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Richard Preston

Climbing the Redwoods

FROM *THE NEW YORKER*

The redwood forests of the Pacific Northwest are one of America's natural wonders. Ancient, tall as skyscrapers, redwoods are a marvel. Perhaps most remarkable is the redwood canopy, a living world three hundred feed above ground. Richard Preston joins a preeminent botanist for a first-hand tour of the redwoods' peaks.

THE COAST REDWOOD TREE is an evergreen conifer, a member of the cypress family, which grows in valleys and on slopes of mountains along the coast of Central and Northern California, mostly within ten miles of the sea. The scientific name of the tree, which is usually simply called a redwood, is *Sequoia sempervirens.* A coast redwood has fibrous, furrowed bark, flat needles, and small seed-bearing cones the size of olives. Its heartwood is the color of old claret and is extremely resistant to rot. It has a lemony scent. Redwoods flourish in wet, rainy, foggy habitats. The realm of the redwoods starts in Big Sur and runs northward along the coast to Oregon; fourteen and a half miles up the Oregon coast, the redwoods abruptly stop.

The main trunk of a coast redwood can be up to twenty-five feet

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in diameter near its base, and in some cases it can extend upward from the ground for more than two hundred and fifty feet before the first strong branches emerge and the crown of the tree begins to flare. The crown of a tall coast redwood is typically an irregular spire that can look like the plume of a rocket taking off. Very few trees of any species today other than redwoods are more than three hundred feet tall. The tallest living coast redwoods are between three hundred and fifty and three hundred and seventy feet high—the equivalent of a thirty-five-to-thirty-seven-story building.

In its first fifty years of life, a coast redwood can grow from a seed into a tree that's a hundred feet tall. Redwoods grow largest and tallest in silty floodplains near creeks, in spots that are called alluvial flats. There, a redwood can suck up huge amounts of water and nutrients, and it is protected from wind, which can throw a redwood down. In its next thousand years, it grows faster, adding mass at an accelerating rate. The living portion of a tree is a layer of tissue called the cambium, which exists underneath the bark. If the cambium of one of the bigger coast redwoods was to be spread out into a flat sheet, it would be nearly half the size of a football field. Each year, a coast redwood can add one millimeter of new growth to its cambium, or the equivalent of one ton of new wood.

As a young redwood reaches maturity, it typically loses its top. The top either breaks off in a storm or dies and falls off. A redwood reacts to the loss by sending out new trunks, which typically appear in the crown, high up in the tree, and point at the sky like the fingers of an upraised hand. The new trunks shoot upward from larger limbs, traveling parallel to the main trunk, or they emerge directly out of the main trunk and run alongside it. The new trunks send out their own branches, which eventually spit out more trunks through the crown. The resulting structure is what mathematicians call a fractal; botanists say that the tree is forming reiterations. The redwood is repeating its shape again and again.

With the passing of centuries, the reiterated trunks begin to touch one another here and there. The trunks fuse and flow together at

these spots, like Silly Putty melting into itself. The bases of the extra trunks bloat out, and become gnarled masses of living wood called buttresses. In the crowns of the largest redwoods, bridges of living redwood are flung horizontally from branch to branch and from trunk to trunk, cross-linking the crown with a natural system of struts and cantilevers. This strengthens the crown and may help it to grow bigger, until it can look like a thunderhead coming to a boil. There are often blackened chambers and holes in the trunks—fire caves, caused by big forest fires. The tree survives and regrows its burned parts, and it continues to thrust out new trunks.

Botanists judge the size of a tree by the amount of wood it contains, not by its height. By that measure, the largest species of tree is the giant sequoia, a type of cypress that is closely related to the coast redwood. The biggest living giant sequoia trees have fatter and more massive trunks than the coast redwoods. But the coast redwood is the tallest species of tree on earth.

Extremely large coast redwoods are referred to as redwood giants. The very biggest are called titans. Currently, about a hundred and twenty coast redwoods are known to be more than three hundred and fifty feet tall. Eighty percent of them live in Humboldt Redwoods State Park, along the Eel River, in Humboldt County, in Northern California. No one knows exactly how old the biggest coast redwoods are because nobody has ever drilled into one of them to count its annual growth rings. Botanists think that the oldest redwoods may be somewhere between two thousand and three thousand years old. They seem to be roughly the age of the Parthenon.

ONE DAY IN EARLY 2003 I arrived at the office of Stephen C. Sillett, on the campus of Humboldt State University in Arcata, a coastal town in Humboldt County. Winter storms had been passing through, and Arcata smelled of redwoods and the sea. Sillett is an associate professor of botany, and he is the principal explorer of the redwood-forest canopy, the three-dimensional labyrinth that exists in the air above the forest floor. He is one of the world's better tree climbers. One reason I had come to Humboldt was to see Sillett climb a redwood.

Sillett conducts his research with a group of graduate students and a few other scientists, whom he trains in advanced tree-climbing techniques. I had never met Sillett, and didn't quite know what to expect. "Steve can come across as brusque, but it's because he's so focused," his brother, Scott Sillett, explained to me one day on the telephone. Scott is an ornithologist at the Smithsonian Institution, in Washington, D.C., who studies songbirds. "Steve is one of the most passionate and curious scientists I know. I love birds, but even I can get sick of them. Steve never seems to get sick of trees."

I found Steve Sillett in his office, a windowless room with white walls, stretched out in a chair before a computer, working on some data from the canopy. He was wearing olive-green climbing pants, a pullover shirt, and mud-stained climbing boots. Sillett is thirty-seven years old, of medium height, and he has a lean body with flaring shoulders, huge forearms, and adept-looking hands. His hair is light brown and feathery, and his eyes, set deep in a square face, are dark brown and watchful. Sillett's manner is usually laid-back, but he can act fast. He once fell out of the top of a big redwood named Pleiades I, which is three hundred and ten feet tall. Dropping through the air, he reached out and caught a branch with one hand. This ripped his shoulder out of its socket and tore a bit of flesh out of his hand, but it also stopped his fall. He ended up hanging from the branch by a bleeding hand and a dislocated shoulder, twenty-eight stories above the ground and feeling a bit surprised with himself. "We're primates. Those opposable thumbs are awesome," he explained.

The forest canopies of the earth are realms of unfathomed nature, and they are largely a mystery. They are also disappearing—they are being logged off rapidly, burned away, turned into fragments and patches—and they are perhaps being altered by changes in the earth's climate caused by human activities. Sillett said, "We want to try to understand the basic biology of the redwood canopy, because it will

give us a blueprint for how things should work in an old-growth redwood forest."

Redwoods are able to reshape the local climate and environment in which they live. They change the chemical nature of the soil, and they assume control of vital resources in the forest, particularly sunlight and water. "We're trying to get a feel for how much water is stored in the canopy—in the trees, in their foliage, in the canopy soil, and in other plants that live in the canopy," Sillett said. "There's a lot of water up here. These trees are controlling the movement of the water in this forest. How do they do that? What will happen to these forests as the climate changes with global warming? The way the world is going, our work in the canopy could be just a task of documenting something before it winks out."

In 1995 Sillett received a Ph.D. in botany from Oregon State University, in Corvallis. Soon afterward, he took his present job at Humboldt and began to explore the old-growth redwood canopy. No scientist had been there before. The tallest redwoods were regarded as inaccessible towers, shrouded in foliage and almost impossible to climb, since the lowest branches on a redwood can be twenty-five stories above the ground. From the moment he entered redwood space, Steve Sillett began to see things that no one had imagined. The general opinion among biologists at the time—this was just eight years ago—was that the redwood canopy was a so-called "redwood desert" that contained not much more than the branches of redwood trees. Instead, Sillett discovered a lost world above Northern California.

The old-growth redwood-forest canopy, Sillett found, is packed with epiphytes, plants that grow on other plants. They commonly occur on trees in tropical rain forests, but nobody really expected to find them in profusion in Northern California. There are hanging gardens of ferns, in masses that Sillett calls fern mats. The fern mats can weigh tons when they are saturated with rainwater; they are the heaviest masses of epiphytes which have been found in any forest canopy on earth. Layers of earth, called canopy soil, accumulate over the centuries on wide limbs and in the tree's crotches—in places where trunks spring from trunks—and support a variety of animal and plant life. In the crown of a giant redwood named Fangorn, Sillett found a layer of canopy soil that is three feet deep. Near the top of Laurelin, or the Tree of the Sun, which is three hundred and sixty-eight feet tall and still growing, Sillett found a huge, sheared-off trunk with a rotted, damp center. Masses of shrubs are growing out of the wet rot, sending their roots down into Laurelin.

Sillett and his students have found small, pink earthworms of an unidentified species in the beds of soil in the redwoods. A Humboldt colleague of Sillett's named Michael A. Camann has collected aquatic crustaceans called copepods living in the fern mats. The scientists have not yet been able to determine the copepods' species. Sillett said, "They commonly dwell in the gravel in streams around here." He can't explain how they got into the redwood canopy. A former graduate student of Sillett's named James C. Spickler has been studying wandering salamanders in the redwood canopy. The wandering salamander is brown and gold, and it feeds on insects, mainly at night. Spickler found that the salamanders were breeding in the redwood canopy, which suggests that they never visit the ground—this population of salamanders appears to live its entire life cycle in the redwood canopy.

Old redwood trees are infested with thickets of huckleberry bushes. In the fall, Sillett and his colleagues stop and rest inside huckleberry thickets, hundreds of feet above the ground, and gorge on the berries. He and his students have also taken censuses of other shrubs growing in the redwood canopy: currant bushes, elderberry bushes, and salmonberry bushes, which occasionally put out fruit, too. Sillett has discovered small trees—wild bonsai—in the canopy. The species include California bay laurel trees, western hemlocks, Douglas firs, and tan oaks. Sillett once found an eight-foot Sitka spruce growing on the limb of a giant redwood.

Over the years, forest-canopy researchers have developed a variety of techniques for gaining access to forest canopies. These

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include towers, walkways, balloons, high-powered binoculars (the researcher looks at the canopy but doesn't go there), direct tree climbing (which is what Sillett does), and construction cranes. There is, for example, the Wind River Canopy Crane, which is situated in the Gifford Pinchot National Forest, in southwest Washington. The crane has a gondola at the end of a long arm, which can deliver a scientist to any point in the canopy that's within reach, including to the tips of branches, and the gondola can go as high as two hundred and twenty feet above the ground. The disadvantage of a crane is that it's expensive to operate, and it's rooted in one spot. The Wind River crane is able to penetrate roughly one and a half million cubic meters of tree space. Steve Sillett and his colleagues are able to explore roughly twenty billion cubic meters of old-growth redwood forest. In any event, the Wind River crane wouldn't be able to get a person into the crown of the taller giant redwood trees, since many of them are mostly or entirely above the highest reach of the crane.

When Sillett and his colleagues are aloft in redwood space, and moving around from place to place, they make use of tree-climbing ropes and a safety harness called a tree-climbing saddle. They wear helmets and soft-soled boots (spikes can damage a tree). Tree climbers normally hang suspended in midair in a harness attached to ropes looped over solid parts of the tree above them called anchor points. The ropes are attached to the climber's saddle by means of carabiners, which are strong aluminum or steel clips. Tree climbers often move very lightly over branches, keeping most of their weight suspended on their anchor ropes. A skilled tree climber can travel horizontally or at diagonals through the crown of a tree while he's hanging in midair, and not even touch the tree with his body. He may toss a length of rope here or there, getting the rope over a new anchor point, and then he can pull himself to a different place in the tree.

Tree climbing is quite different from rock climbing. Rock climbers move upward over a vertical surface of stone by using their hands and feet to obtain friction and support. They are not suspended from taut ropes (except sometimes in the type of rock climbing called aid climbing). A rock climber advances upward while a safety rope, held by a person called a belayer, trails loosely below him. The rope is there in case the rock climber loses his grip on the stone and falls. In tree climbing, the rope is used as the main tool for gaining height and for moving around. The bark of a tree is crumbly and soft, and a climber can't get any kind of secure grip on it with his hands and feet. The branches of a tree can snap off.

The method by which Steve Sillett and his colleagues climb redwoods is known as a modified arborist-style climbing technique. Arborists, or tree surgeons, get around in trees using a special soft, thick, strong rope. When the rope is passed over an anchor point, it is formed into a long loop or noose, which is tied with a sliding knot called the Blake's hitch. The Blake's hitch was invented in 1990 by a tree surgeon in California named Jason Blake. He popularized it among arborists. It looks a little bit like a hangman's knot, though it functions in a different way. It is a friction knot—it can grip securely on a length of rope, or it can slide on the rope, depending on how the knot is manipulated. By sliding a Blake's hitch, a tree climber can shorten or lengthen a loop of rope over an anchor point, and move upward or downward. A climber can also lock the Blake's hitch, and thereby hang motionless.

In the late 1980s, Sillett was a biology major at Reed College in Portland, Oregon, and had already decided that he wanted to become a canopy scientist; for his senior thesis at Reed, he began climbing tall Douglas-fir trees. A few years later, when he was a graduate student at Oregon State, he got a telephone call from an arborist named Kevin Hillery, who had happened to read Sillett's college thesis. Sillett told him that he was using boots with spikes, called climbing spurs, and a short rope called a flipline to get himself up the trunks of the trees—he was climbing the Douglas firs in the way that an electrical worker climbs up a telephone pole. Hillery said, "If you need spurs to climb a tree, you shouldn't be climbing trees." He offered to teach Sillett the arborist-style climbing technique. Sillett soon began developing his own style of climbing. Sillett's method differs from the classical arborist technique in that he ascends into the crown of a redwood along a single strand of rope called the main rope. Once he gets up into the crown, he detaches himself from the main rope and moves around using a shorter length of rope. (Most arborists don't descend trees on a main rope, since most trees aren't tall enough to require one.)

The process of getting into the crown of a tree is known to tree climbers as the entry. To accomplish an entry into a redwood, Sillett ties a fishing line to an arrow and then, with a hunting bow, shoots the arrow over a strong branch somewhere in the lower crown of the tree. He then ties a nylon cord to one end of the fishing line. By pulling on the other end, he drags the cord over the branch. He ties a rope—which will be the main rope—to the cord and drags it over the branch. Now the main rope is hanging in an upside-down U over a branch in the crown of the tree. He ties one end to a smaller, nearby tree, and then he climbs up the loose, hanging end of the rope using mechanical ascenders (of the kind that rock climbers and cavers use). Sillett says, "You loft yourself into the lower crown on a main rope, and then you detach yourself and move from branch to branch."

To do so, Sillett uses a complicated rig of rope and carabiners, sixty feet long, which he calls a double-ended split-tail lanyard, or a motion lanyard. The lanyard works in the same basic way as does Spider-Man's silk. A climber can attach either end to an anchor point. By attaching alternate ends, he can move around while always staying attached to the tree by at least one strand of rope. Sillett is not immune to a fear of heights. At odd moments when he's aloft in the deep canopy, often when he's hanging from a branch on a motion lanyard, a kind of waking dream flashes over him. For a second, he seems to feel something break, and then he seems to feel himself turning in space as he falls for twenty or thirty stories along the trunk of a giant coast redwood.

The crown of an ancient coast redwood can bristle with rotting extra trunks, and it can be crisscrossed with dead limbs that may be up to several feet in diameter, and there can be broken-off dead branches hanging in the foliage, which are called widow-makers. The twitching movement of a climbing rope can stir loose a widow-maker, and a falling branch can tear off other branches, triggering a cascade of spinning redwood spars the size of railroad ties. A falling branch can spike itself five feet into the ground. Redwoods can have pieces of dead wood in them that are bigger than Chevrolet Suburbans. Sillett carries a little folding saw with him and uses it to cut away any small, hazardous dead branches, "but with the big hazards we just have to rely on hope," he says. Redwoods occasionally shed whole sections of themselves. Sillett calls this process calving. The tree releases a kind of woodberg, and as it collapses it gives off a roar that can be heard for a mile or two, and it leaves the area around the calved redwood looking as if a tank battle had been fought there. A calving event would obliterate any humans in the tree. Sillett told me, "The thing I fear most is a falling branch that hooks on my rope. It would slide down the rope into me, and it would tear through my body cavity. You are a grape hanging on a vine, and a falling branch can pop you."

The tallest living part of a tree is called the leader. The leader of a coast redwood is often a delicate spindle, covered with papery bark, and its branches are brittle. When Sillett reaches one, he sometimes takes off his boots and socks and hangs them on a branch, and then he climbs barefoot to the top. "It makes sense to have a form of communication with the tree," he says.

In the summer of 2000, while Sillett was attending a scientific conference, he met a canopy scientist named Marie Antoine. They started climbing redwoods together, and were married soon afterward. Antoine, a slender woman in her late twenties, was born and raised in Canada. She is an expert in lichens and a lecturer at Humboldt State. Sillett and Antoine live in a small yellow house in the hills overlooking Arcata. They keep their tree-climbing gear in the garage.

IN THE 1840S WHEN AMERICAN SETTLERS arrived in Northern California, the redwood forest amounted to roughly two million

acres of virgin, old-growth trees. Loggers began cutting down the redwoods with axes and handsaws, using the wood for making barns, houses, fences, and railroad ties. In the 1920s and 1930s, the introduction of logging machinery, chainsaws, and Caterpillar tractors vastly increased the speed of logging along the northern coast of California, and the old-growth redwood forests began to disappear. Most of these forests ended up being owned by timber companies. As a rule, they carried out clear-cutting operations, in which no tree of any worth was left standing. In all, close to 96 percent of the virgin redwood forest was cut down. Some botanists, including Steve Sillett, believe that during the logging a number of redwood titans were felled that were bigger than any of the living giant sequoia trees are today. In other words, before the logging, the coast redwood was probably the largest tree on earth, not just the tallest.

About ninety thousand acres of old-growth redwoods have remained intact, in patches of protected land. The remaining scraps of the primeval redwood-forest canopy are like three or four fragments of a rose window in a cathedral, and the rest of the window has been smashed and swept away. "Oh, man, the trees that were lost here," Sillett said to me one day as we were driving through the suburbs of Arcata. "This was the most beautiful forest on the planet, and it's almost totally gone. This is such a sore point."

Conservationists won a major victory in 1999, with the signing of a deal known as the Headwaters Agreement, between the federal government and one of the largest redwood-timber companies, Pacific Lumber, which is a subsidiary of Maxxam. The agreement, and subsequent deals, gave the government title to a large part of Pacific Lumber's old-growth redwood tracts, including the seventy-five-hundred-acre Headwaters Forest, half of it virgin redwood, in the mountains southeast of Eureka, California. The government paid Pacific Lumber $380 million. However, stretches of virgin redwood forest left on private timber-company lands continued to be logged.

Today, the timber-company lands in Northern California—owned by Pacific Lumber, Green Diamond Resource Company, and others—

are managed for high-volume production of young redwood trees. The tracts are logged off on a schedule, typically every fifty years or so. It is increasingly difficult to find any redwood trees growing on timber-company land which are more than eighty years old. Sillett has climbed in these trees. Their crowns are nearly devoid of life. They are a redwood desert.

In his office, on the day I first met him, Sillett tapped on a mouse, and a computer-generated image of a grove of redwoods appeared on the screen. "You need to look at some redwood architecture," he said. The grove, he explained, is named the Atlas Grove, and it is in Prairie Creek Redwoods State Park, which is a sliver of protected old-growth redwood forest that hugs the sea along the northern part of Humboldt County. The computer image was a three-dimensional map of the crowns of the trees in the Atlas Grove; he had made the map from data that he and his associates had gathered in years of climbing them. The Atlas Grove is tiny—it is about three hundred and fifty yards long by thirty-five yards wide—and it is a jam of monstrous redwoods with reiterated crowns. The Atlas Grove may be the oldest grove of living redwoods; although Sillett isn't sure exactly how old it is, judging by the height, the amount of rot in the dead parts of the trees, and the types and abundance of epiphytes, it seems to have come into existence around the time of Julius Caesar. The Atlas Grove was discovered in 1991 by a tall-tree explorer named Michael Taylor, who is a friend of Sillett's. Discovery, in the case of a giant tree, doesn't necessarily mean that the tree has never been seen before—the grove had been known to some park rangers. It means that nobody has understood the tree's size, or has measured it.

Sillett named most of the trees in the grove after Greek gods. (Generally, the discoverer of a redwood names it: Sillett often gives the tree a name only after he's climbed it and gained a sense of its character. There's no formal process—the names are private, known mostly to the botanists who study redwoods.) "That's Prometheus, that's

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Epimetheus, and that's Atlas—they were all brothers," Sillett said, pointing to the screen. The trees looked something like witches' brooms standing on their handles. He tapped the mouse again, and the images began to rotate. "Atlas has these three huge trunks in its top, like a trident," he said. "Atlas is so full of soil and plants that you get this overwhelming sense of a tree holding up the earth. Here's the Pleiades. And that's Kronos and that's Rhea."

The biggest tree in the Atlas Grove is a redwood titan named Iluvatar. Sillett named the tree after the creator of the universe in J. R. R. Tolkien's *The Silmarillion.* "Iluvatar is so complex that you can't tell much about it just by looking at it," he said. On the screen, Iluvatar rotated slowly, as if we were flying around it in a helicopter. The crown of Iluvatar contains two hundred and ten trunks, and it fills thirty-two thousand cubic yards of space. It took Steve Sillett, Marie Antoine, and four graduate students roughly ten days of climbing apiece to make a 3-D map of the crown. With these data, Sillett, along with an expert in giant trees named Robert Van Pelt, performed a calculation that shows that Iluvatar contains thirty-seven thousand five hundred cubic feet of wood. Iluvatar is one of the largest living things on the planet.

I asked Sillett where the Atlas Grove was, exactly.

He gave me a guarded look. "It's something you can't print."

Botanists are secretive about the locations of rare plants. They fear that any contact between humans and rare plants can be disastrous for the plants. Sillett is particularly worried about recreational tree climbers. Recreational tree climbing is an evolving sport, or emerging oddity, which is practiced by a thousand or so people in the United States but is rapidly growing in popularity. It apparently got its start in 1983, when a certified arborist in Atlanta named Peter Jenkins began teaching all sorts of people, including children, how to climb trees safely using a rope and a harness and the arborist climbing technique. He founded a tree-climbing school called Tree Climbers International. The classroom of Tree Climbers International consists of two white-oak trees on a plot of land near downtown Atlanta.

Sillett is widely admired by recreational tree climbers, but his feelings about them are laced with foreboding. "Not only are redwoods sensitive to damage from climbing but the whole habitat of the redwood canopy is fragile," Sillett explained, that day in his office. "It cannot survive without damage if people start climbing around in it for recreational reasons." He believes that recreational climbers would try to climb the biggest and tallest redwoods if they knew their exact locations, and they wouldn't bother to get anyone's permission. Climbing a tree without permission is an accepted part of the culture of recreational tree climbing. It is called doing a ninja climb or poaching a tree.

The U.S. National Park Service is in charge of issuing research permits for the parks where most of the remaining giants and titans among the coast redwoods stand. Sillett and other canopy scientists are allowed to climb in the parks only between the middle of September and the end of January each year. During the rest of the year, the National Park Service closes the redwoods to climbing in order to allow the spotted owl and a seabird called the marbled murrelet to nest in the redwoods without being disturbed.

Sillett closed the view of the Atlas Grove on his computer, and stood up. "So, have you seen enough?"

"Not really. I was wondering if I could climb in the redwood canopy with you."

He didn't answer. He looked me over with a kind of professional coolness. His eyes seemed to focus on my face and neck, my torso, and my hands. "Are you a tree climber?"

"Yes, I am."

"These trees are gnarly. All it takes to get yourself killed is one mistake."

I told him that I knew something about climbing trees. I'd come across the Tree Climbers International school one day while I was surfing on the Internet. I had never really thought about tree climbing; it sounded weirdly appealing. I got a flight to Atlanta, and I began to learn the art of movement in a forest canopy. By the time I met Steve Sillett, I had had about twenty hours of basic training. In addition, I had climbed half a dozen trees near my house, which is in New Jersey. But, in Sillett's view, I knew essentially nothing about climbing redwoods. I had never heard of some of the advanced equipment that Sillett uses, like the motion lanyard; in fact, many professional tree climbers have never heard of it, either.

Sillett said that while he was happy to have me walk around on the ground in the redwoods with him and his colleagues, he was not interested in taking me up into the canopy, at least not immediately. (His brother, Scott, who climbs with him every now and then, explained later, "It's definitely true that Steve doesn't trust the climbing skills of others. It takes such focus to climb safely.")

And so I returned to Atlanta for further training. One day in April, I found myself seventy feet above the ground, dangling from a branch on a rope like a Christmas ornament, practicing the skills needed to get oneself safely from place to place in a tree. It was a cool, blue day, and the wind was blowing. I was suspended at the point of a V formed by two loops of ropes. By sliding Blake's hitches, I shortened one loop while I lengthened the other. This changed the shape of the V, from an asymmetrical V oriented toward the left to an asymmetrical V oriented toward the right. In this way, I traveled horizontally in midair to a different place in the tree. In the distance, the rectilinear towers of Atlanta glittered in the sun.

Back home in New Jersey, I ordered from an arborist supply company sixty feet of half-inch tree-climbing rope, four carabiners, and two split tails, which are short pieces of rope that are tied with Blake's hitches to the longer piece of rope. When these things arrived, I assembled a motion lanyard. At first, I practiced with the lanyard while I was standing on the ground—I heaved its ends up over branches in a maple tree in my front yard. Then, wearing a climbing saddle and a helmet, I raised myself into the air with the lanyard, and got about six feet off the ground. In an ash tree that grows off to the side of my house, I ascended sixty feet by throwing the ends of the motion lanyard over higher and higher anchor points—that is, I lanyarded my way to the top of the tree. I extended my circle of climbing, and began to explore a forest canopy that ranges up a hillside above my house.

The forest canopy on my hill extends from about fifty to a hundred feet above the ground. It is composed of the crowns of sugar maples, red oaks, white oaks, chestnut oaks, hickories, ash trees, tulip poplars, and some tall, beautiful old beech trees. As I became more adept at movement in trees, I became better able to go laterally, or on diagonals, through the air. Birds seem to pay little attention to a person hanging on a rope in a forest, and it's not always clear that they are able to identify such an object as a human being. Sometimes flocks of birds sweep through the canopy and divide around a climber or move beneath him. Flying squirrels are tame in the canopy. I've reached out a finger and stroked their fur on occasion. (They close their eyes when you stroke them, but they soon tire of it, and plummet off the branch, catch the air, and soar away.) During climbs into taller trees, I was occasionally able to look down on the backs of birds, which shine with reflected sunlight as they move through the green depths of the canopy, like schools of fish.

SILLETT AND GEORGE W. KOCH, a tree physiologist from Northern Arizona University, and a graduate student named Anthony R. Ambrose have installed electronic monitoring systems in seven of the biggest and tallest redwoods. The monitoring systems consist of weather stations at various spots in the trees, and different kinds of bio-probes, and the systems are linked together with up to half a mile of data cables strung in each tree. The scientists are trying to learn how redwoods move water through their trunks and branches and how they manage to grow so tall.

George Koch is a lanky, genial man in his forties, with knotted arms and an easygoing manner. Sillett taught him how to climb trees. "I'm like a kid in a candy shop, climbing these three-hundred-and-sixty-foot-tall trees with Steve," Koch said to me one day when I visited him in Arcata. "The overwhelming question for me is what determines the height of a tree. At around three hundred and seventy

feet, the tallest redwoods seem to be approaching a ceiling, which is based on a limit in height to which any plant can lift water. Why aren't the redwoods six hundred feet tall?"

Exactly how an extremely tall tree delivers water to its top is a matter of deep interest to Koch and Sillett. Trees bring water upward from their roots through a network of microscopic pipes called the xylem. The pipes are unbroken from the bottom to the top of a redwood. It takes a few weeks for water that is absorbed in a redwood's roots to get to the top of the tree. A redwood can move water upward through its pipes against two million pascals of negative pressure. (The pascal is a standard measure of pressure used by physicists, and negative pressure is basically a sucking force.) Sillett and Koch have been looking for an engineered system that sucks water at two million pascals, so that they can do experiments. But they can't find such a system. Apparently, redwoods are better at pulling water than any human technology is.

In a spell of dry years, air bubbles seem to form in a redwood's pipes and stop the continuous flow of water, and the top dies and usually falls off. In wetter periods, a redwood regrows its top. "Redwoods have an incredible ability to reiterate new trunks," Koch went on. "A side branch will take off and shoot skyward, and in a matter of a hundred years it will become the new leader—the new top—of the tree."

In any ecosystem in which they occur, redwoods tend to dominate. They tower above other species of trees, and they shade them out, killing them or making it nearly impossible for them to grow. Trees are horrible to one another, and redwoods are viciously aggressive. They drop large pieces of dead wood on smaller neighboring trees, which typically shatters the tree. Sillett calls this phenomenon "redwood bombing." In this way, a giant redwood suppresses and kills trees growing near it, including hemlocks, spruces, Douglas firs, and big-leaf maple trees. A giant redwood can clear a DMZ around its base, an area covered with redwood debris mixed with twisted and dead trees of other species.

Redwoods are monoecious, which means that the plant is both male and female. The female organs of the tree are its round, knobby seed cones. A redwood's male organs are small, nubbin-like cones, called strobili, which appear at the tips of branches and release pollen. The grains of pollen contain sperm cells that fertilize egg cells inside the female cones, and seeds are produced. Over its lifetime, a redwood can release ten billion seeds. It may be that only one of the seeds gets lucky and becomes a mature redwood tree. If a redwood is sheared off at its base, or if it burns to a blackened spar, it can send up from its roots a circle of small trees, or clones, having DNA identical to the parent tree's. The clones become a ring of redwoods in the forest, forming a structure called a cathedral tree.

Redwoods are exceedingly efficient at gathering light. A grove of redwoods is able to soak up more than 90 percent of the sunlight falling on the crowns of the trees. Young redwoods are able to survive in dark places, where almost no other trees can survive, since they come into existence in the deep shade of their elders. When an old redwood falls, creating an opening in the canopy, sunlight splashes onto smaller redwoods, and they leap upward, rapidly becoming big trees. Little redwoods can sometimes crop up in thickets of slender trunks.

Scientists suspect that such a group of small redwoods may be joined at its roots, and also may share a common root system with a large redwood nearby—but nobody really knows. The small redwoods and the big redwood may all exchange water and nutrients with one another. It is possible that the root systems of the redwoods in a forest are fused into a web underground, so that they can be thought of as a single living thing. These are all questions that remain unanswered by science.

IN THE DARKNESS BEFORE DAWN on a cold November morning near Arcáta, Marie Antoine was hurrying around her kitchen. She was singing to herself in a dreamy kind of way. That morning, she wore a gray hooded cashmere sweater, cream-colored slacks, and climbing boots. She tossed a handful of blueberries into a blender. "Steve, do you want a smoothie?"

"Definitely," he answered. He and I were kneeling on the living-room floor, nearby, and he was inspecting a heap of my climbing equipment, which I'd taken out of a duffelbag. He stood up, and led me through a door into the garage, where a hank of climbing rope, sixty feet long, was coiled on a hook on the wall. It was a new rope, and it was bare—it didn't have any carabiners or knots rigged in it. "This is yours, if you want it. I'll tie it up for you."

"I brought my own split tails," I said. I carried the rope back into the living room, and laid it on the floor, and from the duffelbag I took out two split tails and four carabiners, and I tied up my motion lanyard while he watched.

He sipped his smoothie. "Dude, you're doing it. Where did you learn this?"

"I've been practicing a little," I said. I tied the last Blake's hitch and sat back on my heels.

He inspected the knots. "Sweet," he said. He picked up the motion lanyard and handed it to me. "You can stuff it into your climbing bag." A motion lanyard weighs eight pounds. When it isn't in use, it is kept inside a bag, which is normally clipped to the climber's foot stirrup.

The blender whirred. "Which tree are we going to?" Antoine asked.

"I think we need to go to Adventure," Sillett said.

Adventure is one of the world's largest-known coast redwoods. It is three hundred and thirty-four feet tall, and it contains thirty-one thousand cubic feet of wood. The main trunk is sixteen feet in diameter near ground level, and it maintains huge girth nearly all the way to the top of the tree. It has a total of forty extra trunks. Adventure has four fire caves in its crown, two of which are large enough for a person to go inside. Much of the center of the tree seems to be rotten. It is in Prairie Creek Redwoods State Park, a few miles from the Atlas Grove. The precise location of Adventure is a secret that is known to fewer than twenty people, most of whom are botanists. Sillett and

Antoine asked me not to reveal its exact location, for fear that recreational tree climbers might try to poach it.

"Adventure Tree is never exactly my first choice," Marie Antoine commented. "My first experience climbing that tree was kind of scary."

Later, I asked her what had been scary about Adventure.

"I got lost in it."

THE STRETCH OF THE CALIFORNIA COAST that includes Prairie Creek Redwoods State Park is covered with temperate rain forest; it receives eighty inches of rain a year. Even so, places in the park consist of patches of open prairie, where herds of elk graze. The redwoods along the edge of the prairie looked like ruined Doric columns. The road went among them, the canopy closed in overhead, and the world grew dark and quiet—redwoods mute sounds. Adventure lives at the bottom of a small valley. We parked and put on backpacks full of tree-climbing gear. Marie Antoine led the way. We went along a trail, and then left the trail and pushed through masses of sword ferns and walked in zigzags around them. The ferns were chest-high and were soaking wet—it had rained during the night. The forest floor consisted of a soft duff of rotting redwood foliage, and it was spattered with redwood sorrel—small, emerald-green plants that have heart-shaped leaves. The trunks of the trees soared into remote crowns. Blades of sunlight angled through the canopy, and they glittered with droplets of water falling from the tips of branches. The sky was pale blue, without a cloud.

We went down into a gully and arrived at a small creek. A redwood log spanned the creek, forming a natural bridge across it. Adventure grew out of the bank on the other side: I saw a megacylinder of wood with a thermonuclear crown.

We crossed the creek by walking on top of the log, which was slippery, and scrambled up onto the bank at the base of the tree. Sillett opened his backpack and pulled a climbing rope from it. He threaded

the rope up through an attachment point higher in the tree and back down to the ground.

The rope was six hundred feet long, dusty black in color, and just ten millimeters thick. It had a breaking strength of three tons—it was strong enough to lift a car. It is sometimes called black tactical rope, and it is favored by the Special Forces for vertical operations at night. The redwood scientists like it because it's lightweight yet super-strong and can seem nearly invisible. "We like to go low-pro," Sillett explained.

The black rope hung down the side of the tree which faced away from the stream, a nearly featureless shaft without any solid branches on it for two hundred and fifty feet. Sillett took one end and tied it to a small tree. The other end dangled loosely down from the anchor point, far up in the crown; he would climb up the dangling end of the rope. This is known as a ground-anchored climbing rope. He put on his helmet and his climbing saddle. He turned on a two-way radio, tested it, and put it in a pocket on his chest.

While Sillett was getting ready to climb, Antoine led me around to the other side of the tree. It consisted of a towering system of extra trunks, some living and some dead, that ran upward along the stream side of Adventure for more than twenty stories. Antoine put her hands in her pockets and stared up into the structure. "The pieces of dead wood shiver fifty feet over your head when you move around in there," she said, peering up into it. "The first time I climbed this tree with Steve, he told me to go to a certain place, and I misunderstood." She ended up wandering among columns of rotten wood, which wobbled and seemed ready to collapse. Finally, she tied herself to a live branch and called her husband on the radio and asked him to come and get her and show her the way out. It took him twenty minutes to find her, and when he did she was embarrassed—she didn't like needing to be rescued.

Back at the other side of the tree, Sillett clamped a pair of mechanical ascenders to the black rope, and then he began to climb upward, sliding his ascenders on the rope in a one-two type of motion which climbers call jugging. A raven called somewhere in the upper canopy. This was followed by a delicate *pip, pip, pip,* which was coming from somewhere closer to the ground.

Antoine picked up her radio. "Steve, was that a kinglet?"

"It could be a wren tit." He had become a tiny homunculus moving up the bulwark of the tree.

"Adventure just scoffs at the puny humans who try to climb it," Antoine remarked to me.

Sillett vanished into the crown. Time passed. We put on our helmets and saddles. I sat down under a fern, and picked up a sprig of dead redwood foliage. Two mushrooms grew on it.

Our radios crackled. "Okay, Marie, you can go ahead and release the anchor."

"Okay, I'm going to untie the anchor, Steve. I will let you know when it's done." Their radio talk was precise. Any mistake in communication could result in someone's death. (Sillett once saw a climbing companion fall ninety-six feet from a Douglas fir. The friend was a professional climber who had made one small mistake. Miraculously, he lived.) Antoine went over to the small tree and untied the knot. "The anchor is now untied, Steve."

Sillett, up in the tree, tied a knot near the middle of the black rope, and then anchored the knot around a branch, so that both ends of the black rope hung down along different sides of the tree. Antoine and I would simultaneously climb up the opposite ends of the rope.

"You guys can start moving up," Sillett said on the radio.

I clamped my ascenders to my length of the black rope, and I clipped the bag containing the motion lanyard to my foot stirrup. Then I began to jug upward on the rope, along the basal flare of the tree. Twenty feet above the ground, the tree's bark was charred and pitted with fire scars—a small fire on the ground had made the scars, perhaps within the past two hundred years. I kept on jugging. Seventy feet above the ground, I passed a burl, which is a type of benign growth that occurs on trunks. The burl was the size of a pumpkin. I continued climbing upward, along a furrowed wall of wood. Marie

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Antoine was climbing somewhere around the horizon of the trunk, out of sight.

I reached a height of about a hundred and thirty feet. I was now forty feet higher than I had ever climbed in the canopy in New Jersey, and I was just entering the lower edge of the redwood crown. The light began to brighten. The rope to which I was attached ran straight upward into the crown, and it vibrated with tension from the weight of my body. When canopy scientists want to travel in a circle around the trunk of a large tree, they swing like a pendulum at the end of a long rope. I decided to try it. I planted my feet against the tree, and pushed off. I drifted a considerable distance outward, floating gently away from the trunk. On the forest floor below, the clumps of sword ferns looked like green stars. They turned around—I was spinning. I drifted back to the tree, and kicked off again, harder, and drifted farther away from the tree. It seemed, perhaps, like walking on an asteroid, where there is only slight gravity. The curve of the trunk formed a horizon like that of the small worlds in *The Little Prince.*

Marie Antoine appeared—she had circled around the tree to see how I was doing.

The bark was covered with a lumpy white crust that looked like sugar frosting. "What's this stuff?" I asked.

"It's Pertusaria. It's a lichen."

Pertusaria is also called wart lichen. I moved my eyes closer. The warts were mingled with splotches of a grayish-green dust, which was sticking to the bark. The dust, Antoine explained, is another lichen, called Lepraria. It is supposed to resemble the infected skin of a leper. The Lepraria, in turn, was mixed with fingering spurts of a lichen called Cladonia. The Cladonias are among the most beautiful of lichens. They come in wild shapes—trumpets, javelins, stalks of pinto beans, blobs of foam, cups, bones, clouds, and red-capped British soldiers. This Cladonia looked like pale-green tongues of flame. Scattered near it were clusters of orange disks that looked like tiny pumpkin pies. It was a lichen called Ochrolechia, Antoine said. The cracks in the bark were lined with pin lichens—tiny black dots standing up on stalks, like the heads of pins shoved into the wood. It occurred to me that in order to see a giant tree you need a magnifying glass.

We climbed side by side for a distance, until we arrived at a stob—a dead, broken-off stump of a branch. It was surrounded by huckleberry bushes and leatherleaf ferns. The ferns trembled in a breeze that flowed up the side of the tree. The stob was home to what looked like a miniature Japanese garden, about six inches across. We hung suspended in the air before the garden, while Antoine pointed out its sights: "That's Lepidozia, a liverwort. That's a little liverwort called Scapania—it looks like tiny ladders." She pointed to tufts of shimmering, bright-green moss. "That's Dicranum. It's all over redwoods." She estimated that the garden on the stob was several hundred years old.

I climbed for a while on the other side of the tree. I wanted to see the array of trunks which looms over the creek, on the dark side of Adventure. I pendulated in that direction. When I arrived there, I found myself in the middle of a Gothic tower of fusions, bridges, and spires, held up by flying buttresses. The zone was crisscrossed with branches, and the trunks ran out of sight in both directions, upward and downward.

Directly in front of me, at a height of a hundred and eighty feet, was a fire cave. It is called the Upper Fire Cave, and its mouth is plastered with dirt—canopy soil. By gripping on ridges of bark, I was able to pull myself to the edge of the cave. It proved to be a sort of airy chamber in the underside of a flying buttress, and it opened downward into empty space—it is more like a fire ceiling than like a fire cave. I ended up hanging in midair, a few feet below the charred ceiling, looking straight down to the stream. There was a faint sound of rushing water. I saw strands of computer cables emerging from the cave walls, where Sillett and his team had implanted electronic probes. I touched the wall of the cave. It was moist, and it had a yellowish color and a musty smell, and it felt like Stilton cheese.

Two hundred and fifty feet up, the crown of Adventure billowed into a riot of living branches. By this time, the ground had

disappeared—it was hidden below decks of foliage in the lower parts of the redwood canopy—and the sky was invisible, screened by tents of foliage overhead. This was the deep canopy, a world between earth and air. Steve Sillett was nowhere to be seen.

I was now climbing fifteen feet above Marie Antoine. Even though we were still far below the top of Adventure, we were considerably higher than the top of the average tropical-rain-forest canopy. If the upper surface of the Amazonian canopy had existed here, it would have been a hundred feet below us. At this point, the main trunk of Adventure was seven feet in diameter. Now the huckleberry thickets began in earnest. The species was the evergreen huckleberry, a relative of the wild blueberry that grows in Maine. In November, in the California rain forest, the huckleberry leaves were tinged with scarlet at their edges. The bushes were all over the tree: perched on its branches, occupying its crotches, and popping out of the trunk. I wormed through them, following the black rope upward.

AT TWO HUNDRED AND NINETY FEET, I encountered Sillett. He was sitting on a branch inside a spray of huckleberry bushes, and he had a thoughtful look on his face. The main trunk had split open near the branch where he sat, and the opening revealed dead and rotten wood inside the tree. "This beast is full of rot pockets," he said. "These huckleberry bushes are putting their roots through the scars into rotten wood in the center of the tree. One summer, we had half the normal rainfall, but these bushes still put out a full crop of huckleberries. They're getting their water from rotten wood inside the tree." He pointed to something on the side of the tree. "Check out that little brown moss over there."

"Which moss?"

"The one that looks like it's dead."

I hung out over a branch and looked at the moss. It was a greasy-looking thatch growing below a wound at the base of a stob. Redwood sap had been dribbling over the moss.

"It's called *Orthodontium gracile*," he said. "It's an extremely rare moss. It often lives below wounds in old-growth redwoods. It likes the resin. It's nearly gone in Oregon. That's because old-growth redwoods in Oregon have been slaughtered."

I had reached the upper end of the black rope. Nearby, I saw the bottom end of a second climbing rope, a white one, which was hanging down along the trunk of the tree. It wandered upward and out of sight, toward the top of Adventure. Sillett suggested that I get on. I transferred my ascenders to the white rope, and climbed up it for about thirty feet, wriggling through a jungle gym of redwood branches and huckleberry shrubs. The bag that held my motion lanyard bumped along through the bushes. Then, abruptly, the crown thinned out, and a view opened across Adventure Valley.

The white rope came to an end about fifteen feet below the top of the tree. No ropes led to the top. I took the motion lanyard out of my bag, attached it to my saddle with carabiners, and threw one end over a branch above me. I pulled it back to me, to form a noose over the branch, and clipped the noose to my saddle. Then I detached myself from the white rope.

There is something unnerving about leaving the main rope behind and going into free motion in the crown of a redwood tree. The main climbing rope is a lifeline that connects a climber to the ground, and it is the escape route out of the tree. Once you disconnect from the main rope, you are on your own. If you wander far from the main rope, you can end up moving through a maze of wood as tall as an office building by means of a short piece of rope, with no way to get down to the ground unless you can find the main rope again.

With my weight on the motion lanyard, I leaned back, until my body was horizontal and my feet were planted on the trunk, and I walked up the trunk of Adventure. I threw one end of my lanyard over a higher branch, clipped it back to my saddle, and pulled myself up. Suddenly, I hung near the top of the tree. At three hundred and twenty-eight feet, I found myself in the middle of a bush studded with huckleberries. I began eating them. They were tart and crunchy. The branches in the tree's top were festooned with beard lichens—

they looked like the frizzy beards of dwarves. It was a sunny day, and a breeze was blowing, which stirred the lichen beards, and the air held a tang of the sea—the Pacific Ocean lay over a ridge to the west. Adventure rocked in the breeze, like a ship riding at anchor.

The uttermost top of Adventure is dead. It is a gray trunk, encrusted with lichens, which extends about six feet above the huckleberry bush, and ends at a sheared-off stump. Adventure used to be a taller tree. Its top fell off, probably in a storm, perhaps four hundred years ago, or roughly at the time that Shakespeare wrote *The Tempest*. By then, it had already been growing for a thousand years, or maybe more like fifteen hundred years. ("Who the hell knows how old it is," Sillett said.)

The branches around me trembled. A lanyard flipped over a nearby branch, and Marie Antoine appeared. She trunk-walked up to a kind of platform of branches, and sat in the middle of them. "The top of this tree is just a big old juicy dead-wood pit," she said.

The dead trunk at the top of Adventure is a natural water tank, she explained. Rainwater collects in the broken stump at the top, and the water runs down inside Adventure, where it saturates the rotten wood like a sponge. A coast redwood tree seems to have the ability to send out roots from any part of its tissue, including its top. Adventure may be sending roots out of the living wood in its top, which run into the dead trunk, and feeding on the dead parts of itself.

THE NEXT DAY, in the afternoon, I sat down at the base of Adventure, while Sillett went aloft. He had been having trouble with a computer system that he had installed in Adventure, and he wanted to try to fix it. It was getting to be late, and it grew dark on the forest floor, but there was sunlight in the crown of Adventure. I called Sillett on the radio. "Where are you?"

"At the Upper Huckleberry Cave."

"Where's that?"

No answer. I put on my helmet and saddle, and began jugging up the black rope. I found him at two hundred and thirty feet, hanging from his motion lanyard inside a rampart of extra trunks, a long way from the main rope. I climbed up the main rope until I was fifteen feet above Sillett, and then I pulled out my lanyard, flipped one end of it over a branch, and clipped it back to my saddle. Then I released myself from the main rope and dangled on the lanyard. The trunk was a fissured wall going down into shadows. Suddenly, I was very aware that I was hanging more than twenty stories above the ground. I lengthened the noose, and dropped twenty-five feet, until I was hanging below Sillett. I kicked against the trunk, swung away from the tree, and then came back toward him. I grabbed the end of a rope that Sillett had left draped over a branch and, using my ascenders, climbed up the rope at a diagonal to Sillett's location. When I got there, I anchored my motion lanyard over a branch and I hung in the air next to him.

We were suspended below a cracked and decayed expanse of holes in the tree—the Upper Huckleberry Cave. Sillett was hanging in front of a fiberglass box. The box, which was attached to a branch, held a computer controller that gathered data from all the instruments that were installed in the tree. A laptop computer was sitting on top of the box, and he was staring at the screen.

He seemed exasperated. "Every time we climb Adventure, it kicks our butts," he said. "I think it's cursed." He fished a Leatherman tool out of a pouch and began tinkering with it inside the box. The sun had set behind a ridge, and an evening breeze had sprung up. The tree's branches and needles began to give off a hissing sound. "Do you feel that?" he said. "We're moving."

Adventure began to do something that felt like slow breathing. Each sway of the tree took several seconds to complete. The redwoods around Adventure were also tracing deep, slow sways, and their movements were independent of one another: they were going in different directions. The trees seemed intensely alive.

Sillett watched the motion of the redwoods in silence for a little while. "Despite the difficulty of doing science in these trees, there's

always a moment during a climb when you can lose yourself," he went on. "You perceive time more clearly in redwoods. You see time's illusory qualities. When you get up into the crown of a redwood, you stop thinking about your life, you stop planning your future missions. You start feeling the limits of your perceptions of the world as a member of the human species. When you feel one of these trees moving, you get a sense of it as an individual."

"Do you really think of this tree as a kind of entity?" I asked.

"It's a being. It's a 'person,' from a plant's point of view. Plants are very different from animals, but they begin life with a sperm and an egg, the same way we do. This organism has stood on this spot for as many as two thousand years. Trees can't move, so they have to figure out how to deal with all of the things that can come and hurt them. This tree has burned at least once. The fire must have continued inside some of these caves for a long time—the caves were smoldering orange holes in the tree for weeks. Redwoods don't care if they burn. After the fire, the tree went, 'Wooaah,' and it just grew back."

The wind died, and the forest became silent. A fluting call came from the air near us. Sillett looked around. "Maybe a Swainson's thrush." He poked with his Leatherman at the electronics. "A tree is not conscious, the way we are, but a tree has a perfect memory. If you injure a tree, its cambium—its living wood—will respond, and the tree will grow differently in response to the injury. The trunk of a tree continually records everything that happens to it. But these trees have no voice. My life's work is to speak for these trees." He paused. "Dude, it's getting dark. It's time to go down."

THREE HUNDRED AND FIFTY-THREE feet above an alluvial flat in the Humboldt Redwoods State Park, near the top of a coast redwood named Idril, Steve Sillett and Marie Antoine were sitting side by side in the branches. I was attached to the tree with my motion lanyard, near them. My lanyard was anchored around the uttermost top of the tree. Idril is about eight inches thick at that point. The top of the tree is crowded with wires and instruments and a solar panel—Sillett's gadgetry. We were at the upper surface of the world's tallest forest canopy.

I tightened my lanyard, and inched myself up a little higher. The whole top swayed.

"Watch your foot," Sillett said. I had nearly kicked a bioprobe out of the bark.

The upper surface of the canopy was a bubbly froth of redwood crowns, and each tree seemed to have a slightly different color of green. There were deep greens, gray-yellow greens, brown greens, deep-blue greens, and bluish grays. "It's because these trees have a huge amount of genetic variability," Antoine said. It began to rain, and the colors grew sharper. Here and there, skeletons of dead tops seemed to glow—these were redwoods entering middle age. "You can see the Stratosphere Giant," Sillett said, pointing to a green cloud that burst above the canopy to the east of Idril.

On July 30, 2000, an amateur redwood researcher named Chris K. Atkins was bushwhacking around in a little-visited stand of redwoods in the park, using a laser range finder to measure the heights of the trees. On that occasion, Atkins discovered what is currently believed to be the world's tallest tree. He named it the Stratosphere Giant. Sillett measures the Stratosphere Giant once a year, each September, when he climbs it with Marie Antoine, and they run a tape measure along the trunk. This past September, they found that the Stratosphere Giant was three hundred and seventy feet two inches tall. It is the only living tree that is known to have surpassed three hundred and seventy feet, and it is presently growing taller by about four inches a year. It is eighteen feet across at the base, and is around two thousand years old.

The rain became steady. We descended Idril in stages, one by one, rappelling down a rope. Partway down, we stopped in a cluster of branches, and we left the main rope and anchored off on our lanyards. With his lanyard anchored around a branch above him, Sillett stepped out onto a branch, lengthening the lanyard as he went. He

was using the lanyard to maintain his balance and to prevent his full weight from pressing on the branch itself—this is called branch walking. Sillett walked lightly along the slender branch nearly to its tip. He looked almost weightless, and he leaned out and touched the branches of a neighboring redwood. "You could easily get into that tree from here," he said.

We were now at two hundred and fifty feet, near the bottom surface of the canopy in this grove. I clamped a descender to the black, main rope. I released my motion lanyard and tucked it away in its bag. With my weight now on the main rope, I released the descender brake and began to slide down. Then I kicked away from Idril as hard as I could. As I swung from the tree, I opened the brake on the descender full wide. The rope began to rush through the descender, and I fell out of the canopy on a fast rappel. Huge columns appeared, the trunks of trees that stand around Idril, and I floated weightless down through redwood space.