Some of them paint another future, in which children and nature are reunited—and the natural world is more deeply valued and protected.

During the research for this book, I was encouraged to find that many people now of college age—those who belong to the first generation to grow up in a largely de-natured environment—have tasted just enough nature to intuitively understand what they have missed. This yearning is a source of power. These young people resist the rapid slide from the real to the virtual, from the mountains to the Matrix. They do not intend to be the last children in the woods.

My sons may yet experience what author Bill McKibben has called “the end of nature,” the final sadness of a world where there is no escaping man. But there is another possibility: not the end of nature, but the rebirth of wonder and even joy. Jackson’s obituary for the American frontier was only partly accurate: one frontier did disappear, but a second one followed, in which Americans romanticized, exploited, protected, and destroyed nature. Now that frontier—which existed in the family farm, the woods at the end of the road, the national parks, and in our hearts—is itself disappearing or changing beyond recognition.

But, as before, one relationship with nature can evolve into another. This book is about the end of that earlier time, but it is also about a new frontier—a better way to live with nature.

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**Part I**

THE NEW RELATIONSHIP BETWEEN CHILDREN AND NATURE

Here is this vast, savage, howling mother of ours,
Nature, lying all around, with such beauty, and such affection for her children,
as the leopard, and yet we are so early weaned
from her breast to society, to that culture which is exclusively
an interaction of man on man.

—Henry David Thoreau
1. Gifts of Nature

When I see birches bend to left and right...

I like to think some boy's been swinging them.

—Robert Frost

If, when we were young, we tramped through forests of Nebraska cottonwoods, or raised pigeons on a rooftop in Queens, or fished for Ozark bluegills, or felt the swell of a wave that traveled a thousand miles before lifting our boat, then we were bound to the natural world and remain so today. Nature still informs our years—lifts us, carries us.

For children, nature comes in many forms. A newborn calf; a pet that lives and dies; a worn path through the woods; a fort nested in stinging nettles; a damp, mysterious edge of a vacant lot—whatever shape nature takes, it offers each child an older, larger world separate from parents. Unlike television, nature does not steal time; it amplifies it. Nature offers healing for a child living in a destructive family or neighborhood. It serves as a blank slate upon which a child draws and reinterprets the culture's fantasies. Nature inspires creativity in a child by demanding visualization and the full use of the senses. Given a chance, a child will bring the confusion of the world to the woods, wash it in the creek, turn it over to see what lives on the unseen side of that confusion. Nature can frighten a child, too, and this fright serves a purpose. In nature, a child finds freedom, fantasy, and privacy: a place distant from the adult world, a separate peace.
These are some of the utilitarian values of nature, but at a deeper level, nature gives itself to children—for its own sake, not as a reflection of a culture. At this level, inexplicable nature provokes humility.

As the preeminent nature poet Gary Snyder writes, we attach two meanings to the word nature, which comes from the Latin *natura*—birth, constitution, character, course of things—and beyond *natura*, *nasci*—to be born. In its broadest interpretation, nature includes the material world and all of its objects and phenomena; by this definition, a machine is part of nature. So is toxic waste. The other meaning is what we call “the outdoors.” By this connotation, a man-made thing is not a part of nature, but apart from nature. On its face, New York City may not appear natural, but it does contain all manner of hidden, self-organizing wild places, from the organisms secreted within the humus of Central Park to the hawks that circle above the Bronx. In this sense, a city complies with the broadest laws of nature; it is natural (as a machine is part of nature), but wild in its parts.

When considering children in nature, one hunger for a richer description, a definition with more breathing room—one that does not include everything as natural or restrict nature to virgin forest. Snyder is drawn to poet John Milton’s phrase, “a wilderness of sweets.” Milton’s usage of wilderness catches the very real condition of energy and richness that is so often found in wild systems. A ‘wilderness of sweets’ is like the billions of herring or mackerel babies in the ocean, the cubic miles of krill, wild prairie grass seed . . . all the incredible fecundity of small animals and plants, feeding the web,” he explains. “But from another side, wilderness has implied chaos, eros, the unknown, realms of taboo, the habitat of both the ecstatic and the demonic. In both senses it is a place of archetypal power, teaching, and challenge.” When we think of children and the gifts of nature, this third, more bountiful understanding is helpful. For the purpose of this book, when I use the word “nature” in a general way I mean natural wildness: biodiversity, abundance—related loose parts in a backyard or a rugged mountain ridge. Most of all, nature is reflected in our capacity for wonder. Nasci. To be born.

Though we often see ourselves as separate from nature, humans are also part of that wildness. My earliest memory of using my senses, and sensing wonder, came on a cold spring morning in Independence, Missouri. I was perhaps three years old, sitting in a dry field behind my grandmother’s peeling Victorian home. Nearby, my father worked, planting a garden. He threw down a cigarette—as many were likely to do in that age, when Midwesterners habitually tossed refuse on the ground, or launched beer bottles and soda cans and cigarette butts from their car windows, sparks flying in the wind. The dry grass caught fire. I remember the exact sound of the flames and smell of the smoke and the zibush of my father’s leg and foot as he stomped and stepped quickly to chase the fire as it skipped across the field.

In this same field, I would walk around the fallen fruit from a pear tree, hold my nose and bend at the waist, a careful distance from the small mounds of ferment, and then experimentally inhale. I would sit down among the decaying fruit, attracted and repulsed. Fire and fermentation . . .

I spent hours exploring the woods and farmland at the suburban edge. There were the Osage orange trees, with thorny, unfriendly limbs that dropped sticky, foul fruit larger than softballs. Those were to be avoided. But within the windbreaks were trees that we could shinny, the small branches like the rungs of a ladder. We climbed fifty, sixty feet off the ground, far above the Osage windbreak, and from that vantage looked out upon the old blue ridges of Missouri, and the roofs of new houses in the ever-encroaching suburbs.

Often I climbed alone. Sometimes, lost in wonderment, I’d go deep into the woods, and imagine myself as Rudyard Kipling’s Mowgli, the boy raised by wolves, and strip off most of my clothes for the ascent. If I climbed high enough, the branches thinned to the point where, when the wind came, the world would tip down and up and around and up
and to the side and up. It was frightening and wonderful to surrender to the wind’s power. My senses were filled with the sensations of falling, rising, swinging; all around me the leaves snapped like fingers and the wind came in sighs and gruff whispers. The wind carried smells, too, and the tree itself surely released its scents faster in the gusts. Finally, there was only the wind that moved through everything.

Now, my tree-climbing days long behind me, I often think about the lasting value of those early, deliciously idle days. I have come to appreciate the long view afforded by those treetops. The woods were my Ritalin. Nature calmed me, focused me, and yet excited my senses.

“Where All the Electrical Outlets Are”

Many members of my generation grew into adulthood taking nature’s gifts for granted; we assumed (when we thought of it at all) that generations to come would also receive these gifts. But something has changed. Now we see the emergence of what I have come to call nature-deficit disorder. This term is by no means a medical diagnosis, but it does offer a way to think about the problem and the possibilities—for children, and for the rest of us as well.

My own awareness of the transformation began in the late 1980s, during research for Childhood’s Future, a book about the new realities of family life. I interviewed nearly three thousand children and parents across the country, in urban, suburban, and rural areas. In classrooms and living rooms, the topic of the children’s relationship with nature sometimes surfaced. I think often of a wonderfully honest comment made by Paul, a fourth-grader in San Diego: “I like to play indoors better, ‘cause that’s where all the electrical outlets are.”

In many classrooms I heard variations on that answer. True, for many children, nature still offers wonder. But for many others, playing in nature seemed so... Unproductive. Off-limits. Alien. Cute. Dangerous. Televised.

“It’s all this watching,” said a mother in Swarthmore, Pennsylvania.

“We’ve become a more sedentary society. When I was a kid growing up in Detroit, we were always outdoors. The kids who stayed indoors were the odd ones. We didn’t have any huge wide-open spaces, but we were always outdoors on the streets—in the vacant lots, jumping rope, or playing baseball or hopscotch. We were out there playing even after we got older.”

Another Swarthmore parent added, “Something else was different when we were young: our parents were outdoors. I’m not saying they were joining health clubs and things of that sort, but they were out of the house, out on the porch, talking to neighbors. As far as physical fitness goes, today’s kids are the sorriest generation in the history of the United States. Their parents may be out jogging, but the kids just aren’t outside.”

This was the mantra among parents, grandparents, uncles, aunts, teachers, and other adults across the country, even in places I would have expected to have a different view. For example, I visited a middle-class neighborhood in suburban Overland Park, Kansas, not far from where I spent my teen years. In the intervening decades, many of the woods and fields had vanished, but enough natural landscape remained to at least provide the opportunity for outside play. Surely kids still played in nature here? Not often, said several parents, who came together in a living room one evening to talk about the new landscape of childhood. Though several lived on the same block, this was the first time that some of these parents had met each other.

“When our kids were in third or fourth grade, we still had a little field behind our place,” said one mother. “The kids were complaining about being bored. And I said, ‘Okay, you guys are bored? I want you to go out to that field, right there, and spend two hours. Find something to do there. Trust me; just try it one time. You might enjoy yourselves.’ So, begrudgingly, they went out to the field. And they didn’t come back in two hours—they came back much later. I asked them why, and they said, ‘It was so much fun! We never dreamed we could have so much
fun! They climbed trees; they watched things; they chased each other; they played games like we used to do when we were young. So the next day, I said, ‘Hey, you guys are bored—why not go out to the field again?’ And they answered, ‘Nah—we’ve already done that once.’ They weren’t willing to let themselves do it again.”

“I’m not sure I understand exactly what you’re saying,” responded a father. “I think that my girls enjoy things like a full moon, or a pretty sunset, or flowers. They enjoy the trees when they turn—that sort of thing.”

Another mother in the group shook her head. “Sure, the little things, they notice,” she said. “But they’re distracted.” She described the last time her family had gone skiing, in Colorado. “It was a perfect, quiet day, the kids are skiing down the mountain—and they’ve got their headphones on. They can’t enjoy just hearing nature and being out there alone. They can’t make their own entertainment. They have to bring something with them.”

A quiet father, who had been raised in a farming community, spoke up. “Where I grew up, a person was just naturally outdoors all the time,” he said. “No matter which direction you went, you were outdoors—you were in a plowed field, or woods, or streams. We’re not like that here. Overland Park is a metropolitan area now. Kids haven’t lost anything, because they never had it in the first place. What we’re talking about here is a transition made by most of us who grew up surrounded by nature. Now, nature’s just not there anymore.”

The group fell quiet. Yes, much of that once-wild land was being graded and built upon—but I could see woods from the windows of the house in which we were sitting. Nature was still out there. There was less of it, to be sure, but it was there just the same.

A day after talking with the Overland Park parents, I drove across the Kansas-Missouri border to Southwood Elementary School in Raytown, Missouri, near Kansas City. I attended grade school at Southwood. To my surprise, the same swings (or so it seemed) still creaked above the hot asphalt; the hallways still shone with the same linoleum tile; the same pint-sized wooden chairs, carved and initialed with black, blue, and red ink, sat waiting in crooked rows.

As the teachers gathered second-through fifth-graders and escorted them into the classroom where I waited, I unpacked my tape recorder and glanced out the window at the blue-green ridge of trees, probably pin oak, maple, cottonwood, or perhaps pecan or honey locust, their limbs shivering and swaying slowly in the spring breeze. How often, as a child, had those very trees inspired my daydreams?

During the next hour, as I asked the young people about their relationship with the outdoors, they described some of the barriers to going outside—lack of time, TV, the usual suspects. But the reality of these barriers did not mean that the children lacked curiosity. In fact, these kids spoke of nature with a strange mixture of puzzlement, detachment, and yearning—and occasional defiance. In the years to come, I would hear this tone often.

“My parents don’t feel real safe if I’m going too deep in the woods,” said one boy. “I just can’t go too far. My parents are always worrying about me. So I’ll just go, and usually not tell ’em where I’m going—so that makes ’em mad. But I’ll just sit behind a tree or something, or lie in the field with all the rabbits.”

One boy said computers were more important than nature, because computers are where the jobs are. Several said they were too busy to go outside. But one girl, a fifth-grader wearing a plain print dress and a intensely serious expression, told me she wanted to be a poet when she grew up.

“When I’m in the woods,” she said, “I feel like I’m in my mother’s shoes.”

She was one of those exceptional children who do still spend time outside, in solitude. In her case nature represented beauty—and refuge. “It’s so peaceful out there and the air smells so good. I mean, it’s polluted, but not as much as the city air. For me, it’s completely different there,” she said. “It’s like you’re free when you go out there. It’s your
own time. Sometimes I go there when I’m mad—and then, just with the peacefulness, I’m better. I can come back home happy, and my mom doesn’t even know why.”

Then she described her special part of the woods.

“I had a place. There was a big waterfall and a creek on one side of it. I’d dig a big hole there, and sometimes I’d take a tent back there, or a blanket, and just lie down in the hole, and look up at the trees and sky. Sometimes I’d fall asleep back in there, just felt free, it was like my place, and I could do what I wanted, with nobody to stop me. I used to go down there almost every day.”

The young poet’s face flushed. Her voice thickened.

“And then they just cut the woods down. It was like they cut down part of me.”

Over time I came to understand some of the complexity represented by the boy who preferred electrical outlets and the poet who had lost her special spot in the woods. I also learned this: Parents, educators, other adults, institutions—the culture itself—may say one thing to children about nature’s gifts, but so many of our actions and messages—especially the ones we cannot hear ourselves deliver—are different.

And children hear very well.

2. The Third Frontier

*The frontier is a goner. It died with its boots laced.*

—M. R. Montgomery

On my bookshelf is a copy of *Shelters, Shacks and Shanties*, written in 1915 by Daniel C. Beard, a civil engineer-turned-artist, best known as one of the founders of the Boy Scouts of America. For half a century, he wrote and illustrated a string of books on the outdoors. *Shelters, Shacks and Shanties* happens to be one of my favorite books because, particularly with his pen and ink drawings, Beard epitomizes a time when a young person’s experience of nature was inseparable from the romantic view of the American frontier.

If such books were newly published today, they would be considered quaint and politically incorrect, to say the least. Their target audience was boys. The genre seemed to suggest that no self-respecting boy could enjoy nature without axing as many trees as possible. But what really defines these books, and the age they represented, is the unquestioned belief that being in nature was about doing something, about direct experience—and about not being a spectator.

“The smallest boys can build some of the simple shelters and the older boys can build the more difficult ones,” Beard wrote, in the forward of *Shelters, Shacks and Shanties*. “The reader may, if he likes, begin with the first [shanty] and graduate by building the log houses; in doing this he will be closely following the history of the human race,
because ever since our arboreal ancestors with prehensile toes scampered among the branches of the pre-glacial forests and built nest-like shelters in the trees, men have made themselves shacks for a temporary refuge. He goes on to describe, through words and drawings, how a boy could build some forty types of shelters, including the Tree-top House, the Adirondack, the Wick-Up, the Bark Teepee, the Pioneer, and the Scout. He tells “how to make beaver-mat huts” and “a sod house for the lawn.” He teaches “how to split logs, make shakes, splits, or clapboards” and how to make a pole house and secret locks and an underground fort, and, intriguingly, “how to make a concealed log cabin inside of a modern house.”

Today’s reader would likely be impressed with the level of ingenuity and skill required, and the riskiness of some of the designs, too. In the case of the “original American boy’s hogan or underground house,” Beard does urge caution. During the creation of such caves, he admits, “there is always serious danger of the roof falling in and smothering the young troglodytes, but a properly built underground hogan is perfectly safe from such accidents.”

I love Beard’s books because of their charm, the era they conjure, and the lost art they describe. As a boy, I built rudimentary versions of these shelters, shacks, and shanties—including underground forts in the cornfields and elaborate tree houses with secret entrances and a view of what I imagined to be the frontier stretching from Ralston Street beyond the edge of the known suburban world.

Closing One Frontier, Opening Another

In the space of a century, the American experience of nature has gone from direct utilitarianism to romantic attachment to electronic detachment. Americans have passed not through one frontier, but through three; the third frontier—the one that young people are growing up in today—is every bit as much of a venture into the unknown as Daniel Beard experienced in his time.

The passing, and importance, of the first frontier was described in 1893, during Chicago’s World’s Columbian Exposition—a celebration of the 400th anniversary of Columbus’s arrival in the Americas. There, at a meeting of the American Historical Association in Chicago, University of Wisconsin historian Frederick Jackson Turner presented his “frontier thesis.” He argued that “the existence of an area of free land, its continuous recession, and the advance of American settlement westward” explained the development of the American nation, history, and character. He linked this pronouncement to results of the 1890 U.S. Census, which revealed the disappearance of a contiguous line of the American frontier—the “closing of the frontier.” This was the same year that the superintendent of the census declared the end of the era of “free land,” that is, land available to homesteaders for tillage.

Little noted at the time, Jackson’s thesis came to be considered one of the most important statements in American history. Jackson argued that every American generation had returned “to primitive conditions on a continually advancing frontier line.” He described this frontier as “the meeting point between savagery and civilization.” Basic American cultural traits could, he said, be linked to the influence of that frontier, including “that coarseness and strength combined with acuteness and acquisitiveness; that practical inventive turn of mind, quick to find expedients; that masterful grasp of material things . . . that restless, nervous energy; that dominant individualism.” Historians still debate Turner’s thesis; many, if not most, have rejected the frontier, as Turner saw it, as the key to understanding American history and sensibilities. Immigration, the industrial revolution, the Civil War—all had a deep formative influence on our culture. Turner himself later revised his theory to include events that were frontier-like—the oil boom of the 1890s, for example.

Nonetheless, from Teddy Roosevelt to Edward Abbey, Americans continued to think of themselves as frontier explorers. In 1905, at President Roosevelt’s inauguration, cowboys rode down Pennsylvania Avenue,
the Seventh Cavalry passed for review, and American Indians joined the celebration—including the once-feared Geronimo. The parade, in fact, announced the coming of the second frontier, which existed mainly in the imagination for nearly a century. The second frontier existed in Beard's words and illustrations, and in the family farm, which, though already diminishing in number, continued as an important defender of American culture. Especially in the early decades of the twentieth century, the second frontier also existed in urban America; witness the creation of the great urban parks. The second frontier was a time, too, of suburban manifest destiny, when boys still imagined themselves woodsmen and scouts, and girls still yearned to live in a little house on the prairie, and sometimes built better forts than the boys.

If the first frontier was explored by the acquisitive Lewis and Clark, the second frontier was romanticized by Teddy Roosevelt; if the first frontier was the real Davy Crockett’s, the second frontier peaked with Disney’s Davy. If the first frontier was a time of struggle, the second frontier was a period of taking stock, of celebration. It brought a new politics of preservation, an immersion of Americans in the domesticated and romanticized fields and streams and woods around them.

Turner's 1893 pronouncement found its counterpart in 1993. His statement was based on the results of the 1890 Census; the new demarcation line was drawn from the 1990 Census. Early, one hundred years after Turner and the U.S. Census Bureau declared the end of what we usually consider the American frontier, the bureau posted a report that marked the death of the second frontier, and the birth of a third. That year, as the Washington Post reported, in "a symbol of massive national transformation," the federal government dropped its long-standing annual survey of farm residents. Farm population had dwindled so much—from 40 percent of U.S. households in 1900 to just 1.9 percent in 1990—that the farm resident survey was irrelevant. The 1993 report was surely as important as the census evidence that led to Turner's obituary for the frontier. "If sweeping changes can be captured in seemingly

trivial benchmarks, the decision to end the annual report is one," reported the Post.

This new, symbolic demarcation line suggests that baby boomers—Americans born between 1946 and 1964—may constitute the last generation of Americans to share an intimate, familial attachment to the land and water. Many of us now in our forties or older knew farmland or forests at the suburban rim and had farm-family relatives. Even if we lived in an inner city, we likely had grandparents or other relatives who farmed or had recently arrived from farm country during the rural-to-urban migration of the first half of the twentieth century. For today’s young people, that familial and cultural linkage to farming is disappearing, marking the end of the second frontier.

The third frontier is populated by today’s children.

Characteristics of the Third Frontier

In ways that neither Turner nor Beard could have imagined, the third frontier is shaping how the current generation of young Americans, and many to come, will perceive nature.

Not yet fully formed or explored, this new frontier is characterized by at least five trends: a severance of the public and private mind from our food’s origins; a disappearing line between machines, humans, and other animals; an increased intellectual understanding of our relationship with other animals; the invasion of our cities by wild animals (even as urban/suburban designers replace wildness with synthetic nature); and the rise of a new kind of suburban form. Most characteristics of the third frontier can be found in other technologically advanced countries, but these changes are particularly evident in the United States (if only because of the contrast with our frontier self-image). At first glance, these characteristics may not seem to fit together logically, but revolutionary times are seldom logical or linear.

In the third frontier, Beard’s romantic images of the outdoor child seem as outdated as nineteenth-century depictions of the Knights of the
Round Table. In the third frontier, heroes previously associated with the outdoors are irrelevant; the real Davy Crockett, who symbolized the first frontier, and even Disney’s Davy, from the second frontier, are gone and nearly forgotten. A generation that came of age wearing buckskin jackets and granny dresses is now raising a generation for whom all fashion—piercing, tattoos, and all the rest—is urban.

- For the young, food is from Venus; farming is from Mars

My friend Nick Raven, who lives in Puerta de Luna, New Mexico, was a farmer for several years before he became a carpenter and then a teacher at a New Mexico prison. Nick and I have fished together for years, but we are very different men. I have described him as an un-doubting nineteenth-century father; I am a doubting twenty-first-century dad. Nick believes fish should be caught and eaten; I believe that fish should be caught and, most of the time, released. Nick believes that violence is inevitable, that suffering is redemptive, and that a father must teach his children about the harshness of life by exposing them to that harshness. I believe that, as a parent, it’s my job to protect my sons from the brutality of the world for as long as I can.

In an earlier book, *The Web of Life*, I described the relationship that Nick and his children had to animals and food:

When Nick’s children were small and he and his family still lived on their farm down a dirt road in a valley of adobes and cottonwoods and chiles, his daughter came home one day to find her favorite goat (not a pet, really, but one that followed her around) skinned, gutted, and strung up in the barn. This was a time when Nick’s family was short on shoes, and the meat they ate was meat that Nick butchered or shot. It was a terrible moment for his daughter.

Nick insists he has no regrets, but he still talks about it. She was hurt, he says, but she knew from that moment on, and for the rest of her life, where the meat that she eats comes from, and that meat is not born plastic-wrapped. This is not the kind of experience I would have wanted for my children, but I have had a different life.

Few of us miss the more brutal aspects of raising food. For most young people, however, memory supplies no experience for comparison. More young people may be vegetarians or consume food from the health food store, but fewer are likely to raise their own food—especially if the food is an animal. In fewer than a half century, the culture has moved from a time when small family farms dominated the countryside—when Nick’s way of understanding food was dominant—to a transitional time when many suburban families’ vegetable gardens provided little more than recreation, to the current age of shrink-wrapped, lab-produced food. In one way, young people are more aware of the sources of what they eat. The animal-rights movement has taught them about the conditions within, say, poultry factory farms. It’s probably no coincidence high school and college students are adopting vegetarianism in increasing numbers. Such knowledge, however, does not necessarily mean that the young are personally involved with their food sources.

- The end of biological absolutes. Are we mice or are we men? Or both?

The young are growing up in an era without biological absolutes. Even the definition of life itself is up for grabs.

One morning in 1997, people around the world opened their newspapers to see a disturbing photograph of a live, hairless mouse with what appeared to be a human ear growing from its back. The creature was the product of a team of researchers from the University of Massachusetts and the Massachusetts Institute of Technology that had introduced human cartilage cells into an earlike scaffold of biodegradable polyester fabric implanted onto the back of the mouse. The scaffold nourished the ersatz ear.

Since then, one headline after another has announced some potential blending of machines, humans, and other animals. The implications have evaded the public for two decades, according to the International Center for Technology Assessment, a nonprofit, bipartisan organization that assesses technological impacts on society. As of 2000, several hundred
animals—patented life forms—had already been genetically engineered or altered with human genes. Over twenty-four human genes—including those for human growth and nerves—had been inserted into rats, mice, and primates to create creatures called chimeras. These new creatures are to be used primarily for medical research, but some scientists seriously discuss the possibility of chimeras someday existing outside the lab.

Think what it means for children to grow up now, and how different their experience of nature and definition of life is, or soon will be, from the experiences of us adults. In our childhood, it was clear enough when a man was a man and a mouse was a mouse. Implicit in some of the newest technologies is the assumption that there's little difference between living and nonliving matter at the atomic and molecular level. Some see this as one more example of turning life into a commodity—the cultural reduction that turns living bodies into machines.

As the twenty-first century dawned, scientists at Cornell University reported building the first true nanomachine—near-microscopic robot—capable of movement; the miniscule robot used a propeller and motor and drew power from organic molecules. This development opened "the door to make machines that live inside the cell," one of the researchers said. "It allows us to merge engineered devices into living systems." At Sandia National Laboratories in Albuquerque, a scientist predicted that a system of "massively distributed intelligence" would vastly increase the nanorobots' ability to organize and communicate. "They will be able to do things collectively that they can't do individually, just like an ant colony," he said. Around the same time, an entomologist in Iowa created a machine combining moth antennae and microprocessors that sent signals of different pitches when the antennae picked up the scent of explosives. Researchers at Northwestern University created a miniature robot equipped with the brain stem of a lamprey eel. And a Rockville, Maryland, company engineered bacteria that could be functionally attached to microchips; the company called this invention "critters on a chip."

We can no longer assume a cultural core belief in the perfection of nature. To previous generations of children, few creations were as perfect or as beautiful as a tree. Now, researchers flood trees with genetic material taken from viruses and bacteria to make them grow faster, to create better wood products, or to enable trees to clean polluted soil. In 2003, the Pentagon's Defense Advanced Research Projects Agency funded researchers to develop a tree capable of changing colors when exposed to a biological or chemical attack. And the University of California promoted "birth control for trees," a genetically engineered method of creating a "eunuch-tree that spends more of its energy making wood and not love."

For baby boomers, such news is fascinating, strange, disturbing. To children growing up in the third frontier, such news is simply more hair on the dog—an assumed complexity.

- A hyperintellectualized perception of other animals

Not since the predominance of hunting and gathering have children been taught to see so many similarities between humans and other animals, though now those similarities are viewed in a very different, more intellectualized way.

This new understanding is based on science, rather than myth or religion. For example, recent studies reported in the journal Science describe how some nonhuman animals compose music. Analyses of songs of birds and humpback whales show they use some of the same acoustic techniques, and follow the same laws of composition, as those used by human musicians. Whale songs even contain rhyming refrains, and similar intervals, phrases, song durations, and tones. Whales also use rhyme in the way we do, "as a mnemonic device to help them remember complex material," the researchers write. According to their study, whales physiologically have a choice: they could use arrhythmic and nonrepeating tunes, but instead, they sing.

Such information is not a substitute for direct contact with nature,
but this kind of knowledge does inspire a certain wonder. My hope is that such research will cause children to be more inclined to cultivate an understanding of their fellow creatures. Sure, romanticized closeness—say, swimming with dolphins at an animal touchy-feely resort—may soften some of our loneliness as a species. On the other hand, nature is not so soft and fuzzy. Fishing and hunting, for example, or the way Nick Raven put meat on his table, are messy—to some, morally messy—but removing all traces of that experience from childhood does neither children nor nature any good.

"You look at these kids [in the animal-rights movement], and you largely see urban, disaffected, but still privileged people," says Mike Two Horses, of Tucson, founder of the Coalition to End Racial Targeting of American Indian Nations. His organization supports native people such as the Northwest's Makah tribe, who are traditionally dependent on whale hunting. "The only animals the young animal rightsists have ever known are their pets," he says. "The only ones they've ever seen otherwise are in zoos, Sea World, or on whale-watching [now whale-touching] expeditions. They're disconnected from the sources of their food—even from the sources of the soy and other vegetable proteins they consume."

I see more good in the animal-rights movement than Two Horses does, but his point has merit.

- **Contact with nature: so close, and yet so far**

Even as the definition of life itself is up for grabs, the potential for contact with more common wild animals is increasing, despite what Two Horses says. In a number of urban regions, humans and wild critters are coming into contact in ways that have been unfamiliar to Americans for at least a century. For one, the U.S. deer population is the highest it has been in a hundred years.

In *Ecology of Fear: Los Angeles and the Imagination of Disaster*, social historian and urban theorist Mike Davis describes what he calls a new dialectic between the "wild" and the "urban": "Metropolitan Los Angeles, now bordered primarily by mountains and desert rather than by farmland as in the past, has the longest wild edge, abruptly juxtaposing tract houses and wildlife habitat, of any major non-tropical city. . . . Brazen coyotes are now an integral part of the street scene in Hollywood and Toluca Lake." A reporter for the British newspaper *The Observer* writes: "[American] settlers and their descendants went about taming the environment with warlike ferocity. After ethnically cleansing the natives, they set about the extermination of bears, mountain lions, coyotes and wildfowl . . . but mountain lions adapted. Los Angeles may be the only city on earth with mountain lion victim support groups."

At midcentury, millions of Americans migrated to suburbia, following the dream of owning their own homes and a piece of land—their own quarter-acre of the frontier. For a while, space was expansive. Today, sprawl does not guarantee space. The newly dominant type of development—with interchangeable shopping malls, faux nature design, rigid control by community covenants and associations—dominates the bellwether metro regions of Southern California and Florida, but also encircles most of the older urban regions of the nation. These dense donuts of development offer fewer places for natural play than the earlier suburbs. In some cases, they offer even fewer natural play spaces than the centers of the old industrial cities.

In fact, parts of urban Western Europe are greener—in the sense of increasing the amount and quality of natural surroundings within urban regions—than most of urban/suburban America, a land still associated with frontier and open space. "An important lesson from many of these European cities has to do with the very perception we have of cities," writes Timothy Beatley, professor in the Department of Urban and Environmental Planning at the University of Virginia, in *Green Urbanism: Learning from European Cities*. Particularly in Scandinavian cities, where green design is gaining popularity, "there is a sense that
cities are and ought to be places where nature occurs. In the United States, a challenge remains to overcome the polar distinction between what is urban and what is natural. Perhaps because of the expansiveness of our ecological resources and land base, we have tended to see the most significant forms of nature as occurring somewhere else—often hundreds of miles away from where most people actually live—in national parks, national seashores, and wilderness areas.

These are some of the trends that form the American context for a de-natured childhood, something that is perhaps as mysterious as—and certainly less studied than—the march of the nanorobots or the advance of the chimera.

3. The Criminalization of Natural Play

For many years I was self-appointed inspector of snowstorms and rainstorms ...  
—Henry David Thoreau

Consider Mister Rick’s neighborhood.

Fifteen years ago, John Rick, a middle-school math teacher, and his family moved to Scripps Ranch because of its child-friendly reputation. Set in a lush old eucalyptus grove in a northern San Diego neighborhood laced with canyons and linked by walking paths, Scripps is one of those rare developments where parents can imagine their children enjoying nature, just as they did. A sign near its entrance reads, “Country Living.”

“We have more Scout troops per capita than just about anywhere else in the country,” says Rick. “The planners fought to have vast amounts of open space for kids to play in and parks for every neighborhood.”

A few years after moving to Scripps Ranch, Rick started reading articles in the community’s newsletter about the “illegal use” of open space. “Unlike where we had lived before, kids were actually out there running around in the trees, building forts, and playing with their imaginations,” he recalls. “They were putting up bike ramps to make jumps. They were damming up trickles of water to float boats. In other words, they were doing all the things we used to do as kids. They were creating for themselves all those memories that we cherish so fondly.” And now it had to stop. “Somehow,” says Rick, “that tree house was now a fire hazard. Or the ‘dam’ might cause severe flooding.”
Authoritative adults from the Scripps Ranch Community Association chased kids away from a little pond near the public library, where children had fished for bluegills since Scripps Ranch had been a working cattle spread many decades earlier. In response to the tightened regulations, families erected basketball hoops. Young people moved their skateboard ramps to the foot of their driveways. But the community association reminded the residents that such activities violated the covenants they had signed when they bought their houses.

Down came the ramps and poles; and indoors went the kids. *Game Boy* and *Sega* became their imagination,* Rick says. *Parents became alarmed. Their kids were getting fat. Something had to be done.* So the parents supported the creation of a skate park in a more willing neighborhood. That neighborhood was ten miles away.

Rick is free to move to another neighborhood, but in the growing donuts of development surrounding most American cities, such restrictions are becoming the rule. Countless communities have virtually outlawed unstructured outdoor nature play, often because of the threat of lawsuits, but also because of a growing obsession with order. Many parents and kids now believe outdoor play is verboten even when it is not; perception is nine-tenths of the law.

One source of constriction is private government. Most housing tracts, condos, and planned communities constructed in the past two to three decades are controlled by strict covenants that discourage or ban the kind of outdoor play many of us enjoyed as children. Today, 47 million Americans live in homes regulated by condominium, cooperative, and homeowners’ associations, according to the Community Associations Institute. The number of community associations burgeoned from 10,000 in 1970 to 231,000 today. These associations impose rules on adults and children (if children are allowed in them at all), ranging from mildly intrusive to draconian. Scripps Ranch is governed by one of the more flexible community associations, but even here official squads of adults regularly tear down forts and tree houses built by kids in the wooded canyons.

Some reasons are understandable: for example, concern about camps of transients or the outbreak of fire. But the unintended consequence is the discouragement of natural play.

Public government also restricts children’s access to nature. For the most part the criminalization of natural play is more suggestive than real. However, in some communities, young people who try to recreate their parents’ childhoods may face misdemeanor charges or see their parents sued. In Pennsylvania, three brothers, ages eight, ten, and twelve, spent eight months and their own money to build a playhouse in their backyard; the district council ordered the boys to tear the tree house down because they had no building permit. In Clinton, Mississippi, a family happily spent four thousand dollars to build an elaborate, two-story, Victorian-style tree house. They asked the city if a permit was necessary, and a city official said no. Five years later, the city planning and zoning department announced that the tree house must be demolished because it violated an ordinance prohibiting construction of an accessory building in front of a house.

Other stringent restrictions on children’s outdoor play spring from our efforts to protect nature from human population pressures. For example, to protect the endangered Arroyo southwestern toad, 3,000 acres of camping and fishing in Angeles National Forest were closed year-round. At California’s Oceano Dunes region, kite-flying has been banned because kites scare off a protected species of shorebird, the snowy plover, which has a limited habitat suitable for nesting. After the ban went into effect, a park ranger told Oceano resident Ambrose Simas he could no longer fly kites (perceived as hawks by the plover) with his great-grandson on the same beach where he had once flown kites with his father and grandfather. In my city, it is illegal to *injure, destroy, cut or remove any tree . . . [or] plant . . . growing in any city-owned park . . .
without written permission from the city manager.” But what exactly constitutes “to injure?” Does a child seriously injure a tree by climbing it? Some think so. Another statute makes it illegal to “take, kill, wound, or disturb... any bird or animal... unless the same shall have been declared noxious by the city manager...”

If endangered and threatened species are to coexist with humans, adults and children do need to tread lightly. But poor land-use decisions, which reduce accessible nature in cities, do far more damage to the environment than do children. Two examples: Each year, 53,000 acres of land are developed in the Chesapeake Bay watershed; that’s about one acre every ten minutes. At that rate, development will consume more land in the Chesapeake watershed in the next twenty-five years than in the previous three and a half centuries, according to the Alliance for the Chesapeake Bay. Similarly, the Charlotte, North Carolina, region lost 20 percent of its forest cover over the past two decades; between 1982 and 2002, the state lost farmland and forests at the rate of 383 acres a day. The U.S. Department of Agriculture projects forests declining from 767,000 acres in 1982 to 377,000 in 2022. Amazingly, developed land in North Carolina increased at a rate twice that of the state’s population growth.

As open space shrinks across America, overuse increases. This is true even in those metropolitan regions considered, by the public, to be more suburban than urban. Ironically, people who move to Sun Belt cities expecting more elbowroom often find less of it. Eight of the nation’s ten highest-density metropolitan areas are in the West. In some of those cities, typical development methods favor decapitated hills, artificial landscaping, yards the size of grave sites, and few natural play areas. The disappearance of accessible open space escalates the pressure on those few natural places that remain; local flora is trampled; fauna die or relocate, and nature-hungry people follow in their four-wheel-drive vehicles or on their motorcycles. Meanwhile, the regulatory message is clear: islands of nature that are left by the graders are to be seen, not touched.

The cumulative impact of overdevelopment, multiplying park rules, well-meaning (and usually necessary) environmental regulations, building regulations, community covenants, and fear of litigation sends a chilling message to our children that their free-range play is unwelcome, that organized sports on manicured playing fields is the only officially sanctioned form of outdoor recreation. “We tell our kids that traditional forms of outdoor play are against the rules,” says Rick. “Then we get on their backs when they sit in front of the TV—and then we tell them to go outside and play. But where? How? Join another organized sport? Some kids don’t want to be organized all the time. They want to let their imaginations run; they want to see where a stream of water takes them.”

Not every youngster automatically conforms. When Rick asked his students to write about their experiences in nature, twelve-year-old Lorie described how she loved to climb trees, particularly ones on a patch of land at the end of her street. One day, she and a friend were climbing in those branches and “a guy comes along and yells, ‘Get out of those trees!’ We were so scared; we ran inside and didn’t come out again. That was when I was seven, so that old man seemed pretty frightening. But it happened again last year in my own front lawn—but this time it was someone else, and I decided to ignore him, and so nothing happened.” Lorie thinks all of this is pretty stupid, limiting her opportunities to be “free and not have to be clean and act like girls who are afraid of a scratch or mud all the time.” She adds, “To me, still being considered a kid, it can’t be too much to ask. We should have the same rights as adults did when they were young.”

Measuring the De-natured Childhood

Over the past decade, a small group of researchers has begun to document the de-naturing of childhood—its multiple causes, extent, and impact. Much of this is new territory; the criminalization of natural play, for example, which is both a symptom and cause of the transformation, is
occurring without much notice. Copious studies show a reduced amount of leisure time experienced by American families, more time in front of the TV and the computer, and growing obesity among adults and children because of diet and sedentary lifestyles. We know these things. But do we know exactly how much less time children spend specifically in nature? No. “We also don’t know if there is any geographic or class divide, in terms of which kids spend time in nature,” says Louise Chawla, a Kentucky State University environmental psychology professor and a tireless champion for increasing children’s experiences in nature. Good longitudinal studies that span the decades are missing. “We don’t have older data to compare. No one thought to ask these questions thirty or fifty years ago,” she says.

Like many of us, too many researchers have taken the child-nature connection for granted. How could something so timeless change in such a short time? Even if some researchers asked that question, others dismissed it as an exercise in nostalgia. One reason is that there’s no commercial incentive to ask. For years, James Sallis has been studying why some children and adults are more active than others. He is program director of the Active Living Research Program for the Robert Wood Johnson Foundation, a multi-year effort to discover how to design recreational facilities and whole communities so they stimulate people of all ages to be more active. The studies are focusing on such sites as urban parks, recreation centers, streets, and private homes. “Based on previous studies, we can definitely say that the best predictor of preschool children’s physical activity is simply being outdoors,” says Sallis, “and that an indoor, sedentary childhood is linked to mental-health problems.”

I asked him what he had learned about how children use woods, fields, canyons, and vacant lots—in other words, unstructured natural sites. “We don’t ask about those places,” he said.

If the Robert Wood Johnson Foundation isn’t collecting such data, it’s unlikely that studies funded by commercial interests would finance such research. One of the great benefits of unstructured outdoor recreation is that it doesn’t cost anything. Sallis explained. “Because it’s free, there’s no major economic interest involved. Who’s going to fund the research? If kids are out there riding their bikes or walking, they’re not burning fossil fuel, they’re nobody’s captive audience; they’re not making money for anybody. . . . Follow the money.”

Nonetheless, the circumstantial evidence of a generational break from nature is growing in the United States and elsewhere.

In 1986, Robin Moore, a professor of landscape architecture at North Carolina State, charted the shrinkage of natural play spaces in urban England, a transformation of the landscape of childhood that occurred within a space of fifteen years. In 2002, another British study discovered that the average eight-year-old was better able to identify characters from the Japanese card trading game Pokémon than native species in the community where they lived: Pikachu, Metapod, and Wigglytuff were names more familiar to them than otter, beetle, and oak tree. Similarly, Japan’s landscape of childhood, already downsized, grew smaller. For almost two decades the well-known Japanese photographer Keiko Haginoya photographed children’s play in the cities of Japan. In recent years, “children have disappeared so rapidly from his viewfinder that he has had to bring this chapter of his work to an end,” Moore reports. “Either indoor spaces have become more attractive, or outdoor spaces have become less attractive—or both.” Moore, who is president of the International Association for the Child’s Right to Play and director of the Natural Learning Initiative, cites such causes as poorly designed outdoor spaces; the rapid growth of domestic air-conditioning since the 1950s; apprehensive parents who keep their children close to home; state-mandated school curricula that do not allow time for study outdoors; and the overly structured lifestyle of many families.

Support for scientific research on this issue is more common over-
seas than in the United States. Nonetheless, a growing body of evidence indicates that direct exposure to nature is essential for physical and emotional health. For example, new studies suggest that exposure to nature may reduce the symptoms of Attention Deficit Hyperactivity Disorder (ADHD), and that it can improve all children’s cognitive abilities and resistance to negative stresses and depression.

**Nature-Deficit Disorder**

The overarching importance of this research combined with our knowledge of other changes in the culture demands a shorthand description. So, for now, let’s call the phenomenon *nature-deficit disorder*. Our culture is so top-heavy with jargon, so dependent on the illness model, that I hesitate to introduce this term. Perhaps a more appropriate definition will emerge as the scientific research continues. And, as mentioned earlier, I am not suggesting that this term represents an existing medical diagnosis. But when I talk about nature-deficit disorder with groups of parents and educators, the meaning of the phrase is clear. Nature-deficit disorder describes the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses. The disorder can be detected in individuals, families, and communities. Nature deficit can even change human behavior in cities, which could ultimately affect their design, since long-standing studies show a relationship between the absence, or inaccessibility, of parks and open space with high crime rates, depression, and other urban maladies.

As the following chapters explain, nature-deficit disorder can be recognized and reversed, individually and culturally. But deficit is only one side of the coin. The other is natural abundance. By weighing the consequences of the disorder, we also can become more aware of how blessed our children can be—biologically, cognitively, and spiritually—through positive physical connection to nature. Indeed, the new research focuses not so much on what is lost when nature fades, but on what is gained in the presence of the natural world. “There is a great need to educate parents about this research—to awaken or inspire the parents’ pleasure with nature play—as the necessary context for continued nature experiences for their children,” says Louisa Chawla. Such knowledge may inspire us to choose a different path, one that leads to a nature-child reunion.