveal the truly paradoxical nature of high tech, in both its global and its local implications. At the local level, the major issue is not necessarily the usefulness of the products but rather the tradeoffs inherent in catering to high tech's development agenda. Cash-poor communities desperate to attract the next Intel microprocessor plant would do well to understand the transformative power of the industry.

Once the problems associated with high tech are recognized, though, improvements and solutions become apparent. There are some positive examples emerging from Silicon Valley itself. The Greenbelt Alliance and the Mid-Peninsula Open Space District, for instance, are both working not only to preserve strips of open land in the Valley, but also to stop all further expansion and force cities to pursue "in-fill" development instead of building more mansions in the foothills. The private sector has also joined the battle to preserve land: early in 1998, the foundation established by Silicon Valley pioneer David Packard

(one of Frederick Terman's students and the co-founder of Hewlett-Packard) announced that it will spend $175 million over the next five years to protect farms, open space, and wildlife habitat here in California. Several Valley chip-making firms have even pioneered the use of natural soaps and citrus solutions in an attempt to clean up their manufacturing processes. And San José, besides adding carpool lanes to local freeways, recently made considerable improvements to its public transit system, with the result that ridership on the city's light-rail line has increased 31 percent in the past five years.

All these initiatives suggest the urgent necessity of pursuing development from a regional perspective. The Silicon Valley model, as elaborated by Frederick Terman, is based on economic regionalism, a conscious effort to build a broad community of business partners and academics all engaged in interrelated pursuits. To be truly successful, though, high-tech development requires regional planning that addresses social and ecological issues as well. Even county-wide plans are not broad enough: Silicon Valley itself has significant influence on traffic patterns in at least five separate counties. Only from a broad bioregional perspective can planners consider the complex interconnections between jobs and profits and housing and farmland and water quality and parks and ethnic diversity and class tensions and freeway back-ups. "Our task," wrote Lewis Mumford, in an essay entitled "The Regional Framework of Civilization," "is to replace the primeval balance that exists in a region ... in a state of nature, by a richer environment, a more subtle and many-weighted balance, of human groups and communities in a state of high culture." For instance, if the developers of Silicon Valley had proceeded a little more cautiously, they might have been able to build just as many chip manufacturing plants without paving over all of the region's Class I agricultural land.

Moreover, just as local communities would profit from examining and planning for the more problematic aspects of high-tech development, society at large would be well-served by a more critical approach to the dark side of the industry as a whole. One of the main reasons Silicon Valley grew the way it did, after all, was that no one thought to question technologi-

cal "progress." And now many of us are buying "smart" appliances, and computers, and modems, simply assuming that they are going to improve our lives. We are participating in a massive transformation, which is accepted virtually without debate—just like the transformation of the Santa Clara Valley. "No one is stepping forth to suggest that there might be something at stake," writes cultural critic Sven Birkerts, "that the headlong race to wire ourselves might, in accordance with the gain-loss formulae that apply in every sphere of human endeavor like the laws of physics, threaten or diminish us in some way."

It seems clear, though, that high tech writ large, just like unrestrained economic growth, is a mixed bag, as Edward Tenner has documented extensively in his book *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*. Technological devices do often save time, and yet beepers, e-mail, and cellular phones have all extended the work day, especially for Silicon Valley employees, who are among the busiest in the nation. And though the computer keyboard is easier to use than a typewriter, it nevertheless causes more health problems (repetitive strain injury in particular). Meanwhile, the Internet links us all together in the so-called electronic hive, but it may allow actual social skills to atrophy, as people interact less often on what is referred to, as an F2F (or face-to-face) basis. Recent studies have even suggested a link between high levels of Internet use and clinical depression.

Nevertheless, the techno-evangelists, like magicians or movie directors, continue to preach, urging us to embrace every aspect of the high-tech revolution, whatever the consequences. High tech is clean, they say, it's democratic, it's profitable, and it makes life easier and more fun. In other words, the industry is fundamentally misleading and ahistorical in its approach. And perhaps most dangerous is the seemingly concerted attempt of high-tech boosters to inspire scorn for the actual, physical world. In celebrating the Virtual, futurists like Gregory Stock also celebrate "comfortable indoor environments" and consider it perfectly appropriate that "the emotional links between humans and the 'natural' environment are weakening," since the best of human experience is now occurring "in an entirely different realm." Confronted with arguments about the need to uphold biodiversity, Stock simply shrugs, and opines that there are only a few animals in the world that really matter, anyway. "There is an immense roster of species," he notes, "that neither affect nor interest the vast majority of humankind."

One major selling point of the high-tech revolution, then, is its power to gloss over physical reality. San José is the Hollywood of the North; people come here to escape Real Life in the Real World. And if we remake other communities in Silicon Valley's image,

When pear and plum trees were torn up to make way for industrial parks in the Santa Clara Valley, it was not the first time California orchard country had been supplanted by urban sprawl. A generation earlier, the great orange orchards of Los Angeles County—seen here in a late-19th century engraving—were bulldozed for the housing tracts and highways that jam today's San Fernando Valley from rim to rim.

Virtual Life in a Virtual World will indeed begin to seem like the only logical option. Just spend a few hours exploring some high-tech suburbs, urges Mark Slouka, author of *War of the Worlds: Cyberspace and the High-Tech Assault on Reality*. Slouka's experiences in California led him to conclude that "no life outside the home is possible [in some of these communities]. There is no playground, no park, no field or meadow.... So what do people who live in these communities do? What else can they do? They live inside: watching television, listening to their home entertainment systems, playing computer games." This move inside, this preference for Virtual Reality over Real Life, is perhaps the key environmental issue confronting the industrialized world. There can be no ecological protection without a sense of place.

Our saving grace may be that, like the Silicon Valley executives who are now planting vineyards, most

of us eventually tend to feel the need to connect with nature, to feel rooted in the soil, to blend in with one particular landscape: that's the way human beings have lived for thousands of years. Until recently, high-tech devotees from around the world were willing to pull up their roots and plant new ones in Silicon Valley: all it took was a call from Hewlett-Packard or Intel or National Semiconductor. These days, though, more and more engineers are declining prestigious jobs in the Valley because of quality-of-life issues. Sometimes visiting a virtual park on the World Wide Web just isn't enough.

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