Excerpts from *The Future and Its Enemies: The Growing Conflict Over Creativity, Enterprise*, by Virginia Postrel (Free Press, 2011)

Chapter 3
The Infinite Series

Dynamism generates progress through trial and error, experiment and feedback. Both components of the process are crucial. … This principle is not limited to technological ideas; it applies to all innovations. But in many areas of life, both trial and error—the freedom to experiment and the ability to fail—have been undermined by stasists uncomfortable with the inevitable risks such an evolutionary system entails. Disapproval of risk taking permeates our culture and shapes our law. Sometimes we forbid taking risks. Sometimes we spread the consequences from the risk taker to others. Either way, we squelch the learning that is essential to progress. …

Risk and courage are essential to innovation. Among technologists, the importance of "early adopters" is widely acknowledged. Without people willing to pay the high prices that let innovators develop markets, improve processes, and drive down production costs, we would not have computers, stereo equipment, or contact lenses. But money isn't the only currency that finances new ideas. Other early adopters pay by willingly taking risks on unproven innovations, whose benefits likely come with flaws or side effects. These risk takers provide critical feedback both to innovators and to potential later adopters. The information they supply helps determine whether a new idea will flop altogether or get a chance to prove itself to a wider public. …

The political scientist Aaron Wildavsky described two basic strategies for dealing with risk: anticipation, the static planning that aspires to perfect foresight; and resilience, the dynamic response that relies on having many margins of adjustment:

> Anticipation is a mode of control by a central mind; efforts are made to predict and prevent potential dangers before damage is done. Forbidding the sale of certain medical drugs is an anticipatory measure. Resilience is the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back. An innovative biomedical industry that creates new drugs for new diseases is a resilient device. … Anticipation seeks to preserve stability: the less fluctuation, the better. Resilience accommodates variability; one may not do so well in good times but learn to persist in the bad.

Many circumstances demand a mixture of both strategies. But in a rapidly changing environment—whether the changes spring from human action or natural phenomena—resilience is essential. Silicon Valley is built on resilience. Companies seek to establish partnerships with other vendors rather than try to do everything themselves. Employees job-hop from place to place, confident that if one employer closes shop they can find work elsewhere. Technologists work to get products out as quickly, rather than as perfectly, as possible. People do the best they can at the moment, deal with problems as they arise, and develop networks to help them out. Unexpected shocks are inevitable; the goal, then, is to foster adaptability.

Resilience is enhanced by the dynamic processes and combinatoric options of the infinite series. Silicon Valley's many companies make it more resilient against economic shocks than a region that depends on a few vertically

integrated firms. Similarly, richer, more technically advanced places bounce back more quickly from natural disasters than do poorer places with less cushion and fewer methods of response. Contrary to reactionary dreams of self-sufficient static utopias, places that routinely trade with the outside world are also more resilient. In an emergency, they can call on material resources and moral support from outside their stricken region. The people who piled their cars with provisions and drove to aid the victims of Hurricane Andrew represented a resilient response to disaster, a response dependent on flexible tools and decentralized reactions.

When the Kobe earthquake struck in 1994, the region's wealth and large stock of construction equipment sped cleanup, even though Japan's anticipation strategy, which had promised quake-resistant roads, railroads, and buildings, had failed. Indeed, the official bias toward anticipation made things worse. With regular telephone service down, officials refused to let Nippon Motorola give out free cellular phones because the authorities didn't want to issue the phones' identification numbers. The Kobe city government turned away volunteers because, says an official, "we couldn't verify the trustworthiness of the people who volunteered, so we could not take responsibility for them."

Kobe was hurt by another form of technocratic stasis as well: sheltering established ideas and enterprises from competition. Laws to protect small shops limited supermarkets that wanted to reopen. Other restrictions blocked home-building companies from bringing in American carpenters able to handle prefabricated or 2-by-4-based construction. A more flexible system, one without legal bias toward small stores or particular construction methods, would have been much more resilient.

Such protectionist policies enforce stability at the cost of stifling both resilience and progress. They eliminate the checking process essential to trial-and-error learning, the way by which we identify the "failures" that new forms might correct. By protecting small stores, Japan blocks competition that would encourage shopkeepers to improve customer service, lower prices, or carry more varied product lines—and that might quickly spread successful new techniques. Until relatively recently, much of New York City effectively did the same. But in the mid-1990s, large-scale retailing hit the city. *The New York Times* took note of the effects in a front-page article, leading with the tale of stationery store owner Michael Jacobs, who had "re-created his business in the megastores' image":

> He bought uniforms and name tags for his employees, and walkietalkies so they would not have to shout to one another over customers' heads. He began accepting returns. He extended his hours, opened on Sunday for the first time, and last Christmas hired his 14-year-old son, Andrew, as doorman. Every new touch, Mr. Jacobs admits, was borrowed from the bigger players across the avenue.
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> "I made it into the 20th century by following these other stores," Mr. Jacobs said. "It's like going to college for getting the customer in your store—you have to pick up and steal these little ideas."

Competition provides not only useful criticism but a continuous source of experiments. It gives people like Jacobs the ideas with which to create still more progress and encourages them, too, to come up with incremental improvements. By picking winners, stasist protectionism eliminates this learning process, which includes learning what does not work.

"Premature choice," warns the physicist Freeman Dyson, "means betting all your money on one horse before you have found out whether she is lame." Protecting established interests from new challengers is one form of premature choice. But technocratic planners also sometimes kill existing alternatives to force their new ideas to "succeed." To protect the space shuttle, NASA not only blocked competition from private space launch companies, it also eliminated its own expendable launchers. Such preemptive verdicts often mark public works projects. Planners pick an all-purpose winner, squeeze out alternatives, and eliminate any real chance of experiment and learning.

Consider the infamous Denver International Airport (DIA). Aviation officials touted the $ 4.9 billion project as essential to keep up with the region's growth. They promised it would be a vast improvement over the old Stapleton Airport, which was often socked in by bad weather. But its sponsors foisted DIA on unwilling customers. The airport is twenty-five miles outside Denver, pretty much in the middle of nowhere, while Stapleton was just fifteen minutes from downtown. To make matters worse, there are no hotels near DIA. And the new airport's cost per passenger is somewhere between $ 11.75 and $ 18.14, depending on how you count—substantially more than either the $ 4.59 at Stapleton or the $ 9.91 promised by former Mayor Federico Peña. Frequent travelers resent the inconvenience and the generally higher ticket prices. "I liked Stapleton better," one told The Denver Post. "You could literally leave about 45 minutes before your plane departed. With DIA, you have to leave an hour and a half before." A flight attendant expressed a common sentiment: "It's a beautiful airport. But we hate it."

On the airport's first anniversary, journalists had trouble reaching a simple verdict on DIA. There were complaints all right—lots of them. But some passengers liked the spiffy new airport, with its marble floors and inviting shops. And flight delays had in fact dropped dramatically. The first-anniversary stories were confused, lacking a central theme.

The reporters had missed the main problem: The city had eliminated the most obvious source of feedback—competition from the old airport. It had made DIA a protected monopoly rather than an experiment subject to competitive trial. By shutting down Stapleton, DIA's political sponsors had made it impossible to rule the new airport a definite error. No matter how many complaints passengers lodge, officials can always point to other advantages. At the same time, however, DIA's monopoly keeps it from becoming an accepted success. Without a genuine trial, we simply have no way to tell whether travelers (or airlines) would rather trade a convenient location for fewer weather-related delays. One airport must fit all. Love it or hate it, if you're flying from Denver you don't have a choice.

Another common way to protect experiments from feedback is to pass the costs of errors onto someone else. The conservative writer David Frum argues that such false signals undermine bourgeois virtues to a far greater extent than Bell's "cultural contradictions" would do alone. Frum seeks public policies that would restore the connection between personal actions and outcomes:

> Twenty years ago, an economist named Sam Peltzman noticed that drivers who wore seatbelts, while suffering far fewer accidents than drivers who did not, inflicted far more. The safer the driver personally felt, the more carelessly he drove. The welfare state functions as a political safety belt, reducing the riskiness of all of our lives; and just as with real safety belts, there are what Peltzman called "feedback effects" from our newfound sense of personal secu-

> rity…. Why be thrifty any longer when your old age and health care aré provided for, no matter how profligately you act in your youth?
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> Why be prudent when the state insures your bank deposits, replaces your flooded-out house, buys all the wheat you can grow, and rescues you when you stray into a foreign battle zone? …
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> We cannot rescind the emancipation of appetite; but we can make its indulgence riskier by canceling the welfare state's seductive invitation to misconduct.

As with the Denver airport, we can never say for sure which protected decisions—which "emancipations of appetite"—would have survived a true test.

Insulating mistakes from early feedback can make their cost astronomical. Instead of adjusting when corrections are relatively inexpensive, such "experiments" allow negative results to compound until they can no longer be ignored—and often cannot be corrected. The savings and loan debacle was such a disaster. It was the product, from start to finish, of technocratic planning and static assumptions. First, federal regulations fixed the thrifts' institutional forms and business practices, forcing them to lend specifically for home purchases and to pay interest at rates limited by law. Locked into undiversified portfolios of long-term loans, the S& Ls were designed as static institutions in a static environment. They developed a complacent corporate culture, secure in the knowledge that they had a ready market for loans and that federal law gave them a quarter-point interest edge over banks in attracting deposits. The government also promised that in the unlikely event an S& L went belly up, depositors would get their money back. Nothing was supposed to change: not the demand for houses, not the price of money.

Suddenly, in the 1970s, interest rates began to rise rapidly. Nobody had expected the increase, least of all the S&Ls. And they were not resilient. To keep up with inflation, depositors began pulling their money out of thrifts and putting it into high-interest money market funds. Prohibited by law from adjusting their strategy, the S&Ls faced ruin. So beginning in 1980, Congress partially deregulated the industry, allowing thrifts to raise interest rates paid on deposits and to jump into riskier businesses. Lawmakers did not, however, eliminate the seat belt of deposit insurance. To the contrary, they made the insurance even more generous, raising the ceiling from $ 40,000 to $ 100,000 per account.

Under the circumstances, the result was quite predictable: major risk taking by the S&Ls. The thrifts were still stuck with long-term, low-interest mortgage loans that didn't bring in enough income to pay off depositors. They needed to find big returns to make up the difference. Thanks to deposit insurance, they faced few consequences if their new investments went bad. So insolvent thrifts, often called "zombies," began to take greater and greater risks in an attempt to earn enough to cover their debts (which, for a bank or S& L, means making good on deposits). Some of their speculative real estate deals and "junk bond" investments look irresponsible, even crazy, in retrospect. But they made perfect business sense. If the deals worked out, the thrifts kept the profits. If those investments went bad, the federal government would cover the losses. Most of the zombies' high rolling did not pay off. These S&Ls became more and more insolvent, deeper and deeper in debt. The errors could not continue forever. In the end, cleaning up the S&L mess cost $481 billion, about $417 billion of it from the taxpayers.

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Pursued long enough, insulated action will produce a public backlash against "progress" and a legally enforced bias against enterprise and experimentation. The S& L bailout quickly turned into a rhetorical club for business bashers, not a symbol of social insurance. It made people suspicious of risk-taking financial institutions in general. The technocracy of forced change often begets the technocracy of complete resistance.

Consider the development and redevelopment of cities, a process shaped as much by political planning as by real estate supply and demand. In Gelernter's golden age, Robert Moses willfully remade New York City. "He gouged great gashes across it, gashes that once had contained houses by the hundreds and apartment buildings by the score," writes the biographer Robert Caro.

Moses was the quintessential technocrat, determined to shape the future to his sense of order and destiny. Squelching all opposition, he razed neighborhoods and spent tax money with abandon and without accountability. His West Side Improvement project cost at least $180 million in Depression-era dollars. 58 Unhindered by the constraints of competition or limited budgets—or the need to buy land from consenting sellers—Moses practiced "progress" without limit or feedback. He was a man of action who neither submitted his experiments to trial nor acknowledged the potential for error. Moses believed, he wrote, in "the courageous, clean-cut, surgical removal of all of our old slums…. I am against phony compromises, however labeled, which look to patching up a few buildings here and there. … There can be no real neighborhood reconstruction, no superblocks, no reduction of ground coverage, no widening of boundary streets, no playgrounds, no new schools, without the unflinching surgery which cuts out the whole cancer and leaves no part of it to grow again, and spread and perpetuate old miseries." And so, in the 1950s, Moses directed slum clearance programs that drove thousands of residents from poor but functional neighborhoods into dangerous areas and even more horrifyingly decrepit housing—or into once-middle-class brownstones that were subdivided into increasingly crowded new slums. Gripped by a static vision in which people could be surgically removed without consequence or spillover, Moses eradicated entire niches in the ecology of city housing and covered up the results.

Nor was he alone in such efforts. The same attitudes, methods, and surgical metaphors permeated the planning profession. Over the fifteen years beginning in 1949, about a million Americans were evicted from their homes to make way for federally financed urban renewal projects. Justified in the name of improving cities, these sweeping efforts were protected from competitive feedback that might indicate what city residents actually wanted. The whole point of such activities, in fact, was to upset the housing patterns and businesses that had evolved through the normal dynamic processes of city life.

"The consequences of a typical federal urban renewal project are often harsh," wrote the economist Martin Anderson in his 1964 book, The Federal Bulldozer. "People are forcibly evicted from their homes, businessmen are forced to close their doors, buildings, good and bad, are destroyed—all in the name of an appeal to some higher 'good,' the public interest." In the late 1950s, the West End of Boston, among the most famous urban renewal projects, went from a vital, if poor, multiethnic neighborhood to a concrete maze of overpasses and a few highrise apartment buildings. In the process, some twelve thousand people were run out of their homes, almost always into more expensive but not necessarily better apartments. Living within walking

distance in the early 1980s, I found the former West End nearly impenetrable and utterly repellent, a dead zone. At the time, having no idea of its history, I wondered how such a wasteland could have grown up in the midst of an otherwise vibrant area.

The reason was simple: Developers in urban renewal areas didn't have to find buyers willing to pay more than the old neighborhood had been worth to its previous owners. Like Soviet farmers feeding livestock with subsidized bread, these developers were encouraged to destroy value rather than create it. They could buy land at about 30 percent of what cities paid to acquire it—and that acquisition itself, through eminent domain, had already eliminated the ability of private owners to refuse to sell for a "reasonable" sum. Avoiding competition and thwarting resistance to planners' stasist schemes was, argues Anderson, what the program was all about:

> Again and again—from bankers, politicians, newspaper editors, businessmen, and even religious leaders—I heard statements like these: 'Well, I've tried to buy property in that area of town, but the owner won't sell at a reasonable price. Somebody has to make him sell at a 'fair' price. Who does he think he is, standing in the way of the whole city?" Or, "We need at least a whole block to do anything worthwhile; we can't fool around trying to buy a lot here and a lot there. Besides some old man may feel attached to property that's been in his family for years. We can't wait for him to die. We need the tool of eminent domain."

Eminent domain effectively shut down the economic feedback that would have told city planners and developers that people just didn't want to live the way technocrats envisioned, that the planners' versions of "progress" did not, in fact, make life better. Eventually, of course, such high-handed attitudes—and the devastating consequences the federal bulldozer had for city life—created a backlash. Neighborhood resistance began to block even voluntary development. New bureaucratic barriers were erected: environmental impact reviews, land marking regulations, architecture reviews, hearing after hearing. "Rights of resistance and control have been carved into law," writes the urban planning scholar Sidney Plotkin. "Friction has been built into the system…. More and more, owners and citizens act on the belief that change must be conditioned on the consent of the governed, especially when the consequences of innovation threaten to hit dangerously close to home." 65 Cities have replaced one form of technocratic stasis with another. Innovation has become the enemy, "not in my backyard" the rallying cry. Consistent only in their dedication to central control, technocratic authorities still vest themselves with the power to decide which experiments can proceed and which trials will be cut off, which futures are possible and which can never be.

Compared to the alternatives, dynamist trial and error is a very humble process. It invests no one with decisive power, assumes no one is omniscient or even particularly wise. It cherishes the unheralded inventor willing to test a new idea. It acknowledges human differences and permits diverse approaches. It recognizes that most ideas will fail—and turns that weakness into a powerful lever for progress. "There is no way to find the best design except to try out as many designs as possible and discard the failures," writes Freeman Dyson. Trial and error understands that life is unpredictable.

Dynamists may dream great dreams but they make modest claims. The infinite series promises not perfection but learning, not godlike oversight but diffused expertise. It makes progress mostly in baby steps. We are, it admits,

fallible and largely ignorant. We have not discovered the one best way to live, nor are we likely to. But we can, and have, improved our lot, building on the discoveries, insights, and experiments of the past.

At the very center of the dynamic vision, then, is a recognition of the human condition—of the limits of our minds but also of their potential. How to think about knowledge is for dynamists not an esoteric challenge for philosophers but a central, organizing question.

Chapter 6
Creating Nature

Eden is in Western myth the unchanging and pristine paradise, lost through overreaching and lamented ever since. In the biblical story, however, Eden is more complicated. It is a living, growing place whose life depends on water and human labor. God plants the garden only after he has created man from the ground, and he charges Adam to work and keep the garden: to both improve and preserve it. Humanity is to be the source of both change and stability. Adam is part of nature—his very name springs from the earth, adamah—yet he is also distinct from it.

Of course, no sooner has God created man, animals, and woman than the creator loses control of his creation. Genesis is the original Frankenstein myth. That man and nature could defy God has provoked theologians for centuries. We can leave the theological puzzles aside, however. Genesis suggests truths that do not depend on a particular religious tradition: Even in Eden, humanity occupies a garden, a place between static order and wild nature, á place we both work and keep. And no creation is completely under its creator's control. The world changes almost as soon as it is formed, and so does humanity. They change each other.

Yet the ideal of the untouched paradise, of orderly nature undisturbed by human action, still shimmers in many imaginations. Nature is a source of moral authority for some, of security for others. It offers standards and models. It is autonomous and eternal. "The chief lesson is that the world displays a lovely order, an order comforting in its intricacy," writes Bill McKibben in his best-selling book, *The End of Nature*. "And the most appealing part of this harmony, perhaps, is its permanence—the sense that we are part of something with roots stretching back nearly forever, and branches reaching forward just far." Throughout its long history, this image suggests, nature has not really changed. Its harmony and order are permanent, reminders of the beauty of stasis.

Changeless nature is not just a matter of utopian dreams. Those who seek stasis in the human world argue that they are following nature's way, that dynamism is not merely disruptive but unnatural. "The characteristic that best distinguishes flourishing ecosystems is never growth, but rather stability (a conservative virtue in its own right)," writes John Gray, the British philosopher, in his appeal for conservatives and greens to join forces. "This is a truth which is acknowledged in the discipline of ecology in all of its varieties. … Modernist political faiths which advocate the unlimited growth of population, production and knowledge … are effectively in rebellion against every truth we have established about order in the natural world" (emphasis added). The open-ended future of discovery and learning is not merely disrup-

tive but downright perverse. The infinite series, Gray maintains, defies the natural order of things.

Clearly, how we think about nature—and about artifice—informs how we think about the growth and evolution of human societies. If what is given by nature is good by definition, then to change it is evil. If nature supplies patterns, distinctions, boundaries, and essences for us to respect, then recombinations are immoral or dangerous. If stasis is the highest form of biological nature, then perhaps it is also the highest form of human society. If human beings and human work are fundamentally unnatural, set apart from the rest of the world, then we must choose either all-out war against nature or separation from it—destruction or quarantine.

If, however, nature is itself a dynamic process rather than a static end, then there is no single form of "the natural." An evolving, openended nature may impose practical constraints, but it cannot dictate eternal standards. It cannot determine what is good. If human beings, human work, human purposes, and human imagination are part of nature in some significant way, then neither destruction nor quarantine is an option. The distinction between the artificial and the natural must lie not in their source—human or not—but in their characteristics, in the way they relate to the world around them.

"Certain phenomena are 'artificial' in a very specific sense: they are as they are only because of a system's being molded, by goals or purposes, to the environment in which it lives," writes Herbert Simon in The Sciences of the Artificial, which seeks to give such fields as engineering, architecture, design, and administration the same sort of status and theoretical grounding that the natural sciences have. Artifice implies design, goals, external purposes. It requires control. Even the artifacts of nonhuman creatures, from wasp nests and beaver dams to the moistened sticks chimpanzees use to dig out termites, all extend their designers' control over the environment. Human artifacts, writes Simon, "are what they are in order to satisfy man's desires to fly or to eat well. As man's aims change, so too do his artifacts—and vice versa."

But artifice does not offer complete control. Simon notes that "those things we call artifacts are not apart from nature. They have no dispensation to ignore or violate natural law." The artificial and the natural are bound together: The artificial serves its creators' purposes, subject to the limits of nature.

The natural, by contrast, does not require purposes. It simply is. Nature, lacking intent, is amoral. And natural systems are out of control. 6 Purposeless, undirected behavior is characteristic not only of ecosystems, weather patterns, or tectonic plates but of undesigned human systems, such as languages. English grammar is not more or less moral than Chinese; it simply is. And while linguists and copy editors may study or trim a language, as a gardener tends plants, no one can control the system as a whole. It is constantly evolving.

Natural systems often evolve from the purposeful activities of their members, however. Birds pick wild strawberries and excrete their seeds, making it more likely that the sweeter, redder berries that attract birds will reproduce. That natural selection has nothing to do with the birds' purposes and is not under their control. Squirrels bury acorns, encouraging the evolution of oak trees that produce nuts of a size and shape particularly appealing to squirrels. The animals' actions must fit within the broader biological system, but they also affect its future direction.

This relation between decentralized actions and the natural systems that encompass them is even more apparent in the human world. When someone coins a word to capture a new attitude, invention, or idea, the new term must fit into the broader language, over which the word's creator has no control. And the new word affects the future evolution of the language. The same is true for an entrepreneur with a new product. He can directly control only his immediate economic environment (and even there his control is partial), not the economy as a vast, complex, natural system. But his success or failure will have ripple effects. Through such consequences, artifice is continually creating nature: generating new patterns and systems beyond anyone's control.

The tension between the natural and the artificial is a subject as old as philosophy or science, but the industrializing world of the late eighteenth and nineteenth centuries was famously obsessed with the question. We have inherited its romantic culture—a suspicion of nature tamed—as much as its technological arts and technocratic government. The romantics set emotion in opposition to reason, nature against artifice, humanity against technology. To preserve nature's purity, they recommended the quarantine of the human mind. That has never been a choice we could truly accept. It denies the fundamental links between body and mind, humanity and nature. In the name of authenticity, the romantic ideal counsels passivity and fatalism.

Understanding the relation between the natural and the artificial has recently assumed increasing urgency. Ours is, more and more, a biological era: an age defined by its insights into and power over the stuff of life itself. We are self-consciously, and quite literally, creating nature. How we understand what that creation means will determine much about our future. We must either choose between the rationalists and romantics—or their technocratic and reactionary derivatives—or we must find a different way.

So let us return to the garden. In *The End of Nature*, McKibben muses about the meaning of the greenhouse effect, which he argues has so transformed the atmosphere as to replace autonomous "nature" with a completely man-made world: "The greenhouse effect is a more apt name than those who coined it imagined. … We have built a greenhouse, a human creation, where once there bloomed a sweet and wild garden." It is a striking line, adopted even by negative reviewers. And it is quite peculiar. McKibben misses the obvious: Gardens themselves are human creations, which organize and rearrange nature. Natural processes continue in the garden—not everything is under the gardener's control—but those processes are channeled to human ends; in a garden, the natural is mixed with the artificial. Our very view of nature "sweet and wild" assumes human influence.

The artificiality of gardens was in fact the subject of much poetry in the English Renaissance, an age as concerned as our own with the relation between nature and artifice. … Like the crossbreeding that produces tulips streaked with color, grafting is highly "unnatural," a high-tech process that was extremely difficult to discover and to master. We take grafting for granted only because we are used to it. Every vineyard is a colony of clones; every rose garden, cherry orchard, and bougainvillea-strewn trellis is artificial. In modern nurseries, plants regularly "procreate without a Sex."

The quest for improvement, and for novelty, does not overturn nature. It recreates it. By understanding how biological processes work, we turn them to human ends. We do not overthrow nature, but cooperate with it, using nature's own art to create new natural forms. Our artifice alters the path of nature, but it does not end it, for nature has no stopping point, no final shape. It is a process, not an end.

On the oldest part of the newest land in the United States, the everexpanding Big Island of Hawaii, is a place that looks like Eden: the Waipi'o Valley. It nestles, flat and green, between a slate-gray beach and verdant cliffs up to two thousand feet high. A stream winds through it, giving the valley its name, "curving water." The volcanic soil is rich, the rain ample, the temperature warm. For nine centuries, Waipi'o was Hawaii's breadbasket, its irrigated paddies supplying taro, whose starchy roots are mashed into poi. Fruit trees grow wild here—guava, mango, Java plum, banana—along with ginger, berries, medicinal plants, and edible ferns. The kukui, or candlenut tree, yields nuts that can be eaten or strung together and burned for hours of light. Wild horses and pigs roam the valley, and its water is full of prawn, fish, and escargot-like snails. Waterfalls dangle from the valley's back wall. Viewed from the plateau above, Waipi'o is a miniature world, small enough to cup in your hands. Except for the mosquitoes and a bit too much humidity, it does seem like paradise.

Yet there are few people here. And the stories Kelly Loo tells are full of hunger: How, as children in the valley, he and his friends used to swipe the food offerings their Chinese neighbors left for ancestral spirits. How he used to find eggs and hide them in the outhouse, hoarding them for himself. 'What did I know?" he says. "I was a hungry kid." Retired from a job with the water company, Loo now lives in a suburban-style home on the outlook above the valley, where amenities such as electricity and paved roads are available. He takes tourists down to the valley floor in his four-wheel-drive van, telling stories as he negotiates the forty-five-degree semipaved one-lane road. He also grows taro, and has the calloused hands and herbicide-loving attitudes of a farmer.

Loo is thoroughly at home among the valley's plants and animals, happy with a garden to work and keep, full of Hawaiian natural lore. But he does not wax romantic about how "stability" distinguishes "flourishing ecosystems." It is not human nature to prefer poverty and hunger to the comforts of cold beer and four-wheel drive.

Besides, Loo knows that nature is not stable.

On April 1, 1946, a fifty-foot-high wall of water slammed into this tranquil valley, flattening everything before it. The same tsunami killed ninety-six people in the city of Hilo, fifty miles to the south. The several hundred residents of Waipi'o escaped unharmed, but their homes and other buildings were destroyed. Today's valley has no sign of the houses, stores, or churches of Loo's boyhood. He points to a wild and vacant meadow where his home town once stood.

The Waipi'o Valley's current "natural" state is the result of that cataclysm—and, just as surely, of the pull of economic opportunity elsewhere. In the valley, and in the rest of the world, nature is more complicated than romantic visions of stability suggest. Waipi'o did not arise spontaneously, created by autonomous nature seeking its proper form. Many of its varied flora and fauna are imports, brought by the Polynesians who first settled the island and the Europeans who followed centuries later. Palm trees, taro, and bananas are not native to bare volcanic rock.

"There is almost no circumstance one can find where something isn't changing the system," says the paleoecologist George L. Jacobson, Jr., who studies changes reflected in sediments and rocks. If nature does tend toward an equilibrium, he notes, "it's never allowed to get there, so we might as well not expect it to exist." Nature has no end, no goal, no one best state. …

From a scientific point of view, stasis is neither natural nor desirable. Interpreting the Endangered Species Act to enforce a hands-off policy has endangered numerous species, from butterflies and songbirds to grizzly bears, that depend on habitat not found in "climax" forests. Different living things require different conditions; the diversity of life is encouraged by the dynamism of nature.

Assuming that nature will remain constant tends to backfire. Daniel Botkin began his career as the caretaker of New Jersey's Hutcheson Memorial Forest, an uncut stand of oak and hickory bought in the 1950s by Rutgers University. The forest's protectors assumed that leaving the woods alone was the best way to save it for posterity. The Hutcheson Forest was, said a 1954 article, "a cross-section of nature in equilibrium." Without human interference, the forest was expected to stay pretty much the same forever, each generation of trees providing for the next: "The present oaks and other hardwood trees have succeeded other types of trees that went before them. Now these trees, after reaching old age, die and return their substance to the soil and help their replacements to sturdy growth and ripe old age in turn." In this patch of New Jersey, the experts believed, nature had found its balance.

But the oaks did not reproduce; maples began to take over. By examining fire scars in the stumps of dead trees, Rutgers researchers discovered the artifice behind their cherished nature. Before Europeans arrived in New Jersey, Indians had burned the underbrush every decade or so, presumably either to drive game or make travel easier. "These frequent fires cleared the understory, favored oaks over maples, and created the open forest of tall trees believed by naturalists in the early sixties to be original, constant, and unaffected by human influence," writes Botkin. The Indians weren't trying to produce a beautiful forest of hickory and oak; that particular mix of trees was a ripple effect, nature created as a consequence of art. Contrary to static assumptions about how ecologies work, Botkin warns, a place that is truly protected from human interference "may become a 'nature' nobody has ever seen before and perhaps nobody really wants." By contrast, the "environment that we like, and that we think of as 'natural'" is often the creation of earlier human action.

For ecologists like Botkin, a turbulent sense of nature in no way means that whatever humans do is good. It simply demands far more clarity about what human beings want from the environment and more research into how particular natural systems work. In some places, we may want to recreate the experience of nature as European explorers discovered it on the American continent three hundred years ago, a nature shaped by Indians' artifice. In others, we may want to preserve a particular species or maintain fishing grounds. Or we may have more global purposes, planting trees not for their own sakes but to soak up carbon dioxide, for instance. Achieving any of these goals—all of which are "artificial"—requires careful data collection, sophisticated and subtle models, and significant local knowledge. When Botkin's research team sought to understand the fluctuations in Washington State salmon populations, they got the most useful information not from the traditional theory of "maximum sustainable yield" but from an old-time fisherman, who knew that future supplies of salmon could be predicted by the water levels in the stream when they hatched.

Far from trying to plough up biological systems, Botkin and his fellow ecologists are eager to preserve and extend them—to create the varieties of nature that environmentalists value. Botkin is suspicious of civil engineering to tame rivers and mourns the passing of the prairie; he thrills to the songs of

sparrows and the howling of wolves, a symphony in the forest night. But he does not claim that "nature knows best." Rather, Botkin argues frankly for the human value of saving what he loves, for prairies as a connection to history and species preservation to serve our "aesthetic and moral sense." He does not disdain as artificial the restoration ecology that applies the mind of a gardener to the recreation of lost natural systems such as midwestern prairies. He believes human desires will and, by implication, should affect the evolution of nature. That belief puts Botkin at odds with green reactionaries, who despise human influence. He bluntly acknowledges, "Nature in the twenty-first century will be a nature that we make; the question is the degree to which this molding will be intentional or unintentional, desirable or undesirable." …

Reactionaries, by contrast, need nature as a moral absolute, exemplified by its perfect balance. "The ecological perspective begins with a view of the whole, an understanding of how the various parts of nature interact in patterns that tend toward balance and persist over time," writes Al Gore in his best-selling book called, not coincidentally, *Earth in the Balance*. Botkin's research topples this entire worldview. His work declares that nature has no single goal—that there is no static standard for "the natural." If nature doesn't define its own purposes, and if even "natural" states may incorporate human artifice, then nature is no guide even to its own proper destiny, much less to human life. …

Nature does, of course, impose some constraints on human actions: We cannot, as far as we know, go faster than the speed of light or be in two places at the same time. Chemicals bond in some ways and not in others. Certain plants require bright sunlight, others shade. Salmon will spawn only under certain, quite complicated, conditions. Any gardener knows, with Sir Francis Bacon, that to be commanded, nature must be obeyed. Nature tells us that if we want X, we must do Y and cannot do Z. It does not tell us whether to want, or not to want, X, It does not dictate that wilderness areas must remain "untrammeled by man," that logging, automobiles, wheat fields, and Disneyland are inherently evil, or that every species of beetle should be preserved. Turbulent nature does not decree the one best state for each part of the globe. It cannot tell us what to want. …

Our very selves, then, are part of the garden, simultaneously artificial and natural, within our control and beyond it. We need choose neither destruction nor quarantine: Nature and artifice are not antitheses but complements. "The wilderness is not just something you look at; it's something you are part of. You live inside a body made of wilderness material. I think that the intimacy of this arrangement is the origin of beauty. The wilderness is beautiful because you are part of it," writes architect Paul Shepheard. "Cultivation—the work of humans—has a different sort of beauty. There is nothing else under the sun than what there has always been. Cultivation is the human reordering of the material of the wilderness. If it is successful, the beauty of it lies in the warmth of your empathy for another human's effort."