DOUBLE MAP SUPPLEMENT: THE WORLD

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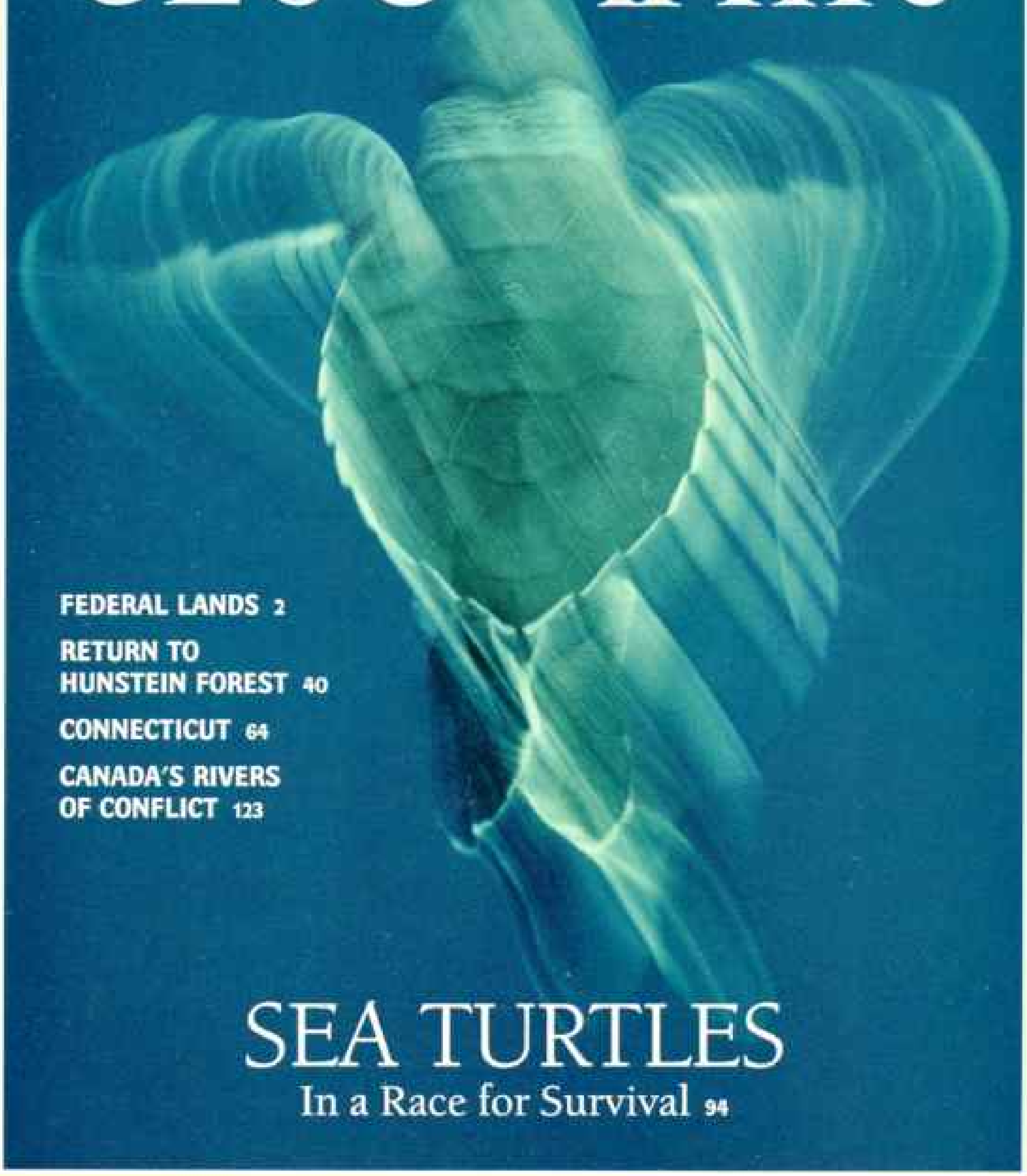

SEA TURTLES

In a Race for Survival 94

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DOUBLE MAP SUPPLEMENT: THE WORLD

COVER: In a desperate flight from its birthplace on Mexico's west coast, a two-inch-long sea turtle hatchling swims toward open ocean—and a perilous future. Photograph by Bill Curtsinger.

Cover printed on recycled-content paper.

New Showdowns in the Old West

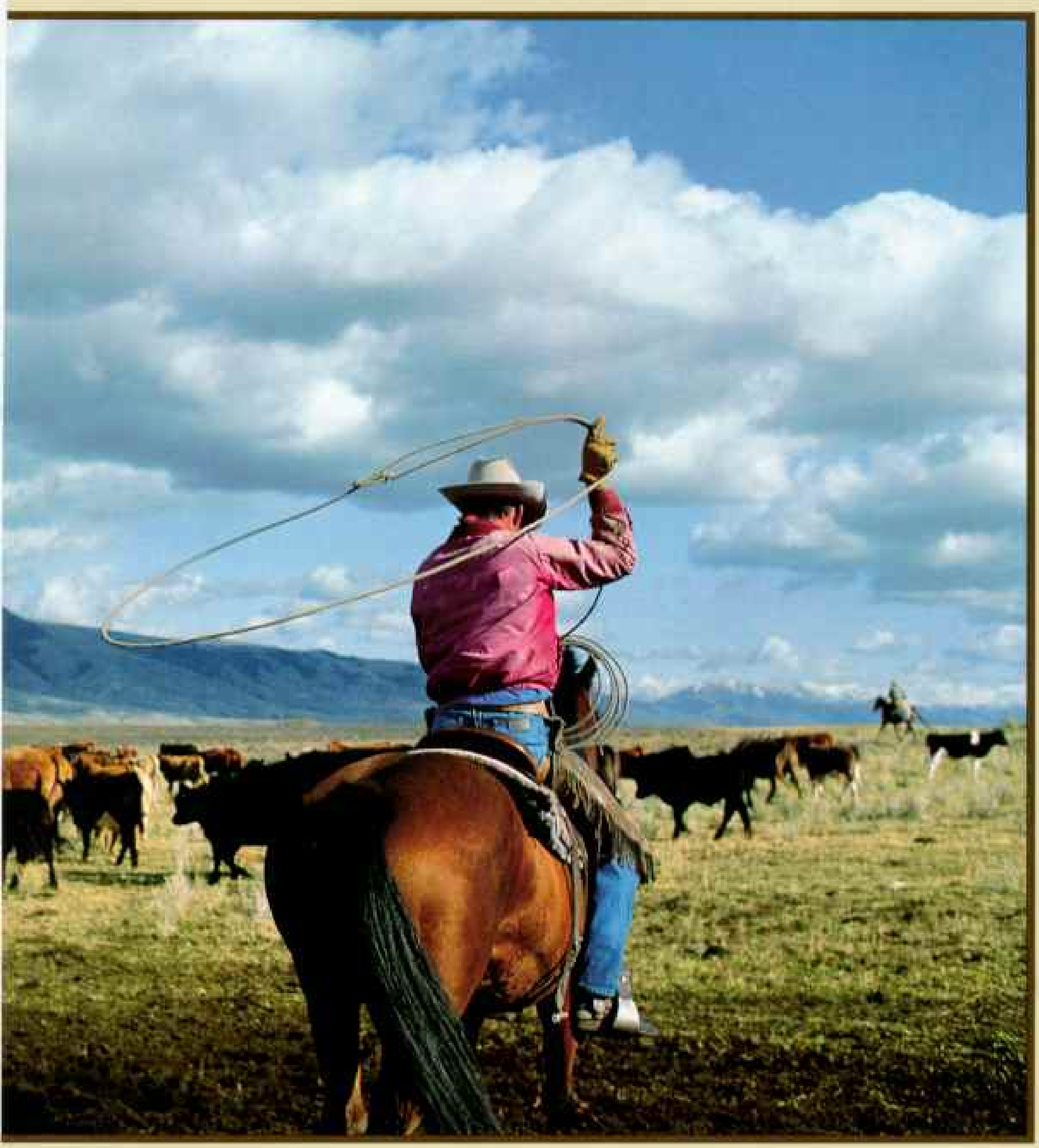
FEDERAL

By RICHARD CONNIFF

Photographs by JOEL SARTORE

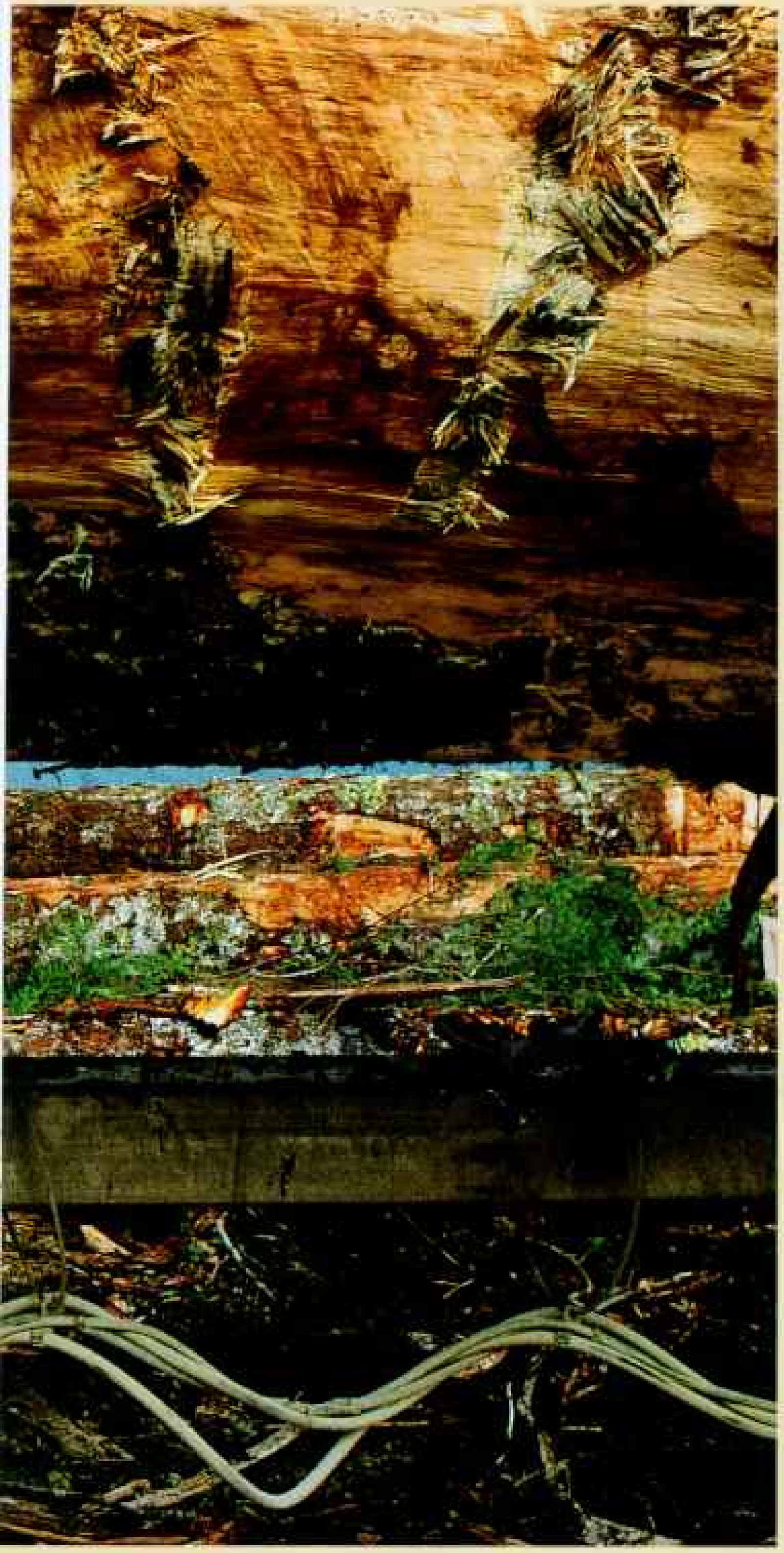
American icon or endangered species? The cattlemen of Lemhi County, Idaho—where Carl Lufkin drives cattle fattened on public land to his employer's ranch—claim to be the human equivalents of the spotted owl. Many guardians of the New West disagree and say it's high time that all users of the nation's vast tracts of federal lands—ranchers, miners, loggers, and recreationists—pay a fair market price to their landlord, the U. S. taxpayer.

LANDS



LOGGING

WASHINGTON *Prodigy of the forest, a centuries-old western hemlock is hauled from Olympic National Forest by a logging crew. Focus of a raging debate, such old-growth trees are prized by timber companies for their high value.*



A line drawn in the forest

With 90 percent of the Northwest's old-growth forest already fallen to the saw, many Americans want to halt further cutting of ancient trees. But the controversy goes deeper than that. Environmental groups contend that the Forest Service charges too little for the timber logged from the nation's 156 national forests and provides too many services to the timber industry. They figure the cost to taxpayers at hundreds of millions of dollars in lost revenues.

Worse yet, they say, the system subsidizes practices such as clear-cutting, which can harm wildlife, streams, and mountain slopes—entire ecosystems. Loggers counter that these are narrow views that devalue the human stake in a vital industry, involving whole communities based on timber that supplies affordable lumber for American homes. "What better way to provide jobs and houses," asks one timber worker, "than with a renewable resource?"

GRAZING

WYOMING *Leaving their tails behind them—and cleaner for it—lambs are a fixture on federal lands in southern Wyoming. The Bureau of Land Management (BLM) administers the lion's share of rangelands in Wyoming and throughout the West.*

A line drawn on the range

Hard work, and dirty to boot, livestock running is seldom a passport to wealth for the small rancher. Nonetheless, the 24,000 or so ranchers who graze sheep and cattle on federal lands wield political clout far beyond their numbers. Large corporate operators and wealthy individuals hold permits to almost half of federal grazing land; one rancher holds allotments covering more than five million acres.

Spurred by outcries over degradation of western range, the Clinton Administration has proposed comprehensive grazing reforms. The government would make grazing permits on BLM land contingent on the user's record of environmental responsibility. Overseeing the permits would be advisory councils no longer dominated by ranchers and open to environmentalists, wildlife managers, and others. In addition, user fees would increase substantially to approach what the government considers a fair value.

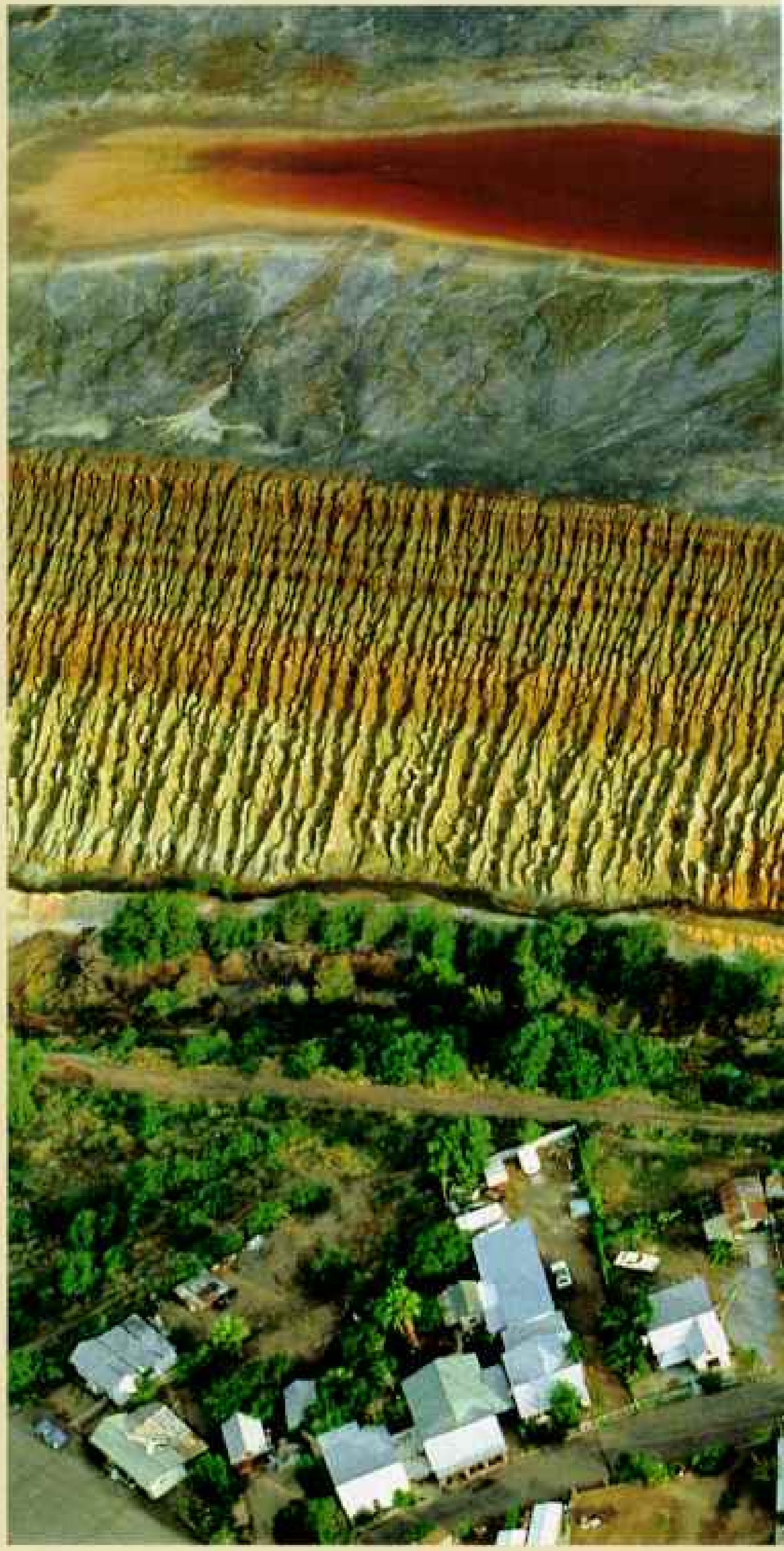
MINING

A line drawn in the earth

"Last free lunch on the old frontier," it's been called—the Mining Law of 1872. Designed to encourage settlement of the West, the law does not require hard-rock mining companies to pay royalties to the U. S. government and allows them to obtain title, or patents, to public lands for between $2.50 and $5 an acre—the price set 120 years ago.

In Montana a company has applied for patents to 2,300 acres of platinum and palladium deposits worth billions of dollars. Cost of the patents: $10,000. Foreign companies can also benefit from the lenient law. A Canadian venture has been mining almost half a billion dollars a year in gold from a site in Nevada.

Taxpayers will incur further losses as bills come due for cleanup of abandoned sites. The Mineral Policy Center says it may cost 70 billion dollars to reclaim non-coal mines that pose health and environmental problems. The 1872 Mining Law is now under review by Congress.



ARIZONA *Backyard nightmare, a copper-tailings impoundment in Arizona reveals its toxicity in the sulfide-tinged rainwater pooling on its surface. Unless such piles of mining residue are properly contained, chemicals may leach freely into the groundwater.*

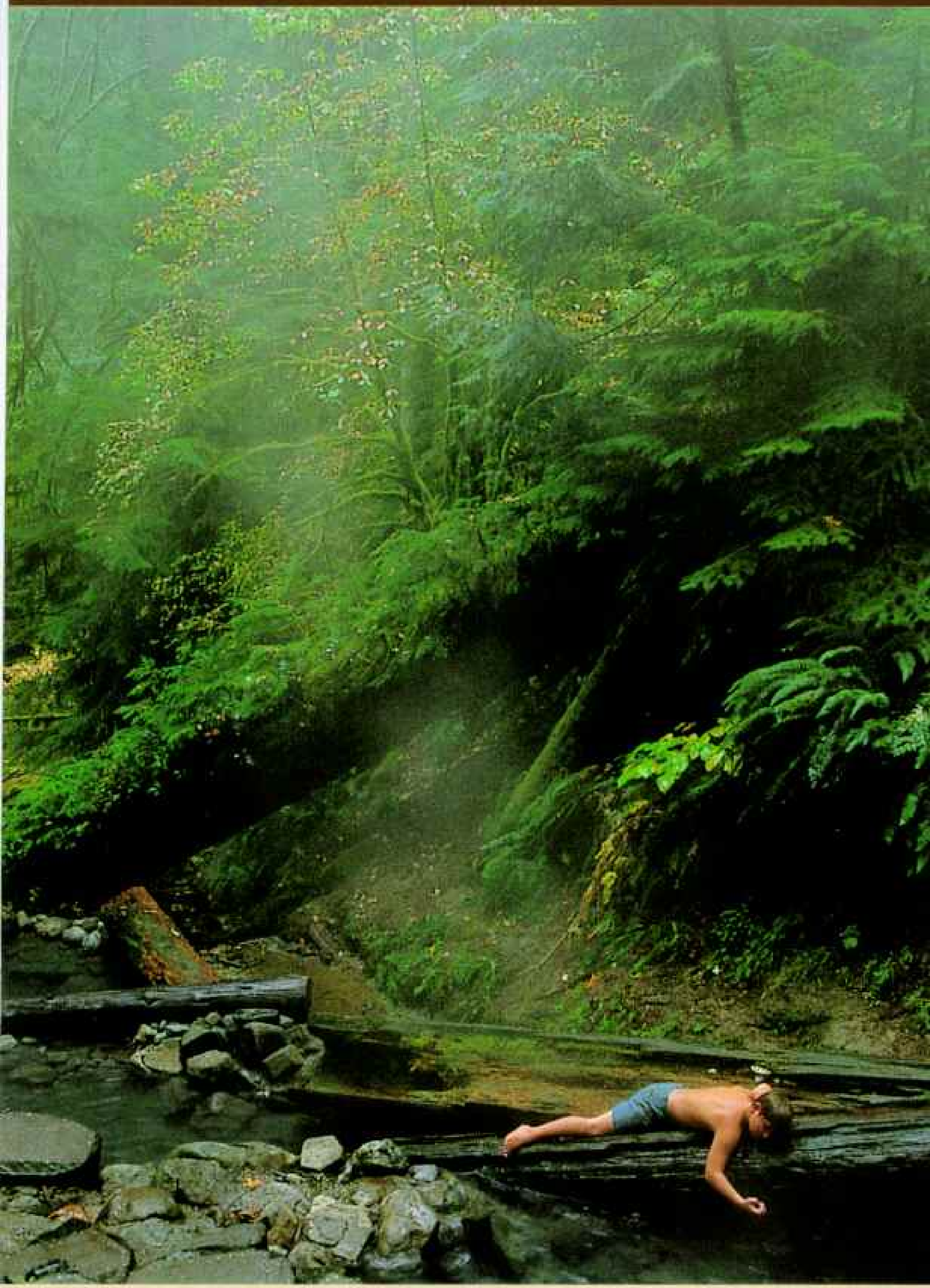
RECREATION

A line drawn in the park

In 1900 four million people lived in America's 11 western states and territories; today there are more than 50 million. Vanguard of the New West, the majority earn their living at desks and behind counters. Avid vacationers and weekenders, they are more likely to view a forested mountain slope as a national heritage than as a natural resource. Competing with Easterners for access to the region's magnificent parks, they encounter gridlock on park roads and turn to national forests and other public lands for recreation and solitude.

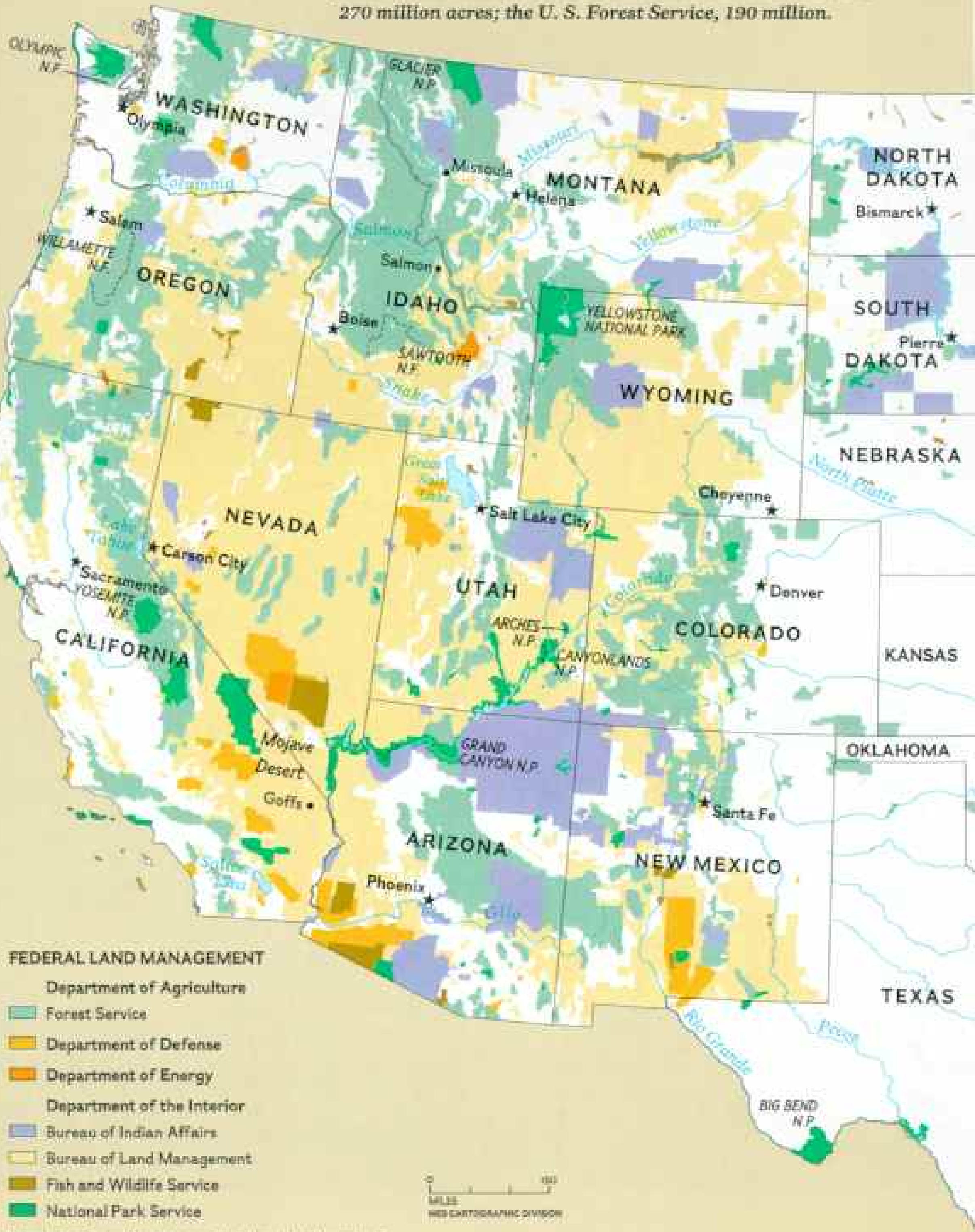
Though promoted as a clean, economic alternative to mining and logging, recreational use can also despoil the land. Increasingly, park and forest visitors are given brochures on environmentally sound toilet procedures and trash disposal.

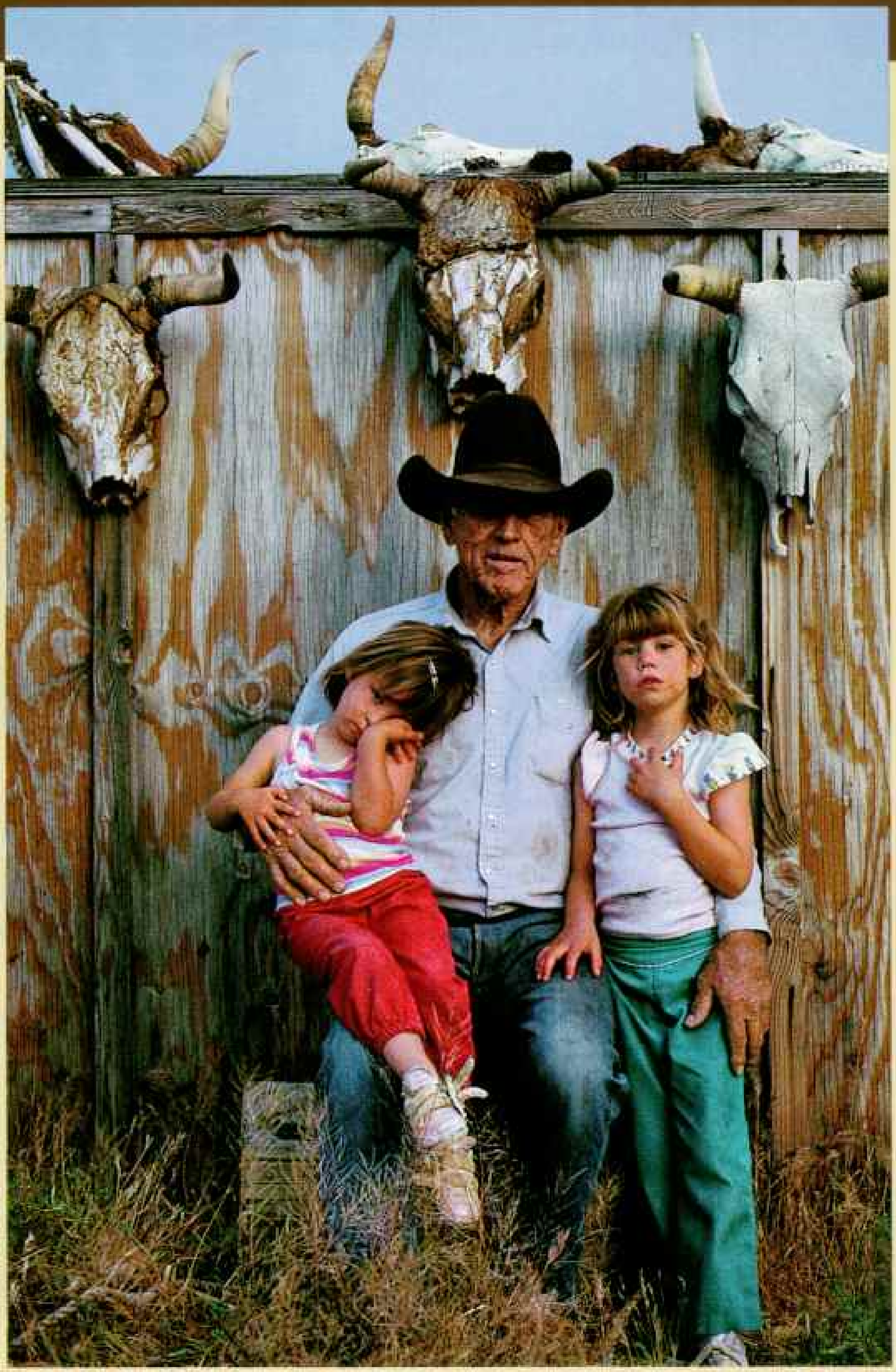
UTAH AND OREGON *On BLM land near Arches National Park, the living desert crust takes a constant beating from mountain bikers, who have chosen this area in Utah as their own special paradise. Thus damaged, it may never recover. More benign is the simple communing of visitors like Cebarn Carroll, enjoying Oregon's Willamette National Forest.*



Far-reaching federal lands

Secured by 19th-century territorial acquisitions, a vast jigsaw of federal jurisdictions accounts for nearly half of the 760-million-acre area of 11 western states—and 87 percent of all federal lands outside Alaska. Nationwide the BLM oversees 270 million acres; the U. S. Forest Service, 190 million.





CALIFORNIA *On the edge of the Mojave Desert near Goffs (population 15), cattle rancher Howard Blair ponders his granddaughters' future: "They won't ever be rich, but they'll have honest roots in the land—if grazing reforms don't force me off."*

LOSING GROUND IN

IN A FRESHLY MOWED FIELD just outside Salmon, Idaho, the old machinery was lined up for auction: a 1951 John Deere B, a battered Massey-Ferguson mower with no rear wheels, tractors with their backs broken and their guts spread out in heaps of rusting junk—which the auction crowd roundly disparaged and yet also coveted, at the right price (or somewhat less).

Beyond the hayfields the federal rangelands and national forests began, and the Bitterroot Range reared up in a jagged gray line. "To the tourist it's quite a scenic area," an old rancher named Clements said, and then dismissed the idea with a wave. "To me these are all just damned mountains."

But those machines were like living things: "What's the matter with that hind leg? Is it just the brake?" said a bidder in a greasy cowboy hat, eyeing a frozen axle. "There ain't no arms on this one," said another. Their interest extended only so far as ingenuity could make this equipment work again in the traditional western industries of ranching, logging, and mining. They were not collecting Americana.

"All right, boys, here we go," the auctioneer sang, "we got four of these. Will you give $35, will you give $35, can you give? 35-35-35?" He was trafficking in the worldly goods of a local mechanic, lately deceased. Clements recalled the time when the shaft cracked on his 50-year-old Massey and the mechanic poked around in these weeds, came up with a replacement part, and got him back to work. The dead man would be missed in a working town like Salmon. Not that sentiment added a dime to the day's bidding. "Just stop and think fellas," the auctioneer was pleading,

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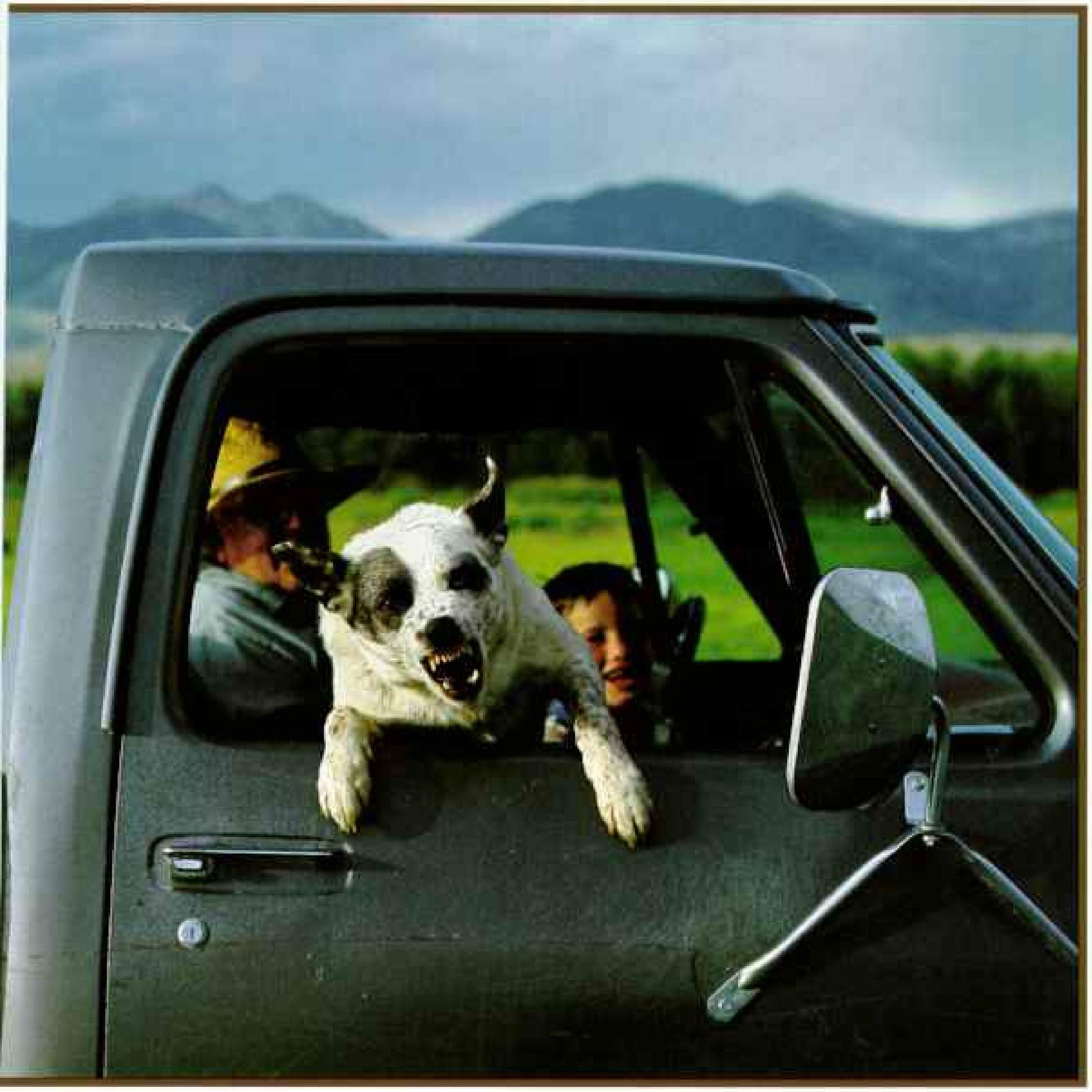
RICHARD CONNIFF has written about Chicago, Easter Island, and California's water crisis for NATIONAL GEOGRAPHIC. JOEL SARTORE, formerly of the *Wichita Eagle* in Kansas, contributed photographs to the recent story on Hurricane Andrew and the coverage of Connecticut in this issue.

Salmon, Idaho



Testy around strangers, Philip Goodell's dog, Nick, expresses, with vigor, the attitude of many in rural Idaho toward outsiders—especially those who would tell them how to use the land. Like many in this area of public domain, Goodell runs cattle on BLM land.

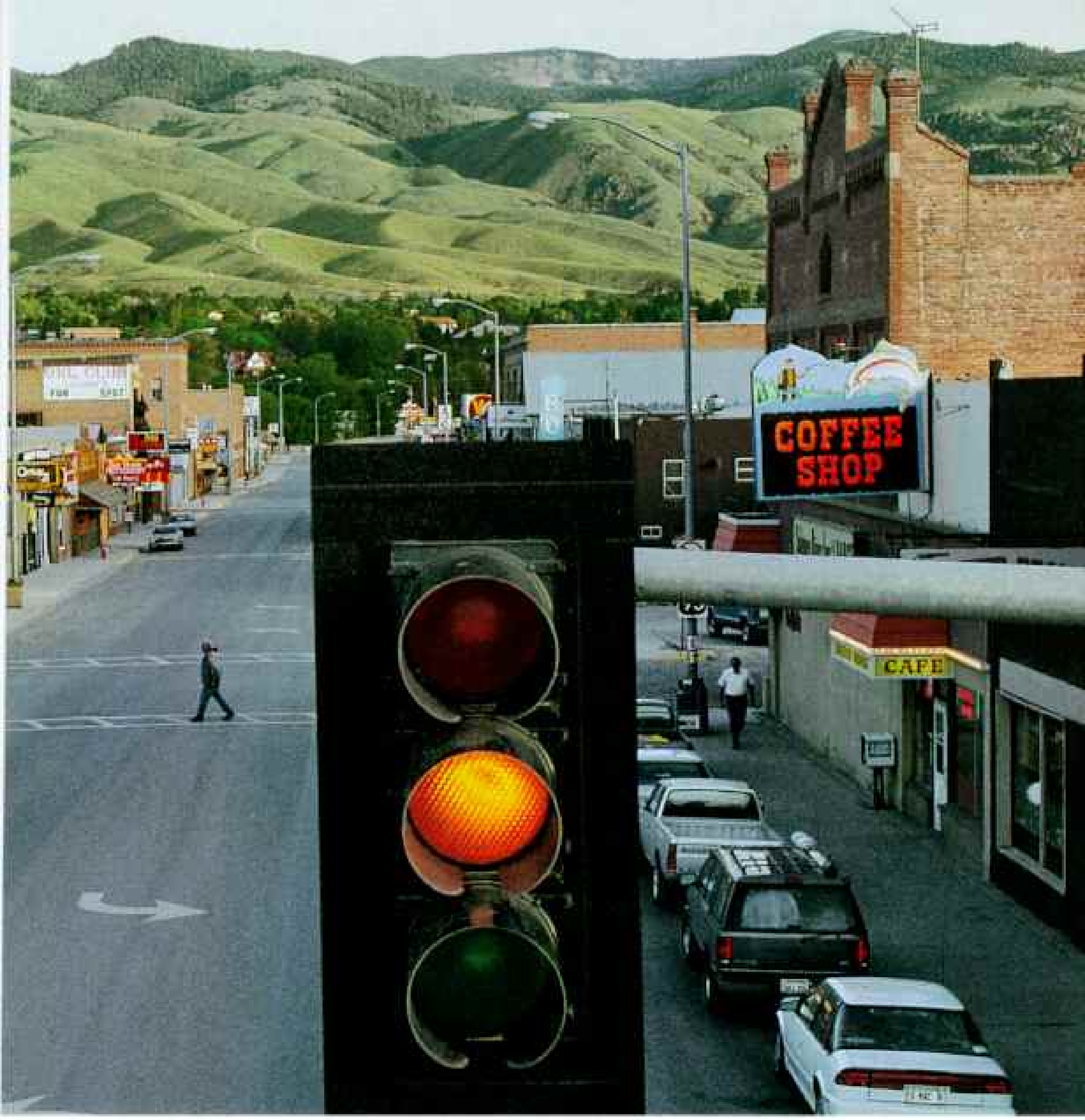
"what *just these babies* here would cost." His voice lifted in song. "10-10-10, will you give 12½, 12½, 12½?"

"You don't want to say anything about which ones run?" a bidder inquired, over a hopeless mess of engines.

"They run once; they'll run again," the auctioneer affirmed. He climbed onto an old tractor, fired it up, and sent the soda can cover rocketing off the exhaust pipe, to grudging murmurs of satisfaction. "Now who'll give me a thousand just to say you have one?"

IT WAS A TIMELESS midsummer morning in east-central Idaho. I'd come to this small town to look at the federal lands—which constitute more than 90 percent of the upper Salmon River basin and more than 350 million acres around the West, most administered by the U. S. Forest Service or the Bureau of Land Management (BLM). Almost every area in the rural West is fighting now over how best to use these lands, and the one thing the adversaries share is a poignant sense that they are losing all they believe was once good and true about the West. For the traditionalists, it's the rugged independence of the cowboy West. For the environmentalists, it's spotted owls swooping through old-growth forests and salmon battling up open rivers. These warring mythologies stand on the brink of the New West, which no longer looks like the promised land. The Clinton Administration, with its avowed commitment to both jobs and the environment, is seeking peaceful compromise—but so far with little result.

The fighting tends to be intensely local. This was why I'd settled on the upper Salmon River Valley to stand in for all the other battlegrounds. Like many outsiders, I arrived by way of the airport at Ketchum and drove the hour northwest to Galena Summit. The upper valley begins there, in the Sawtooth Range, and winds along the river almost to Montana.



Testament to a freewheeling West, a single stoplight at the corner of Main and Church in Salmon controls traffic in Idaho's 5,000-square-mile Lemhi County. Many of the region's 6,900 people, including Rebecca Madsen, show up for the county fair and rodeo.

It passes through every life zone from semiarid upper Sonoran to alpine. It spans the cultural gap between Sun Valley, an enclave near Ketchum built on posh recreation, and Salmon, built on scratching commodities from the earth. I wanted to know if it was possible for this valley to make a living from federal lands without destroying them. To put it another way, I wanted to go beyond the bitter name-calling of other western land disputes to see if it was possible to protect the federal lands without destroying towns like Salmon.

Salmon, the center of life for 6,900 people in a county the size of Connecticut, is the sort of place where the radio station broadcasts the dates the piano tuner and the vacuum-cleaner repairman are due in town. The Rexall drugstore and the A & W Family Restaurant are the closest things to a franchise. There is the Roxy theater on Main Street, where the ticket taker still wears a bow tie, and when the woman at the Quick-Clean laundry finds five dollars in

College-bound, Kip Winterowd and Melissa Eberhard leave Salmon High School eager for new horizons. Now students at the University of Idaho, they doubt they'll come home to live. "Salmon's too isolated," says Melissa, "and unfortunately the jobs aren't there."

User-friendly sheep help young cowpokes master their moves during "mutton busting" at the annual rodeo in Leadore, Idaho. With only 74 inhabitants, the tiny cow town is Lemhi County's "second city." Last year its high school graduated two seniors.

your pants pocket, she tells you so and subtracts it from your bill. For a visitor from back East, like myself, it all feels about three decades removed from the malled-out, multiplexed modern world.

If it is, on one level, a friendly town, Salmon is also leery of outsiders. A political candidate introduces himself to his neighbors with the rueful apology, "I was born and raised here. I guess I'm kind of a newcomer." He means that his parvenu forebears didn't get here till 1929. A letter in the local newspaper defends another candidate with a phrase out of the Red-baiting 1950s: "She is not now nor has she ever been an environmentalist."

AS IN MUCH of the rural West, many people here regard the traditional jobs as the only honest jobs, and they say the upper Salmon River basin is still bountiful enough to accommodate them. On the morning of the auction, tractor-drawn mowers were laying the grass down in glossy windrows along the river bottom, and all around the valley the baled hay was rising in stacks like golden loaves of bread, to feed the cattle through the long winter. In the forested mountains, logging trucks rolled down the dirt roads with their brakes growling, bound for the mill in Salmon, where 50 people work sawing trees into joists.

This valley has never been an easy place to earn a living. (An old mining-town cemetery lists causes of death: "John Davis . . . killed by a snowslide on the trail to the Charles Dickens mine," "Andrea Carameline . . . miscalculated the time necessary to reach safety and was killed in the explosion," "E. J. 'Buck' Wright . . . suicide by morphine.") The hard-work, hard-luck mentality is such that after a local man was caught in a counterfeiting scheme a few years back, a T-shirt appeared with the question, "Who says you can't make it in Salmon?"

Making it in Salmon is only getting harder. The American public has lately come to realize that it owns most of the land hereabouts, and people from the outside world now take a proprietary interest in what used to seem like Salmon's private kingdom. Outsiders tend to be outraged that traditional rural industries pay little to use public lands and often leave behind environmental problems.

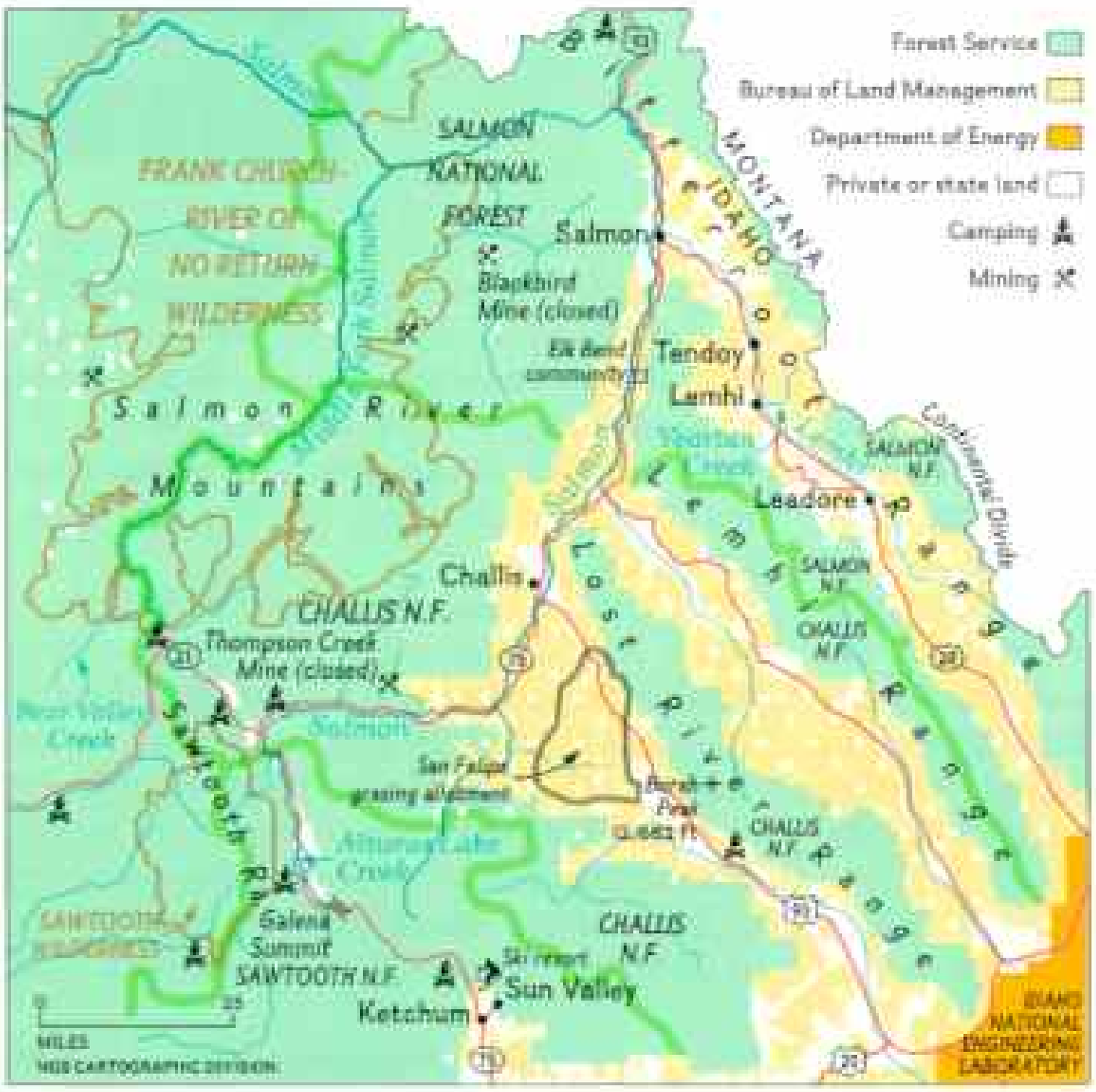
In Salmon the pressure to reform is compounded by the town's namesake fish. Until mid-century, chinook and sockeye salmon choked local streams near the end of their 900-mile spawning migration from the Pacific. Their recent listing under the Endangered Species Act could inhibit many economic activities in the area, though rural industries bear far less blame for the plight of the salmon than do hydroelectric dams downriver.

All this makes the upper Salmon River Valley ripe for fire-breathing rhetoric. "Compromise is a dirty word," a logger named Joe Fraser told me one afternoon as we sat in his backyard. Fraser, a trim 41-year-old, is a member of the local pro-industry group, Grassroots for Multiple Use, and he wore a T-shirt declaring, "Just when you think you can make ends meet . . . they move the ends." He blamed the scarcity of jobs in Salmon on environmental restrictions putting land off-limits to industry. "The only way I'm willing to go now is the other way, where we take some of the land out of restriction," Fraser said.

I asked if wilderness designation wasn't bringing new money into the community from recreationists—generally regarded by environmentalists as the best hope for both the federal lands and towns like Salmon. "We don't want their money, and we don't want their attitude," Fraser said.

It was a notion I heard everywhere in the rural West: Recreational visitors were a threat rather than a new and more sustainable leg for the economy. The locals girded themselves against a mythical tourist who "comes with a $20 bill and a pair of shorts, stays for a week, and doesn't change either one." To Fraser the tourist industry meant flipping burgers instead of harvesting timber. "We've got some pride," he said. "We used to lead quality lives here, and now we don't." Timber sales were becoming scarce for small operators like Fraser. "My son wants to work in natural resources. Instead, he's turning wrenches for Sears Roebuck in Boise."

"It must be a little like the Indians felt," his wife, Debbie, interjected. "They were minding their business, and then these people started to show up. The Indians compromised, but the new people kept pushing and pushing." She raised her eyebrows. "The Americans regret what they did to the Indians. Maybe they'll regret 150 years from now that they destroyed the industry here."



Idaho's federal land

West of the Continental Divide, where Lewis and Clark crossed into Idaho in 1805, the headwaters of the Salmon River trace fingers of fertile range through the state's central wilderness. Enclaves of private and state land dot an overwhelmingly federal landscape. The Salmon, dubbed the "river of no return" by local Indians, crosses the nation's largest wilderness outside Alaska.

The next day I tried this idea on Hadley Roberts, a retired wildlife biologist and the most visible environmentalist in Salmon. With a kind of reluctant forbearance, as if accustomed to being blindsided by Grass-rooters, Roberts replied mildly that industry here was destroying itself by clinging to old, abusive practices. The problem wasn't that the land was being locked up for wilderness, he said; it was being played out.

Then a friend of Roberts's gave Debbie Fraser's Indian analogy his own twist: The Grass-rooters, he said, were like the Indian Ghost Dancers, who thought they could drive out the white men by dancing themselves into a trance under the moon. But no amount of fervor was going to make the federal lands what they had once been—a private empire for commodities production. City dwellers were spilling over Galena Summit from Sun Valley; retirees were filtering south from Missoula, Montana. The tide of migration to California was washing back now in an urbanized wave to the farthest reaches of the mountain states.

At a pricey new dude ranch south of Salmon an outfitter named Frank Valvo, a transplant from California, fairly glowed with anticipation: "The national parks can't take the pressure. They're overbooked," he said. But the two-million-acre Frank Church–River of No Return Wilderness, just next door, was a Yellowstone without the Winnebagos, and the outside world was quickly discovering it. "Little Salmon, Idaho, is going to be a Jackson Hole in ten years," he said. "It's going to be a Sun Valley." It was a thought to make local ghost dancers go pale.

Environmental sore points, clear-cuts in Salmon National Forest are ready for burning to liberate seeds from scattered pinecones. Logging in much of the 1.8-million-acre forest has been stalled by conservation groups attempting to have some roadless tracts set aside as protected wilderness areas. Loggers feel that the quarter of the forest that became part of the Frank Church–River of No Return Wilderness in 1980 is enough. The one local mill dependent on harvesting this forest will have to shut down, they claim, if logging is further reduced.

BUT I HADN'T COME TO SALMON to take scalps, nor did I subscribe to the powerful mythology that everyone with a chain saw, a branding iron, or a bulldozer was a menace to the federal lands. It was too easy for people like me, people who were only passing through, to point a righteous finger at anyone who gets his living directly from the earth—meanwhile conveniently overlooking our own complicity as consumers. It was too easy for newcomers to move into a place like Elkhorn in Sun Valley and loudly moralize against the locals for elk hunting, while failing to notice that their own second homes had displaced elk from their winter range.

I had the notion that the use of natural resources, soundly managed, ought to be a good thing, and not only because the rest of us like our hamburgers and wooden houses. We need working landscapes as well as wilderness. We need cow towns, and not just theme parks about what they used to be. There is still value in the kind of knowledge of the land that can come from carefully nurturing it for long-term profit.

Standing in the auction crowd that morning in Salmon, I was struck by something admirable in the local ethos; it had to do with American horse sense and the ability to make things work. These were traits I could not discern so readily, however, at a benefit wine auction for the arts center that same day in Sun Valley, where patrons were served by waiters dressed as mime artists, and

proceeds from the auction reached $215,000.

I had this uneasy feeling, finally, that a rancher named Bruce Mulkey might be right when he said that environmentalists working to push traditional users off federal lands were making the countryside safe for ranchettes and subdivisions. For me, there is something endlessly forlorn about a place like Elk Bend, south of Salmon, where a California developer sliced an oxbow floodplain into narrow lots for double-wide retirement homes. I hardly ever saw anybody outdoors among the neat post-and-pole fences there. Salmon had not welcomed them.

"They retire from California, they last about three years, and then their bodies get shipped home," a local told me. Meanwhile, the television sets were turned on inside, and the rooftop satellite dishes seemed to be reaching out to geostationary orbit for reruns of *Bonanza*.

UP IN THE SALMON NATIONAL FOREST one dawn an 18-year-old named Shaun Westfall directed his scarred D-6 Cat up a ragged dirt slope. I hung on to one side, and a tree feller in hobnailed boots perched on the other. Downed logs and debris underfoot sent the Cat clanking and swiveting from side to side. It was steep enough that I wondered which way to leap if the Cat rolled.

"You usually get a scare about once a day," said Shaun, a college student who was

A black eye on Idaho, the Blackbird copper and cobalt mine in Salmon National Forest has been targeted as a potential cleanup job for the EPA. Unprofitable since the late 1960s, the mine site remained a tangle of debris until last year. Heavy metals continue to taint nearby Buchtail Creek.

spending the summer with his uncle Doug's logging outfit. Shaun's father had died running just such equipment, Doug Westfall had told me, when a log came in over the engine and "gill-poked" him. "It's all dangerous work," Shaun said.

I got off with the tree feller, Greg Johnson, and watched him start the day's cutting. The chain saw roared to life, and the first tree skipped off its stump like a kid let out of school, then toppled over. The feller moved with quick, decisive steps, cutting strategically, backing away, checking the tangle overhead for a clean fall.

This stand of lodgepole pine was to become a 25-acre clear-cut—a harvesting regimen that can make good environmental sense with lodgepole. I'd been to forests on the Pacific coast where the clear-cutting had gone out of control, and the denuded hills looked like the flanks of some bony dog reduced to stubble by hair clippers. But when I flew over the Salmon National Forest with Hadley Roberts, the clear-cuts seemed small and widely scattered on the rugged hillsides. Roberts readily noted that clear-cuts in solid blocks of forest can open up habitat for wildlife and that lodgepole grows back quickly. But he also criticized plans to log some slow growing areas.

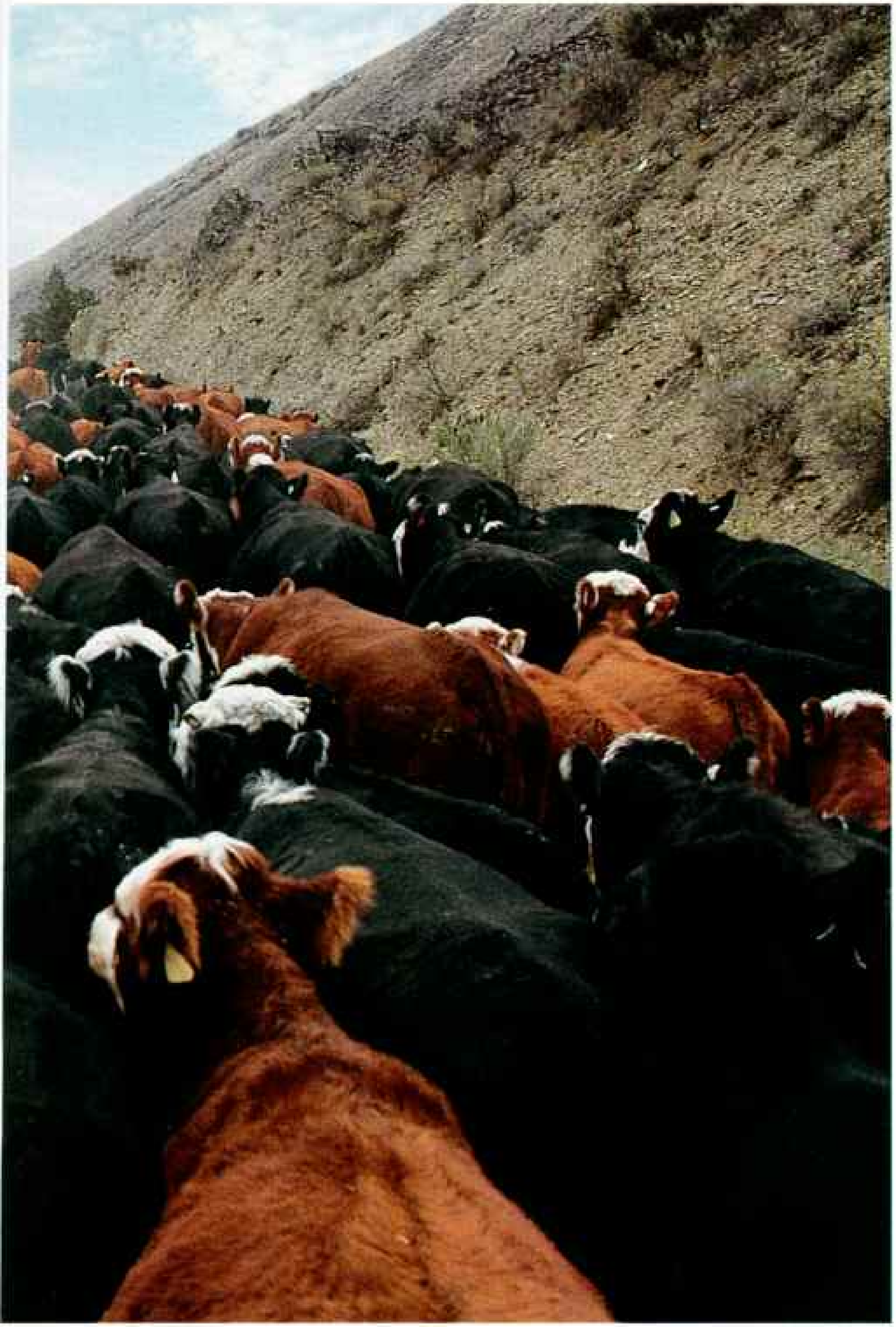
The problem for the Forest Service, loggers, and environmentalists alike is that the easy timber is running out fast. In the past 20 years the Salmon Forest has gone from an annual cut of 40 million board feet to about half that, supplying a single local sawmill where there used to be three. I asked John Burns, the supervisor of the Salmon Forest, if he thought the land here was being played out or locked up. "Both at the same time," he said. It was the answer of a man in the middle, but with the ring of truth.

About a quarter of the 1.8-million-acre Salmon Forest became part of the Frank Church Wilderness in 1980. Another 800,000 acres are referred to as "roadless," but 200,000 of these are officially open for commercial use. The reality is that environmental appeals often block any efforts to log there.

John Burns had come into this standoff with a reputation for "getting out the cut," an important criterion for advancement in the Forest Service—and also for his reputation in Salmon. The mill, which local workers now own, needs the entire allowable cut from the Salmon Forest to operate profitably. Burns would have to get about half the new timber from areas that are now roadless, and he seemed to be bracing himself for the job. "I don't think people understand the big picture," Burns said. "If you keep setting land aside and imposing restrictions, the price is going to go up."

ENVIRONMENTALISTS in Salmon had their own ideas about the big picture. One afternoon I met with the local chapter of the Idaho Conservation League, and the nervous preliminary talk had to do mostly with how hard it was to take an environmental stand in Salmon. It came back to them in small ways: They no longer felt comfortable going into certain stores, and people avoided making eye contact after church.

The cut from the Salmon Forest was smaller now, the members of the group said, because



A river of cattle flows down from the Continental Divide, where the herd had grazed on public lands all summer, to the Lemhi Valley, where it will feed on hay until the following spring. In Idaho, cattle ranching is a 700-million-dollar industry.

the Forest Service had allowed Champion International and other, smaller companies to log most of the best timber in the 1960s and '70s. Valuable ponderosa pine and Douglas fir were stripped from the most accessible slopes. The wilderness and roadless areas had survived only because they were too steep, too thinly forested, or too remote to be worth harvesting. Burns said, "It's a good thing there was a lot less viable country, or no doubt it would all be cut by now."

That is how the federal government has managed its lands all around the West. Forest Service supervisors themselves have complained that in the 1980s politicians pressured them to cut as many trees as they could. The federal-land managers typically knuckled under. They increased the cut in places like coastal Oregon, even when their own staff scientists were telling them that a more gradual harvest was the only way to sustain natural resources like the spotted owl.

The ostensible aim was to generate jobs for constituents, but it didn't work. In Oregon and Washington in the 1980s the allowable cut reached its highest level—and 25,000 timber jobs disappeared because of automation and log exports. When the old-growth trees were mostly gone as well, the government clamped down. Now at least 10,000 Pacific coast jobs are vanishing to protect the northern spotted owl under the Endangered Species Act. In effect, the government had pitted loggers against environmentalists by its play-it-out, lock-it-up brand of land management.

Automation has arrived in Salmon too. At one site, I watched a heavy machine called a feller-buncher nipping off trees and delicately stacking them at a rate of a thousand a day—three times what Westfall's tree feller can manage. Workers displaced from other regions are also coming to Salmon. Out-of-state loggers kept the local budget motel full all summer, but only about half the timber sales wound up at the local mill.

On a walk through what he called the "trailing edge" technology of the mill, Dallas Olson, a part owner, talked about becoming more efficient: Chips get sold to make paper and shavings to make particleboard. "That's what the whole game is about," he said. "You got to get more out of what they give you." He argued for cutting more trees. But he also worried that sometime soon the national forest might not give him any wood at all.

WHEN ENVIRONMENTALISTS want to show you what's wrong with the way federal agencies have managed public lands, they often start at a mine. You could go, for example, to Bear Valley Creek east of Boise, which used to be one of the premier chinook spawning areas in the Northwest. Then, in the 1950s, a company launched a dredge-mining operation at the behest of the Atomic Energy Commission. Promising to keep the creek "crystal clear," it went on to extract a million pounds of rare earth minerals and uranium used in defense manufacturing. Under the Mining Law of

Sun-dappled shower greets Lemhi County folk come to Salmon for the town's Salmon River Days festival. That namesake fish has all but vanished from these parts—a result, say locals, of dams downstream on the Columbia River system that block migration.

1872, which still governs mineral extraction on federal lands and requires no royalty payments, the company patented 910 acres of national forest into private ownership for a total of $2,277.50.

If the direct benefit to the U. S. Treasury was strictly limited by the 1872 law, the cost to the public was not. The site where the ore was milled became a hazardous radioactive area requiring a two-million-dollar taxpayer cleanup. The creek itself was turned upside down, choking the spawning gravels with sediment for 37 miles downstream. In the late 1980s the Shoshone-Bannock Indians initiated a 2.8-million-dollar project to stabilize the area for salmon restoration. To ensure that the patented acreage would not be mined further, the government then bought back its land—not for the original price of $2,277.50, but for 5.9 million dollars.

But going to places like Bear Valley Creek may be unfair to the mining industry, which says that all that happened long ago. One afternoon I visited the Thompson Creek Mine, then owned by Cyprus Minerals, in the Challis National Forest; I wanted to see how a large, progressive company operates. The product was molybdenum, a mineral used as a steel hardener and as a lubricant.

Dave Tupper, the swing-shift supervisor, was as mild and friendly as a Sunday school teacher. He'd been employed here for almost 12 of his 33 years, and he was passionate about his employer's good intentions. He drove me into the pit, a huge open area with a stairway of 50-foot-high benches on each side, like facing ziggurats, where 1,400 feet of mountaintop used to be. He showed me the tailings dam and the waste-rock dumps burying the land at the head of three creek drainages. Cutthroat trout live in the ponds at the foot of each dump, he said. Elk graze below the tailings dam.

Then, with a candor that seemed to be the rule at Cyprus, he brought up the problem of acid mine drainage. Unearthed and exposed to the elements, rock from this mine has the potential to form acid and kill a creek that drains into the Salmon River. But Tupper was confident about the company's plan for encapsulating the material in one of its waste-rock dumps. Later, an environmental coordinator for the Forest Service said it had required the company to post a reclamation bond. I suppose I should have been reassured.

It was, however, one of those nights when everything goes wrong, and people kept calling in on Tupper's radio: "Dave, tell John our compressor quit about halfway down the hole," or "Dave, T-59 is down for problems with the main alternator." It put Tupper in mind of a mishap that occurred just a few months before, when a high wall in the open pit came thundering down without warning. The site's richest ore deposit was now buried under nine million cubic yards of debris.

This tested my faith in engineers: Would the dump in which the acidic rock was to be encapsulated be any more secure, especially when the jobs and profits were long gone? Would the reclamation bond be adequate to fix any problems?

I went away wondering what this kind of project was doing in a national forest—and my misgivings were due in part to petty suspicion that as a taxpayer I was getting reamed on

these deals. Mining interests kept telling me it was a cheap shot to focus on the two and a half dollars to five dollars an acre they pay to buy public land, when I should really be talking about the vast sums they invest to bring this land into production. But I didn't follow that argument: If I sell you an acre for five dollars and you spend a million dollars to turn it into a hole in the ground, does this make the five dollars in my pocket last a day longer?

I felt as if I were getting beat twice on this deal: The 1872 law allowed U. S. and foreign companies to walk away with minerals worth about four billion dollars from public lands

Faces of the New West, masked waiters tend the summer wine auction in Sun Valley, across the mountains and a world away from Salmon. Renowned ski resort for the rich and famous, the town boosts its summer season with music festivals.

each year. I recalled the pointed question a U. S. senator once addressed to a federal-land manager who had been defending the 1872 law: "If *you* owned 500 acres of land, would you let someone come onto your property and mine it for free?"

Afterward, I put the same question to a Grassrooter in Salmon, who replied: "The company is out there producing an economic good, paying taxes, and employing all those people. I can't comprehend why that isn't a benefit to every citizen in the United States."

What the nearby town of Challis had gotten so far was a dozen years of work for as many as 570 people, no small benefit; for a time the mine also provided nearly half the tax base. But when I called back a few months later, the Cyprus mine had shut down, and Dave Tupper, among others, was out of a job. Recovery was unlikely; international competition had

cut the price of molybdenum to a third of what it was when the mine opened. Houses had been plucked off their foundations and hauled away to other once-and-future boomtowns.

And yet the prospect of the next big strike glittered blindingly in the rural imagination. Downriver in Salmon, they experienced their last mining-related bust in the early 1980s, but a new gold mine in the Salmon National Forest still looked like the brightest hope to a lot of people.

Amid the cross-fire talk about the economic benefits and environmental hazards of this project, one thing impressed me most: The plan was to reduce 700 acres of national forest to rubble for a project lasting just seven years. As at the Cyprus mine, modern technology would rip down mountains and fill up creek bottoms on a scale never imagined in 1872. Building a region's future on such projects seemed to me to require a sense that our resources are limitless—a sense that hardly exists outside isolated towns like Challis and Salmon.

I WAS TALKING ONE DAY with Quinton Snook, a rancher and county commissioner, when a federal-land manager named Dave Krosting walked up and began to visit with him on the subject of 15 cattle grazing along a stream that was supposed to be off-limits. Krosting's mission with the BLM is to get ranchers to fix up the creek bottoms on their grazing allotments—a key goal on federal lands around the West but especially here where the creeks should be producing salmon.

Krosting was sympathetic on the subject of Snook's stray cattle but also firm. He'd learned the art of selling people what they don't much want when he was a kid pushing tickets for Boy Scout fund-raisers in his old man's saloon. "Dave *thinks*," said Snook, when Krosting had left, and his tone implied that this was unusual among federal-land managers.

One difficulty with Krosting's mission is that a ruined riparian zone is not like a forest converted overnight to a stump field. To ranchers and laymen alike, the sight of cattle grazing by the side of a stream still tends to look good. You have to stop and think that the cattle crossing the stream may be trampling on the redds, or nests, where salmon deposit their eggs, and the crumbling banks may be smothering the spawning gravels. You have to recollect that if the willows and aspens hadn't been chewed to nubs and if the grass weren't nibbled flat as a putting green, this is where the deer and the antelope would play, along with about 80 percent of all local wildlife.

Over a generation, heavy grazing can take a narrow, meandering stream, where trout hide in the potbelly pools, and turn it into a dry, ragged gut. But noticing the gradual deterioration is a bit like watching your own face grow old. Ranchers tend not to see much change till someone like Krosting makes them look in the mirror. Krosting also seemed to have a knack for getting them to feel good about repairing the damage.

"Oh Lordy, it was a dust bowl," a rancher told me one day soon after, showing off a creek that had begun to mend after he fenced out the cattle. "There's some little bitty cottonwoods," he said, indicating regrowth. "I'll tell you one thing, if you let the damn cattle in, they're going to tear 'em up." This was a rancher who had previously suggested resolving a grazing dispute with the help of his .270, and I remarked that he was sounding out of character. "Just 'cause I'm a rancher," he said, "doesn't mean I go out and kiss every cow on the mouth."

Krosting had gotten the ranchers talking like converts by preaching the gospel of holistic grazing, which says you can have healthy riparian zones and cattle too, if you just use a little forethought to move the animals around the range. When the stream banks have recovered sufficiently, the cattle can move through for a spell of rich grazing in the spring. Then they head up to the hills. Cattle bulk up faster on dry upland forage, Krosting told the ranchers, and a healthier stream might make for a more reliable water supply.

"See this? See how this bottom growed back?" said Chuck Shiner, a lean, weathered old rancher in a rumpled white Stetson, standing above an eroded stretch of Yearian Creek. "There's *lots* of changes. Just that green grass over there, and I suppose if you're scientific, you see sedges"—plants that would, in time, put down a web of roots six feet deep and weave the banks back together again.

"I sound like I'm *for* these things," Shiner said, "and I suppose a little I am." At heart the ranchers mainly want the government off their backs. But salmon also have obvious value for the local economy, and their seasonal

Another bargain from Uncle Sam, cheap user fees help ski resorts profit off federally owned slopes, like those in the Sawtooth National Forest around Sun Valley. Basking in steam-heated pools, few visitors realize they are surrounded by federal land.

movements are part of what once made it gratifying to work the land. "I like to manage this land so my sons can make a living on it," Shiner said, and his words sounded a note of reined-in passion. "It's a hard sonuvabitchin' life, but it's a good clean way to raise people. We're trying to take care of the resource so we can keep it."

On the drive back to Salmon, Krosting was in high-sales mode. "We're out here every day," he said. "We're managing the land. It's not as complicated as people make it seem." And from the backseat one of his biologists added, "I don't know why it's not happening all over the West."

The answer, critics say, is that federal agencies generally lack the backbone to manage natural resources properly, especially when it means challenging established economic interests. To put it another way, there aren't enough people like Krosting willing to show up at the door with bad news and risk having their skin peeled back by a harassed rancher's angry wife. You could make a case that it's not just the land but also small-time users like Chuck Shiner who end up paying the price for lax management.

Some people had hoped the Clinton Administration would change this, particularly because of the strong environmental positions staked out by Vice President Al Gore and Secretary of the Interior Bruce Babbitt. In early skirmishes the administration backed off from its promised reforms. But it continues to press for changes to the 1872 Mining Law and to how grazers use public lands.

ONE MORNING I took a walk on the 95,000-acre San Felipe grazing allotment, south of Challis, with Bill Meiners, a range conservationist who works with environmental groups. He helped instigate legal action against grazing practices here in the mid-1970s, and the resulting settlement targeted the Challis area to become a national model.

A small army of range experts produced the BLM's first environmental impact statement on livestock grazing, and they documented extensive damage. The BLM agreed to an ambitious recovery plan, including a 49 percent cutback in grazing on the San Felipe allotment. The plan was for the cattle to return, under more careful management, in 1994, when the hard work of environmental recovery was to be nearing completion. But the plan was never followed.

Walking across the stark San Felipe landscape, Meiners scoffed that the whole process had been a fraud. He moved with the caution of early Parkinson's disease. He'd grown old in this fight, but he was still tall, clear-eyed, and angry. He pointed out uplands stripped of native plants like bluebunch wheatgrass. With his pocketknife he picked at the crusty soil surface, which now tends to shed water like a shingle, instead of absorbing it. This land was being grazed at twice the level mandated in the management plan, he said. It was so battered "a cow would have to pack a lunch to get across here."

What happened to the celebrated recovery plan? Having achieved a legal settlement, environmentalists like Meiners pulled out and went home to the city.

The San Felipe Ranch belongs to a partnership of influential owners, also back in the city: Bill Hewlett and Dave Packard, better known for the huge computer corporation that bears their names. (Despite ranching's hardscrabble image, ownership by corporations such as Getty Oil and MetLife are common; the General Accounting Office reports that big operators control almost half of all BLM rangeland.) But the power on the local scene was the ranch manager, Dave Nelson, a six-foot-four-inch presence with eyebrows bristling like paintbrush tips and thick arms folded impatiently across his chest.

"We didn't agree with the environmental impact statement because it was flawed in many ways," Nelson told me. "We got experts in to show that they were wrong. We negotiated out." Without any new supporting data, local and state BLM officials agreed privately to a more lenient recovery plan.

Critics say the agency simply followed its unwritten policy: Ignore unwanted data in favor of management by wishful thinking. "People were looking for any excuse to make things turn out better than they were," one BLM staffer confided.

It was, according to another staffer, a classic failure of federal willpower in the face of "horrendous" small-town political pressure: "I've never seen a manager who didn't succumb to the sociological problem of living in a community with the people you're supposed to be regulating," he said. "If you're at all social, if you like to go to bars, if you like to go to

Undammed for its 420-mile length, the Salmon is a river runner's dream—and a big moneymaker for Idaho's hearty recreation industry. Except for tourism, the economic boom in rapidly industrializing south Idaho has largely missed Lemhi County.

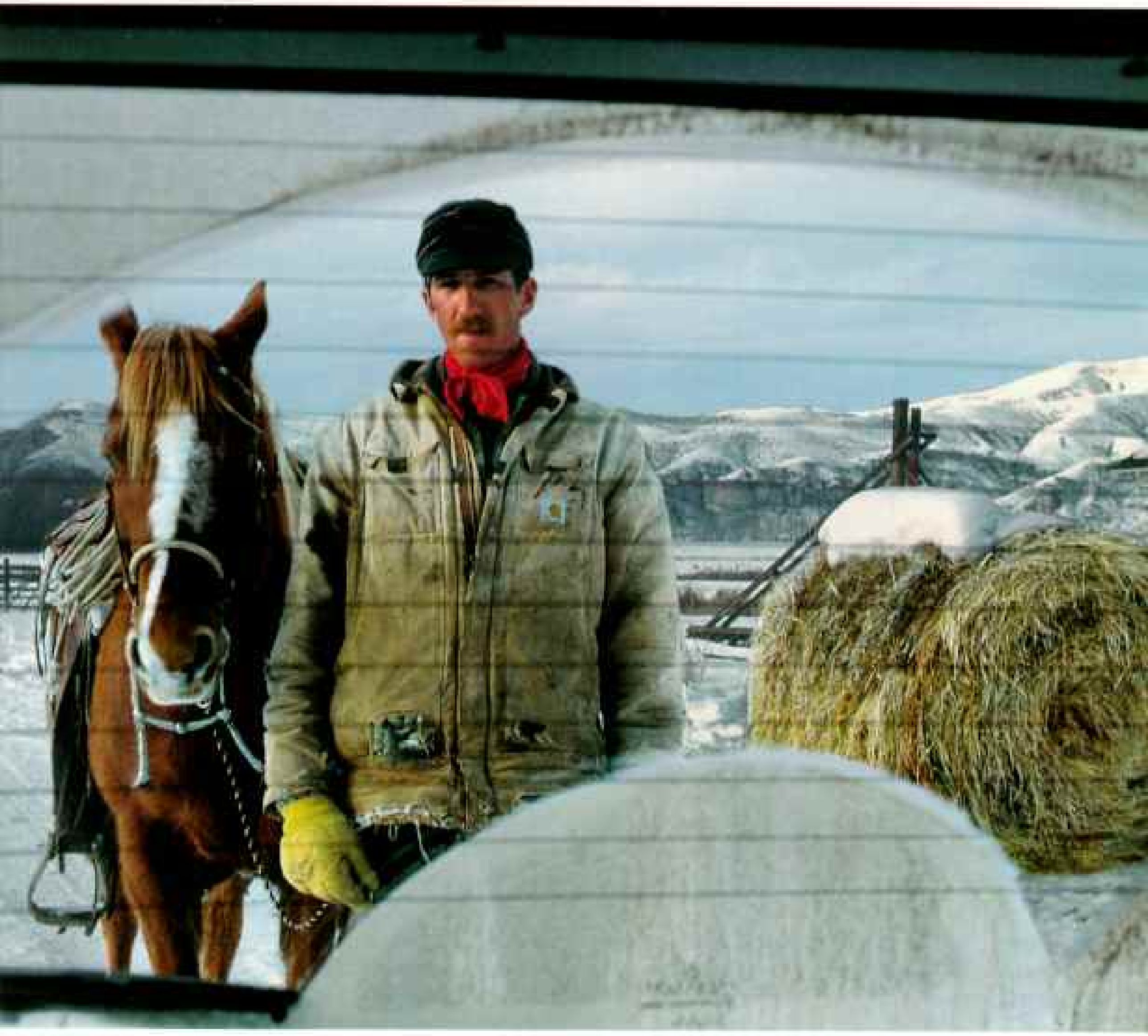
church, you're faced with the same people. It's intimidating, not in a physical way but psychologically."

THE SAN FELIPE CASE matters for ranchers like Chuck Shiner and towns like Salmon because it fuels a growing public perception that short-term economic benefits always triumph over the long-term health of public lands and that the easiest solution is simply to sweep away traditional users. Cowboys, like loggers and miners, have become bad hats out of central casting, creatures of flawed old myth, like Marlboro men who turn up with lung cancer. Their resistance to reform makes them such easy targets that environmentalists sometimes overlook more substantial culprits.

The day that I traveled around with Dave Krosting, many of the ranchers acknowledged their own mistakes on federal lands. But, to a man, they also asserted that they were merely fall guys in the decline of the salmon. One old rancher, boots set wide apart, hands planted in the pockets of his blue jeans, recalled when the grazing was much heavier—and yet the salmon were so thick that horses balked at stream crossings. "The fish was here until those dams came," he said, "and now they're blaming it on everyone else."

At least one environmentalist was saying the same thing. "I've been fighting the livestock industry all my life," said Ed Chaney, a salmon advocate whose Northwest Resource Information Center operates out of Eagle, Idaho. But you could shut down every ranching, logging, and mining operation in the upper Salmon River basin, he said, and not correct the basic problem: Almost all the young salmon would still die trying to get down the Snake and Columbia Rivers past the system of eight major hydroelectric dams built in mid-century by the Army Corps of Engineers.

We were standing next to Alturas Lake



Creek in the Sawtooths, old sockeye habitat. "This time of year," he was saying, "this creek should be red with fish as far as you can see. And it will be again." Fixing the dams would mainly mean significantly increasing water flow during the out-migration of young salmon, from April to July. But the Bonneville Power Administration said the change wouldn't be that simple. It would mean higher electric rates for cities and the aluminum and aerospace industries downstream. Bonneville was loudly emphasizing irrigation and other competing demands upriver.

"They're pitting the environmentalists against the agricultural interests," Chaney said. "People who ought to be allies, people who ought to be working together to restore an asset for the area, are being very cynically pitted against each other by Bonneville and its utility customers." Worse, he argued, the agency charged with protecting the fish under the Endangered Species Act was ganging up in this effort. The National Marine Fisheries Service was making stern noises about habitat degradation in the upper Salmon River Valley. Meanwhile, it had ruled that the dams could continue to kill as much as 90 percent of young salmon—and not jeopardize the survival of the species.

"The National Marine Fisheries Service is powerless against Bonneville and the Army Corps," said Chaney. "But they've been drinking Endangered Species Act firewater, and now they're going to come here to beat up

A study in resignation, cattleman Mark Ellis prepares to vacate Hot Springs Ranch north of Salmon. Sold to a California foundation by his landlord, the thousand-acre spread will be partly developed with the kind of ranchette-style homes favored by the growing numbers of retirees moving into Idaho from California and elsewhere. Unable to match the more than three-thousand-dollars-an-acre selling price for the land, Mark notes: "You can't begin to pay for private land out here by raising cows."

on loggers, grazers, and miners to show that they're doing their job."

The Endangered Species Act might be a handy scapegoat, but it wasn't the real problem. Idaho Governor Cecil Andrus, who used to enforce the law as secretary of the interior, described it as "the only vehicle we have to put the salmon back in the Salmon." To his mind, the real problem was federal failure to enforce the law against the powerful interests he described as "downstream bandits" who had "stolen" Idaho's fish run.

There was a certain irony in this point of view: Small towns like Salmon had benefited for years from federal reluctance to protect natural resources at the expense of traditional rural industries. Now they were liable to be sacrificed because of federal reluctance to stand up for a natural resource against the much larger economic interests of the city. But Chaney took no comfort in this.

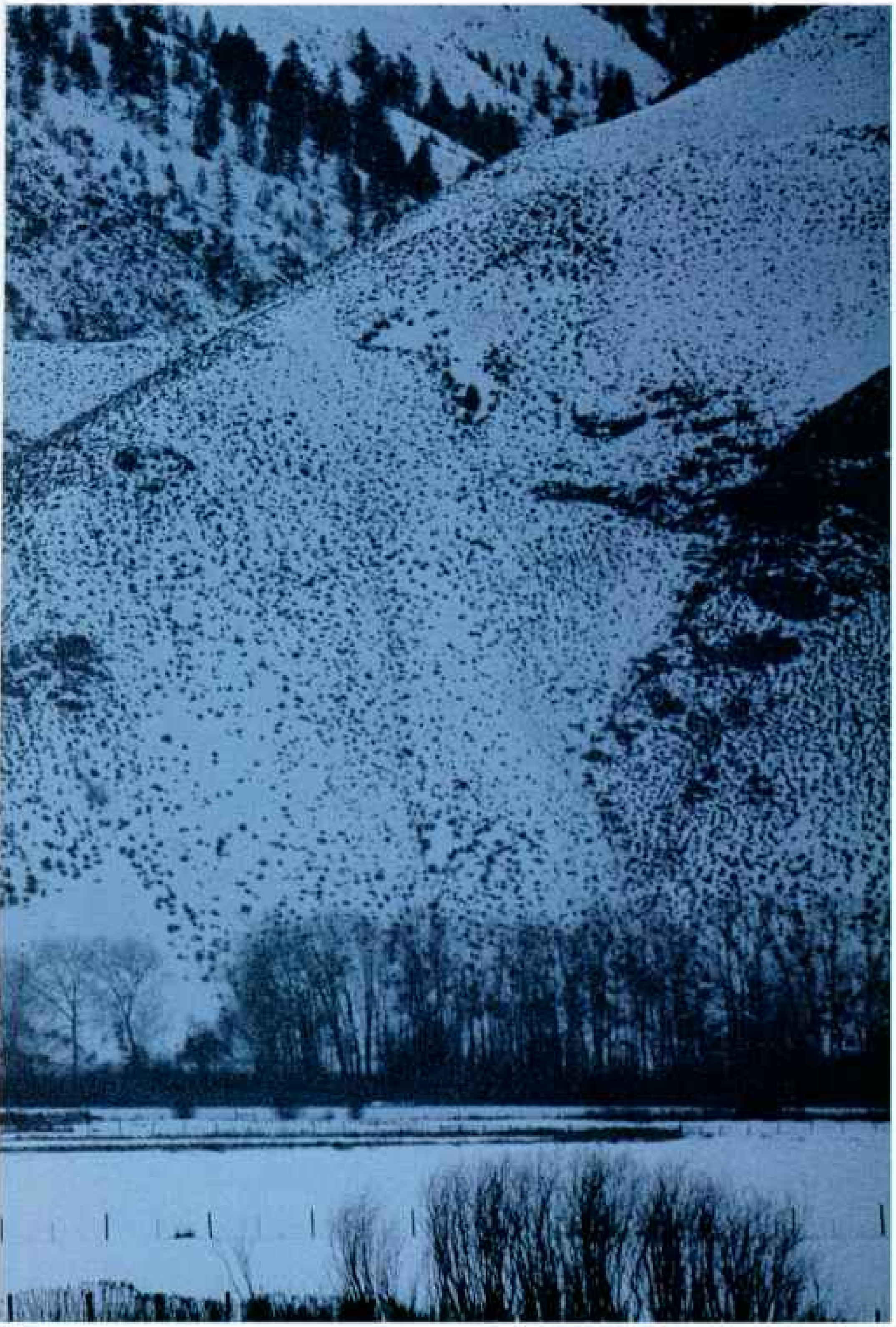
"This is going to work itself out," he said, "and the only way to make it work is for citizens to get together and stop throwing rocks at one another." Grassrooters in Salmon have been reduced to name-calling, he said, "because they don't know what else to do. One reason is that there's nobody out there helping them make the transfer from the Old West to the New West." The environmentalists were just as entrenched, putting their faith in the simplistic idea that a recreational economy would ultimately triumph over all evil.

"It's not an either/or thing," Chaney said. "It's not that fishing and recreation are going to substitute for logging, mining, and grazing. You have to have them all or the whole damned country's going to blow away. It's only the excesses that get us into trouble." But compromise was still a dirty word when it came time for me to leave Salmon.

I'd arrived when deep purple lilacs framed the doorways, and cottonwood flowers were drifting in the streets like snow. The day I left, the shrubs on the slopes were just turning rust color. The radio station was playing a country-and-western tune, "Funny How Time Slips Away," and it seemed to me that the song was speaking to Salmon, once so isolated and independent, now suddenly wide-awake in the grip of an entire region's shifting values.

I reached Galena Summit around sunset, and I stopped for one last look back at the valley. The Sawtooth Range at that hour was dusky blue shadows, and beyond it other mountain ranges repeated the jagged line into the distance. The river meandered along the valley floor, and the sun glinted off its surface in places. Then I noticed that the sun was also glinting off the Friday evening traffic on the highway heading into the valley, a parade of pickup trucks with campers, Jeeps with kayaks, Ford Broncos towing dirt bikes.

Like it or not, change was coming to Salmon. Change was coming to the federal lands. It was time for the Grassrooters and the environmentalists to put down their rocks and seek common ground. It was time for federal-land managers to look to the long term. Below me, the Winnebagos were already on the way. The subdivisions could not be far behind.



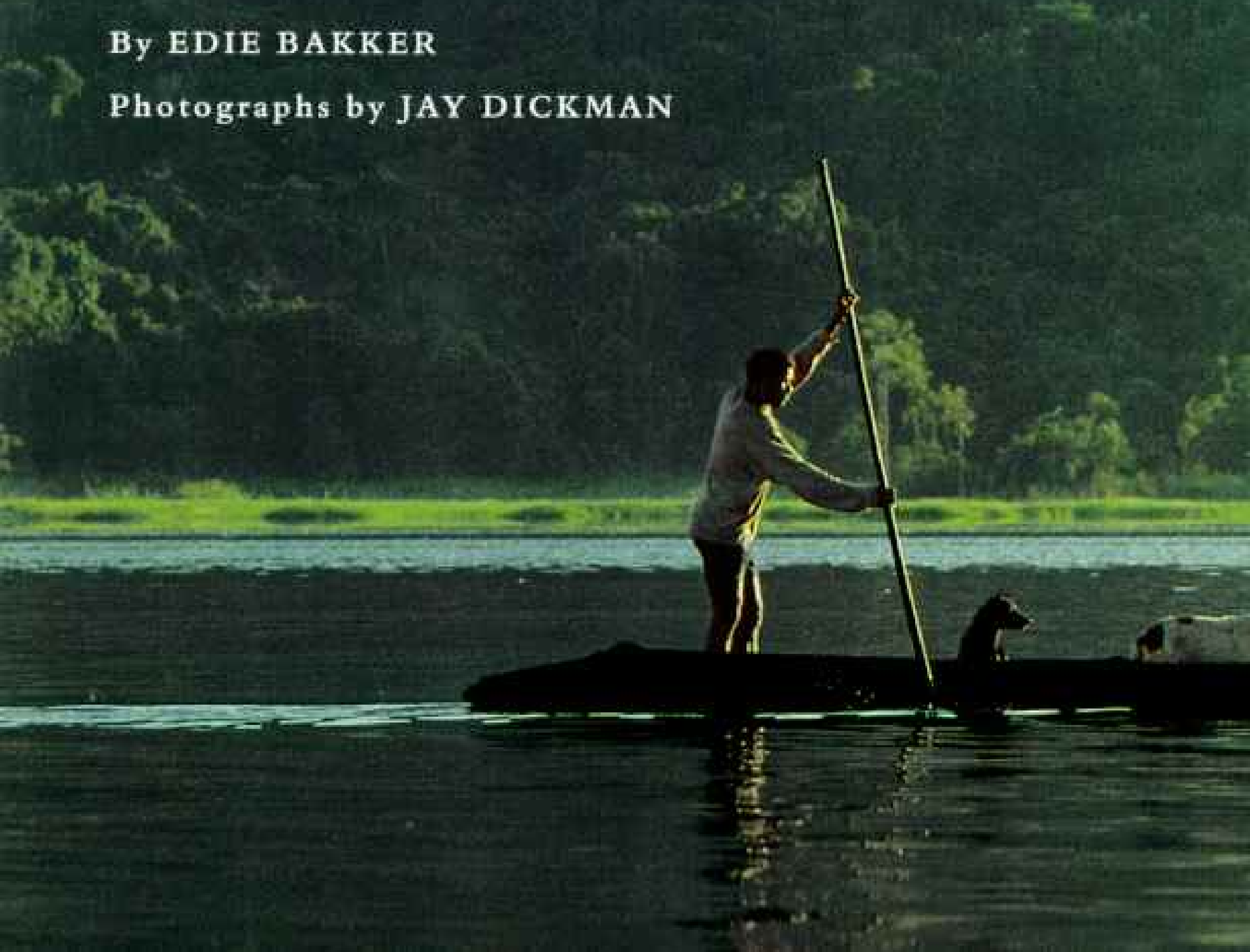
Like mountains looming in the background, the forces of politics and economics are closing in on those who earn their living from the nation's land—in Idaho's Salmon Valley, where a lone rider surveys his ranch, and throughout the rapidly changing West. □

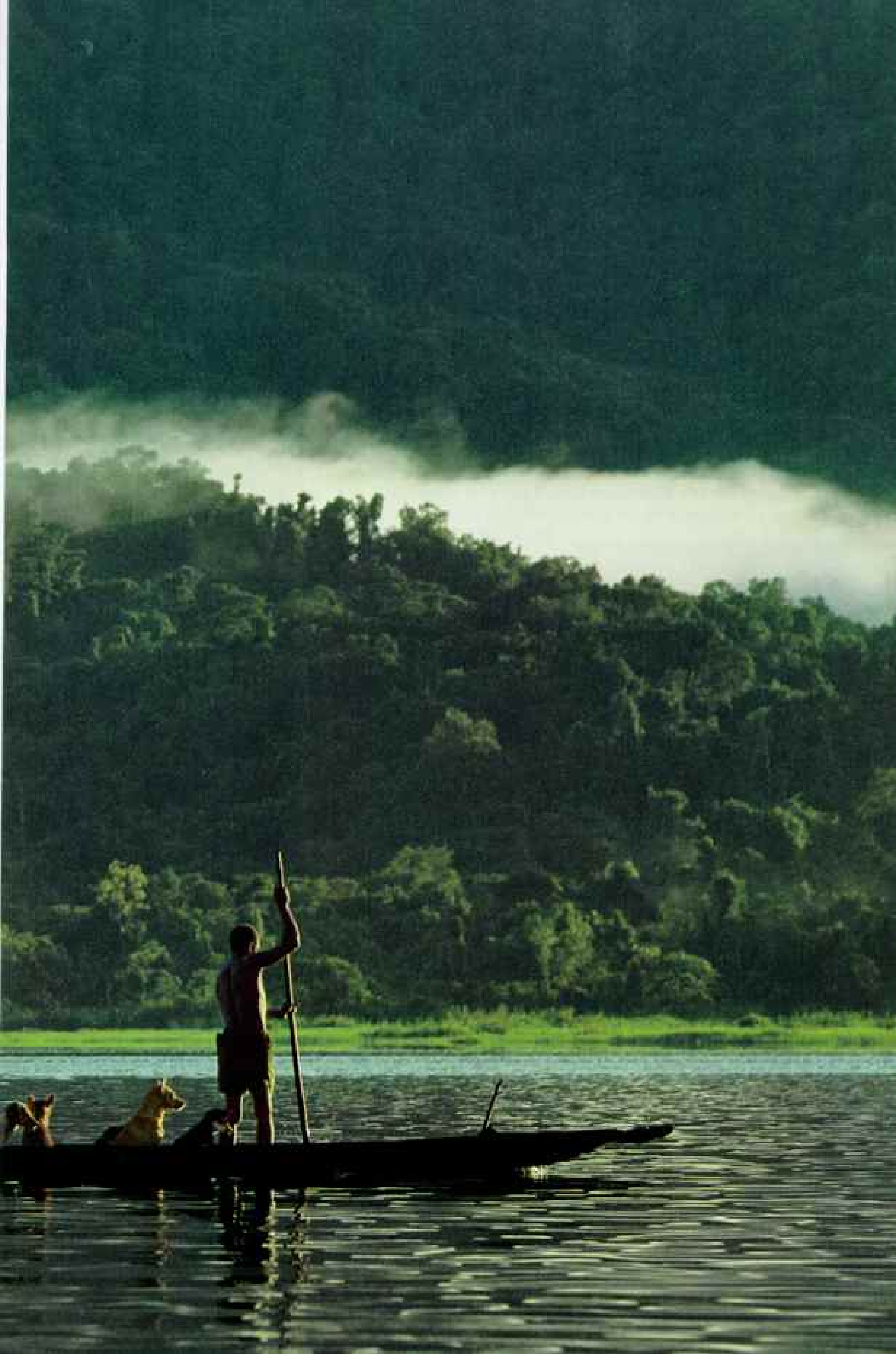
Return to Hunstein Forest

Hunters glide homeward in a dugout canoe on Papua New Guinea's Lake Wagu. The vast rain forest beyond may fall to logging interests, a threat that drew the author—daughter of U. S. missionaries—back to her childhood home.

By EDIE BAKKER

Photographs by JAY DICKMAN





THE SEPIK RIVER meanders through the vast wetlands of northwestern Papua New Guinea, its swirling brown water spilling over banks as much as a mile apart. But sunrise turned its currents pink as we watched from our motorized dugout for a chink in the towering grasses that marks a seasonally flooded channel—a *baret*—leading to the Bahinemo village of Wagu.

I was raised in this remote village in the Hunstein forest, the daughter of American anthropologist-missionaries. The improbably named Hunstein (a legacy of 19th-century German colonialism) is one of the country's most undisturbed rain forests, rising from swampy lowlands into a mist-shrouded mountain range that peaks at 5,069 feet (map, page 47).

I was four years old when we moved here in 1964. My family became members of a Bahinemo clan. I grew up speaking Bahinemo and playing barefoot in a shredded palm-frond skirt.

T. WAYNE DYE

My memories are of watching men carve cedar canoes and of breathing the aromatic showering of soft red chips. Of gathering firewood with my Bahinemo girlfriends and securing it in a harness of carrot-scented vines that twisted around my forehead and hung down my back.

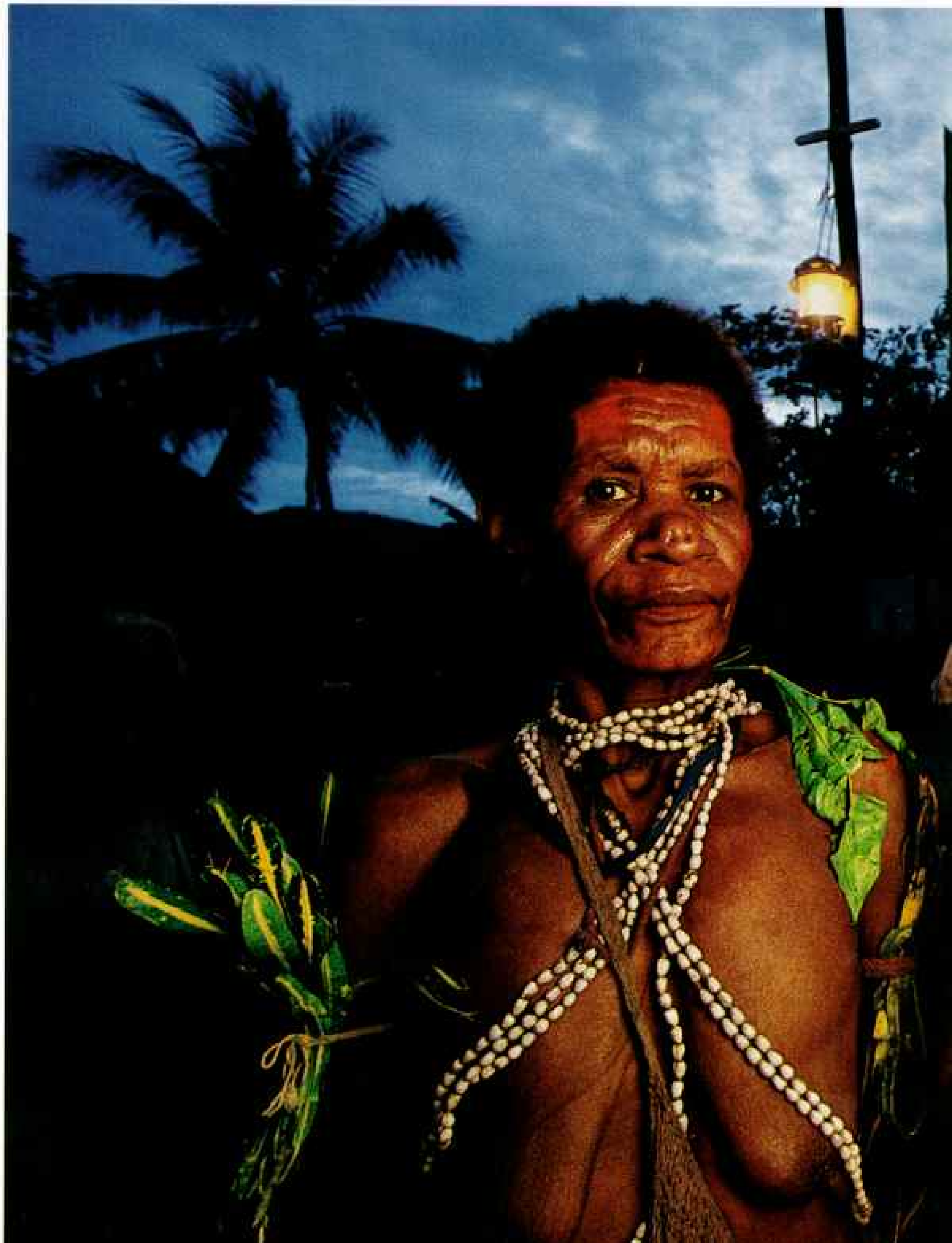
A year after I graduated from the boarding school I attended in Papua New Guinea's highlands, I moved to the United States. Now I was coming back, with my husband, Rob, an aircraft mechanic, and our seven-year-old son, Gabriel, and five-year-old daughter, Sarah. After 11 years of living in the U. S., I was coming home.

The dark green foothills of the Hunstein Range rose at the horizon of the winding baret. Herons, cormorants, egrets, and hawks watched us intently. Parrots screamed and raced away. We crossed the wake of a crocodile and cut into the hills. The view of four-mile-long Lake Wagu opened like a slowly drawn curtain. Mount Hunstein towered blue in the distance, and sweet jasmine drenched the air.

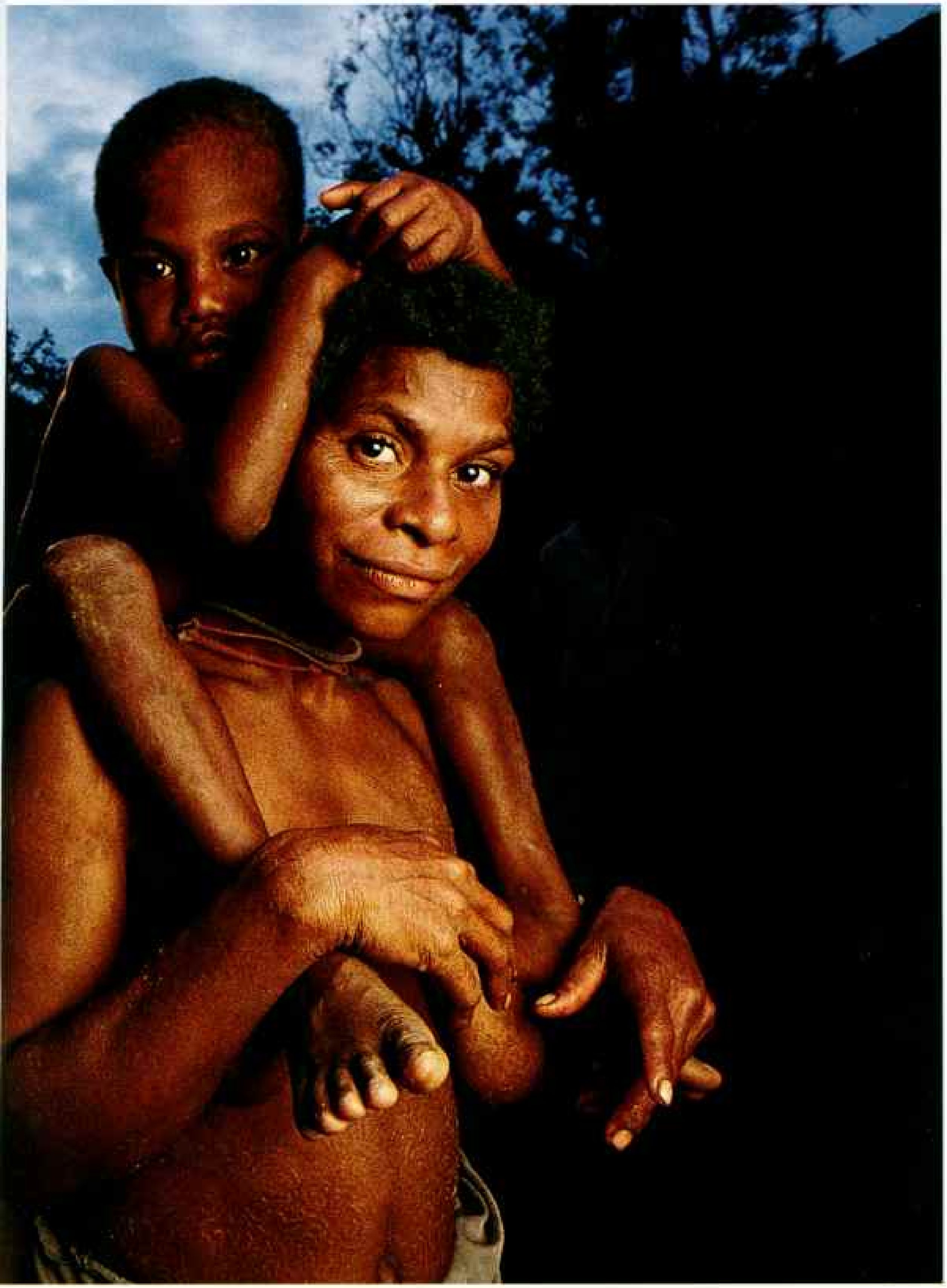
As we beached on the rough, pebbled shore of Wagu village, people rushed toward us hugging, clinging, laughing, and crying. With each pair of eyes I met flowed thousands of silent thoughts. There is no Bahinemo word for "hello," and only an extended absence requires a greeting: "You're here," they said.

"I'm here," I replied.

Returning to Wagu village after 11 years, the author hugs her old friend Baheina Wahiyu. For 20 years her parents, Wayne and Sally Dye (left, with children Tom, Joy, Jamey, and Edie in 1966), taught the Bible, gave medical care, and studied the Bahinemo culture. Now rising interest from tourists and timber companies opens new possibilities for the Bahinemos—but also threatens their way of life.



A sing-sing brings together people of all ages for a night of rhythmic swaying and chanting. Older villagers like Faisowa Wafio wear traditional necklaces of marsh



grass seeds, but Waiyo Hebei, carrying a friend's son, attends without adornment:
Increased contact with outsiders has eroded young people's interest in ancestral ways.

WHAT BROUGHT ME BACK TO WAGU was a crisis—the Hunstein is on the verge of being logged. Some of the world's last major rain forests are in Papua New Guinea. I had heard about clear-cutting in the coastal province of Madang, and the thought of such destruction in the Hunstein was intolerable.

The Papua New Guinea government has left land-use questions with local owners. But I worried that foreign logging companies would not tell the Bahinemos the truth about what logging would do to their forest, still crucial to their livelihood and culture. And did the isolated Bahinemos understand what their treasure means to the world?

Feeling angry, feeling helpless, I had written letters. One found its way to botanist S. H. Sohmer of the Bishop Museum, who organized the Hunstein River Expedition, supported by the Wau Ecology Institute of Papua New Guinea and the Bishop Museum of Honolulu, with funding from the National Geographic Society. There was a need for a comprehensive study of the Hunstein; if we were going to lose it, at least we would know what we were losing. And this knowledge might encourage international conservation efforts.

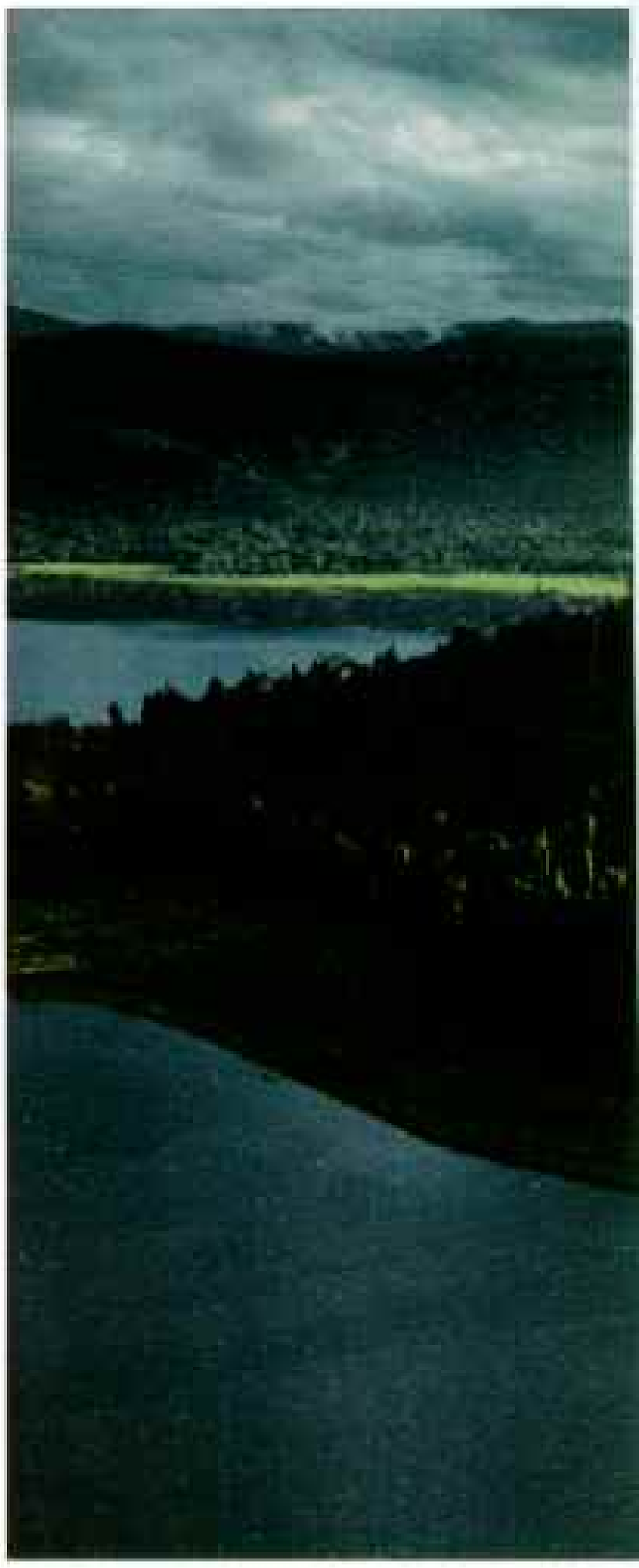
The Papua New Guinea government receives a percentage of log sales and, therefore, views logging as a profitable source of economic development for the region.

"The government has attempted to identify the landowners and follow their wishes," said Harry Sakulas, who grew up in the Sepik River region. He is the director of the Wau Ecology Institute and was one of the field leaders of the expedition. "But there are two serious dangers. First, even if the people speak English, they won't know the legal terms needed to secure their desires. You can't imagine how clever these multinational companies can get at reinterpreting contracts.

"Second, the logging companies will go to incredible lengths to convince people. Promises of a lifetime salary or even a weekend in a hotel on the coast can go a long way when the landowner has never seen a paved road."

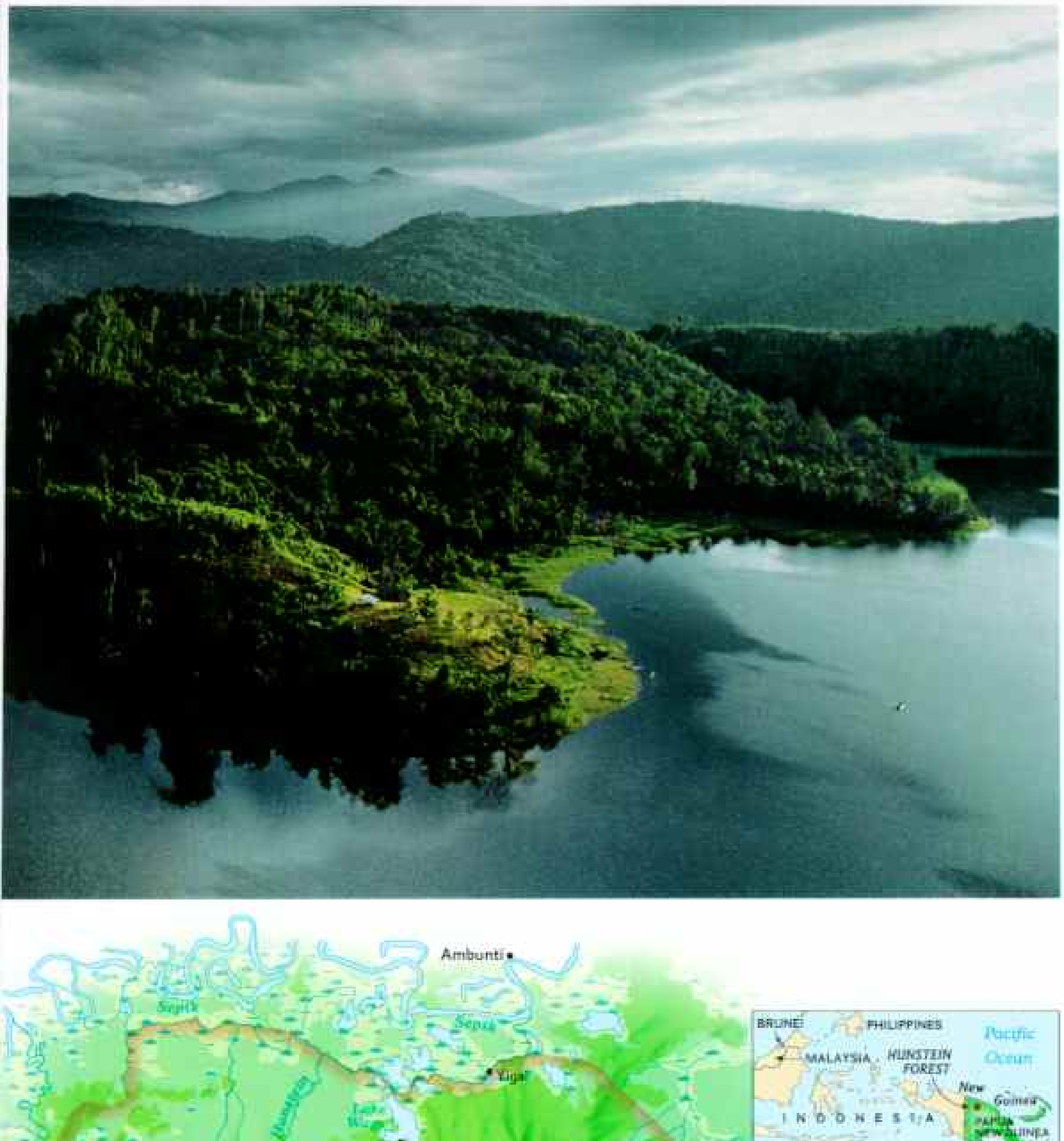
When I arrived in Wagu, the research team had already set up camps in the forest. I would join them, but first I wanted to get reacquainted with the village and with the joy of walking the forest barefoot. This doesn't require tough feet, only an intimate knowledge of the terrain. There are dangers—nests of stinging ants and hornets, death adders, thorny vines—but once you know how to avoid them, you are free to concentrate on the unexpected patterns and colors in this world that at first glance seems only green. Plate-size leaves of mottled orange and yellow drift from the canopy like jumbo confetti, clouds of butterflies flash iridescent purples and blues, liana vines dangle clusters of scarlet flowers 10, even 15 feet long. The stillness is tangible—holy. To walk here is to feel the very pulse of creation. This, I believe, is one of the rain forest's great gifts to us.

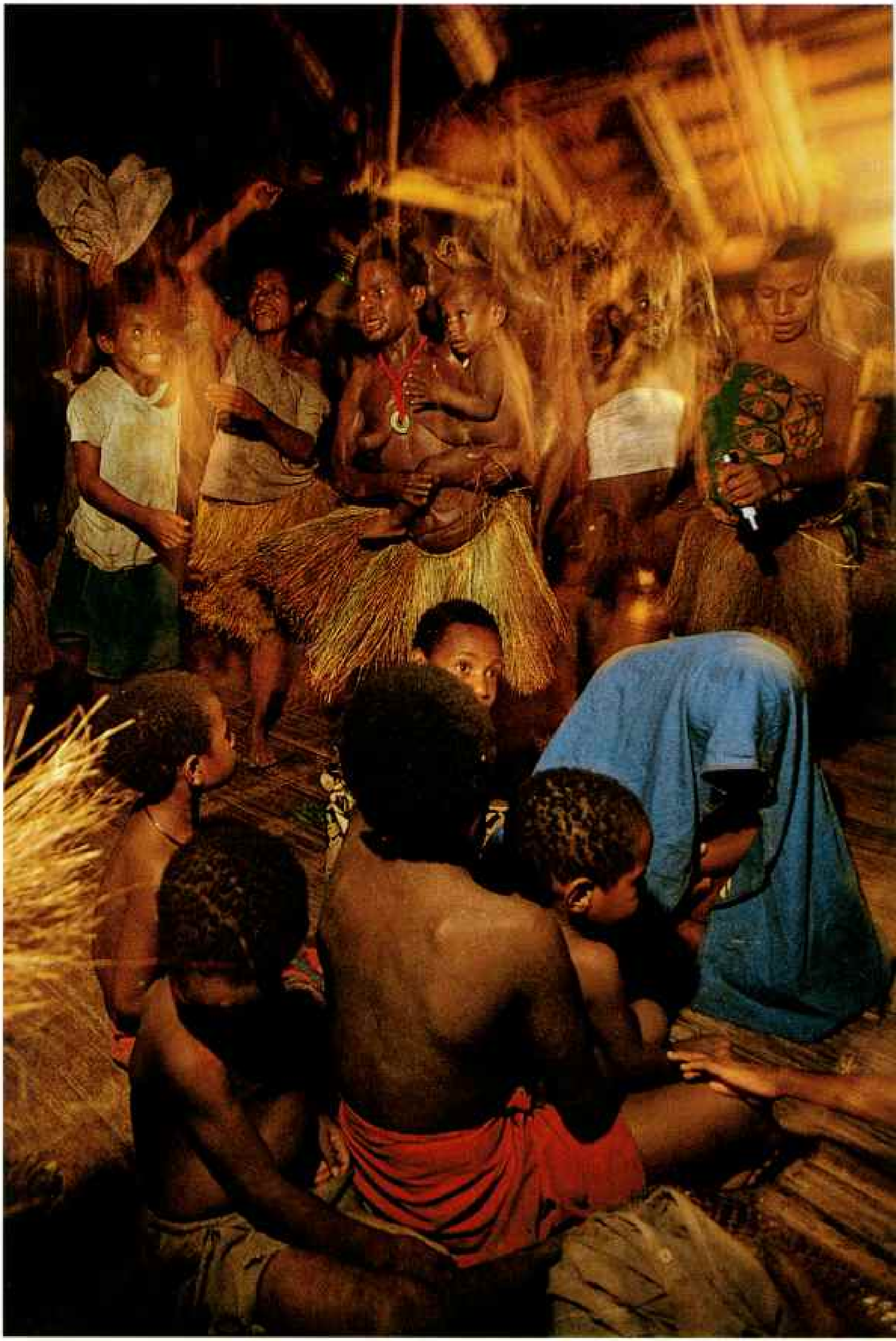
EDIE BAKKER lives in Duncanville, Texas, where she is working on a book about her experiences in Papua New Guinea. The work of Pulitzer Prize-winning photographer JAY DICKMAN also appears in the "Rivers of Conflict" article in this issue.



Clouds break to reveal the summit of Mount Hunstein (above), centerpiece of a rain forest whose German name echoes Papua New Guinea's colonial past.

In 1989 the likelihood of logging prompted an expedition to survey plant and animal life in the region. Half the size of Rhode Island, the Bahinemo territory is owned by nearly 400 inhabitants split into four villages; the largest, Wagu, is home to 135 people.


Ambunti
Sepik
Yigal
Wagu
Range
Hunstein
Mount Hunstein
Gahom
Inalu
BRUNEI
PHILIPPINES
MALAYSIA
HUNSTEIN FOREST
Pacific Ocean
New Guinea
INDONESIA
PAPUA NEW GUINEA
Port Moresby
Indian Ocean
AUSTRALIA
MILES
Extent of Bahinemo territory
Rain forest
Floodplain forest
Swamp and swamp forest
Expedition route
MILES



When I first met the Bahinemos in 1964, they lived in eight villages scattered throughout their 600-square-mile territory. They were recent settlements, each consisting of palm shelters and a men's cult house. Traditionally, groups of three or four families had moved through the Hunstein from camp to camp, hunting wild pigs and flightless cassowaries with bows strung with bamboo fibers and gathering fruits, nuts, and the staple of their diet—starchy pulp of the sago palm.

When the first commercial traders came into the region in the 1930s, a desire for contact with the outside world drew the

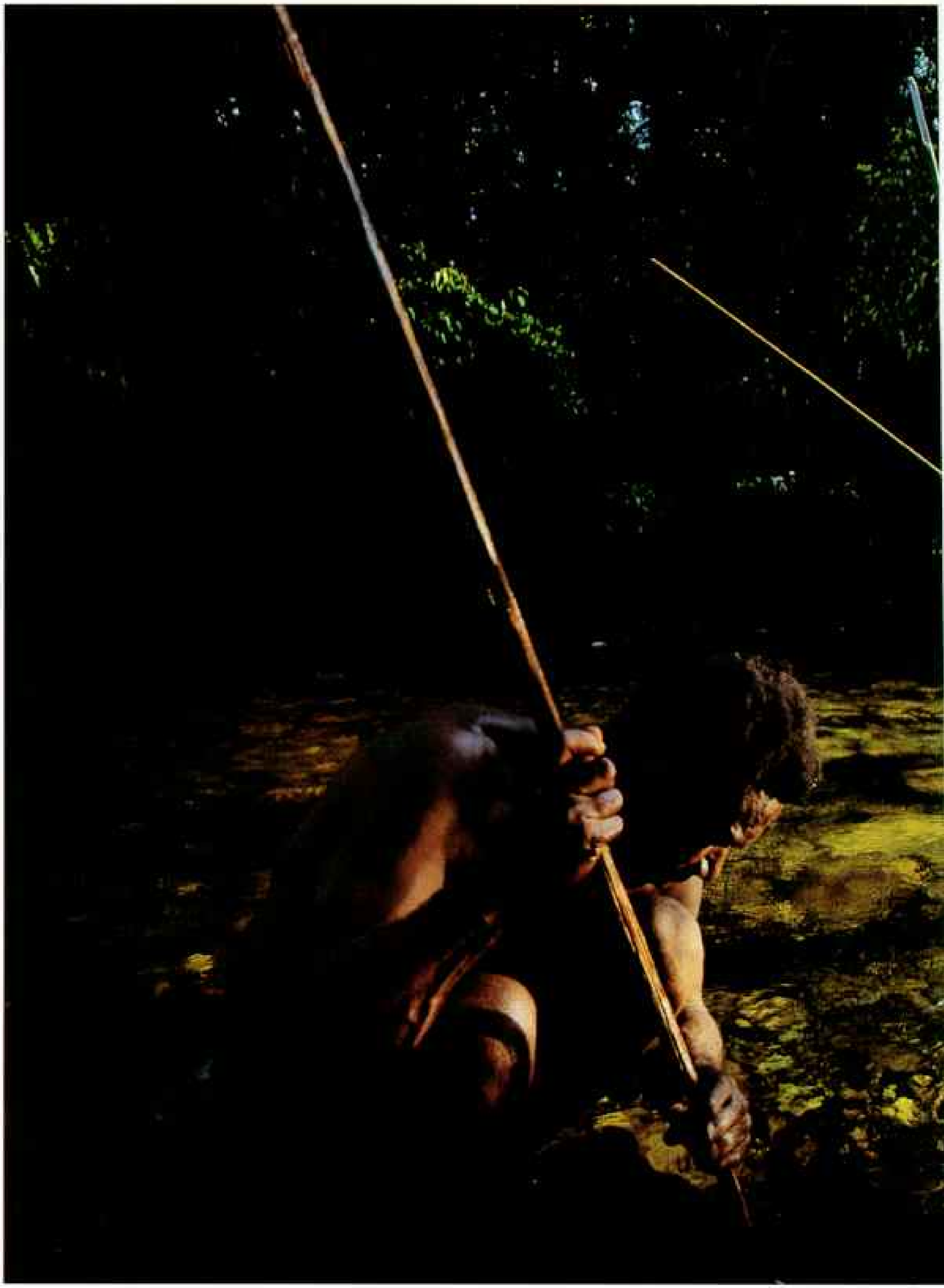
Frenzied dancing rocks a Wagu hut as wedding guests encircle the teenage bride, Niyabogo Kenyafo, huddled under a cloth (left). She will remain covered until a suitable bride-price is paid by the groom's family. Later, the couple's relatives stage a mock battle in the village center, where a time exposure traces a lantern's meandering path.

Bahinemos closer to Lake Wagu and the rivers. Families still lived in the forest for months at a time (and do so today for weeks at a time), but traders came regularly and received carvings and crocodile skins for kerosene lamps, matches, metal axes, knives, spoons, and Western clothing.

Papua New Guinea was then a territory of Australia, and after World War II the government encouraged all the country's tribal people—sometimes forcibly—to settle near the river highways of this nearly roadless land. There they would be closer to outside influences that might persuade them to give up revenge warfare, sorcery, and cannibalism.

The Bahinemos had already begun to abandon these practices, informally agreeing on an area of the Hunstein where there would be no fighting. Too many lives—and too many traditions—were being lost in violent cycles of attack and retaliation.

Little more than 300 Bahinemos remained in the early 1960s. Any population gains expected by the advent of peace were offset by disease, especially malaria—rarely a concern when people



Limned by late afternoon light, men spear catfish in the cool, clear currents of the Hunstein River. Along with wild pigs and ostrich-like cassowaries, fish are the

main source of protein for the Bahinemos, who also eat nuts, fruit, leaves, palm shoots, and the starchy center of the sago palm.

Chips fly as workers sculpt a canoe from a tree trunk. Dugouts are a main form of transportation in this roadless and largely unexplored area.

In June 1992 the Bahinemos and other local landowners sold their timber rights to the central government, giving it permission to solicit bids from logging companies; no permits have been issued so far.

Across Papua New Guinea, logging offers are sorely tempting for indigenous landowners who control 97 percent of the country's territory—nearly three-quarters of it covered by rain forest. Hungry for cash and consumer goods, inexperienced and isolated groups such as the Bahinemos can be easily exploited by foreign timber companies.

lived in the higher forest away from swampy areas. In the eight years before we arrived, not one of 23 children born in the village had survived infancy, and many adults had died also.

Medical care offered by my parents, Wayne and Sally Dye, helped stem malaria and other illnesses and infections. As they learned the Bahinemo language, they began to compile a dictionary and translate the New Testament. Bahinemo was not a written language, nor did its speakers have a name for it or for themselves as a people. My parents helped villagers decide upon a name to give their language an identity. They called it Bahinemo, meaning "our talk." Ask a Hunstein forest resident today if he speaks Bahinemo, and he will say yes. Ask if he *is* a Bahinemo, and he might say no. But they indulge our Western need for organization and do not object to being called by this name.

Nondenominational Christians from the Summer Institute of Linguistics, my parents tried to present the teachings of Jesus in a way that would assure the Bahinemos that their lives and culture have value. In early 1968 many chose to become Christians, calling themselves "kinsmen of Jesus."

Soon after, plans to move the village to nearby Wagu were under way. The people had long wanted to move to higher ground, but the risk from unknown spirits there had seemed too great: Nonindigenous pottery and piles of smooth stones littered the site. But whatever the nature of these spirits, the villagers now believed that God would protect them, and so they moved.

AS I WALKED ABOUT WAGU, it seemed that little had changed. It was uncanny to follow the same mud path edged with hibiscus and mango trees, to touch the palm-wood walls of our old house, and to pour a cup of water from the same kerosene refrigerator.

In other ways much had changed. Most people were wearing Western clothing, and many had adopted Western names. Members of my peer group looked too old to be in their early 30s. The men I grew up with had worn faces and serious eyes. Some of the women were grandmothers.

When I asked my friend Bawi Bafki how many children she had, she paused. Then she began naming them, concluding, "Oh, and Wida. Is that six? No, wait, seven." She beamed: "I have seven children." Her initial uncertainty reminded me how irrelevant counting is to the Bahinemos. Bawi's world is not governed by numbers or schedules. Some things are constant: the sun, the rain, the incessant spread of vegetation. Others happen unpredictably: children, wild game, thunderstorms, malaria, love, death. People do not plan, cause, or control any of it.

By chance, my parents were also visiting Wagu. They now live in Kenya, teaching missionaries the importance of adapting to the culture in which they work. Returning to update my father's study of the Bahinemos, they began by taking a census. They knew that they would quickly readapt to Bahinemo culture, and, as my dad joked, "If you adapt, you don't count."

The eight initial Bahinemo settlements have coalesced into four villages: Wagu, Yigai, Gahom, and Inalu. The region's population has risen to nearly 400, with 135 people in Wagu. Young men still move from village to village—"making the long

walk"—for marriage or economic alliances. People marry for love. It is permissible for a man to take a second wife, but it's considered selfish. There is also intermarriage with speakers of other languages who live adjacent to the Hunstein on land that the government of East Sepik Province is also recommending for logging. Logging is what I quickly began hearing about.

"Don't be concerned about your rain forest," visiting forestry officials had told the Bahinemos. "We can always replant whatever is cut down. Our lawyers can help you write your contract so you will gain as much money as possible."

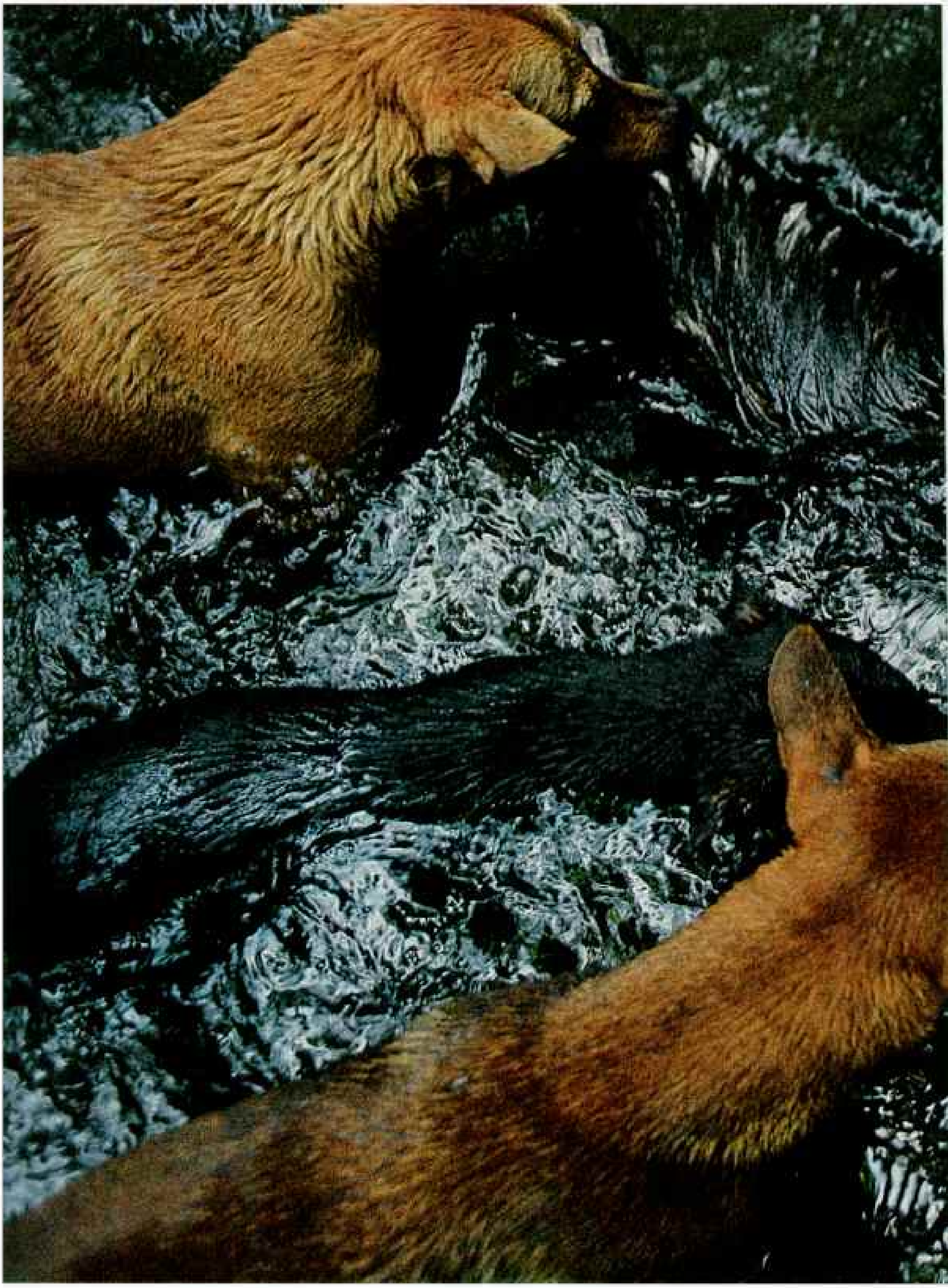
Fighting for life, a tiny whooping cough victim breathes with help from Sally Dye, in Wagu for a visit. The infant's mother, Henabu Nullowoh, kept silent vigil, then wailed with grief when her baby died; she buried her the next day in a cardboard box. Though government vaccines have reduced infant mortality, deliveries to this remote area are erratic.

A woman named Moyali Yalfei, about 45 years old and the widow of the head of the largest landholding clan, told me she thought she *had* to agree to logging. "The forestry department said they wanted it, so I'll have to give it to them, won't I?"

It's not naive of her to think that. A Bahinemo thinks of wealth in terms of personal alliances, not profits. While Westerners base business decisions around profit and expect to cultivate some friends in the process, Bahinemos aim for friendships and hope to earn some money in the process. Some 15 clans control various-size holdings in the Hunstein, and it is an honor to give permission for other people to use your land.

Compounding the confusion of Moyali and other Bahinemos is the overwhelming modern need for cash. As it is, the Bahinemos must struggle for years to obtain an outboard motor, clothes, cassette players, Western camping gear. And if they want to send their children away to high school, they must save hundreds of dollars for tuition and board.

"Trees are our only real source of income," Moyali said.



Snapping jaws end the life of a mighty northern cassowary cornered in a stream by hunting dogs. Up to five feet tall, the flightless birds have claws that can—and

sometimes do—disembowel humans. Valued for their feathers and lean dark meat, cassowaries abound in the Hunstein—a sign of the forest's pristine state.

Tourism could provide an alternative income to logging in the Hunstein, but it too has drawbacks. "Tourism is evil," an important village man told me. "Tourists bring beer. We have enough problems with alcohol as it is. It has made our teenagers stop listening to us and is tearing up families. The last thing we need is a steady stream of beer. But if we made a law that no beer would be sold at our lodge, no tourists would come."

Tour outfitters encourage villages to attract visitors by performing traditional ceremonies and selling carvings, many of which are associated with spirit worship. People who no longer

Stripped to the soil, a hillside in Madang, one of the country's most heavily logged provinces, gives a preview of what unrestrained logging could do to the Hunstein, some 150 miles away. Conservation groups vehemently oppose logging in the region: A 1993 study ranked it among the country's most biologically diverse areas.

fear these spirits because of education or Christianity see this as forced regression. Those who are animists feel the performances are a mockery. Watching a dance in a village south of here in the highlands, I asked a man what they were singing. He hesitated before translating. "They are telling the spirits, 'We shouldn't be doing this. We shouldn't be doing this. We only do it for the tourists, to make a lot of money.' "

ALONG THE HUNSTEIN RIVER and the north slope of Mount Hunstein, the ten scientists of the Hunstein River Expedition had pitched four camps reaching up to 3,300 feet. Each was three to six walking hours apart. The month-long study was just under way when I joined the scientists at Camp Two, a site the Bahinemos call Gipa. Rich with catfish, the crystal river here drops into a deep pool beside a rocky bar.

It rained that night, as it does most nights in the Hunstein

Range. But what struck as we were falling asleep was a deluge, and people scurried to bail sagging tent roofs. The river was nearing the top of its bank, and the researchers worried that the camp would flood. The Bahinemos working as carriers—camped only a few feet from the churning current—laughed. "This is just an ordinary rain! If it rained like this for three days in a row, then we would worry."

The rushing water gave good news to expedition leader S. H. Sohmer. "The water is clear; this is a healthy, well-balanced rain forest." He explained that the slightest disturbance of a rain forest can set off soil erosion.

"The soil here is thin. Without the roots of forest trees to hold it in place, it will quickly wash away, leaving bare rock. Then, with nothing to hold moisture, the area dries out and rain rushes off the barren land, creating floods. The watershed is one of the most important reasons for preserving this type of forest."

Hiking with me up to Camp Three—called "20-mile camp" by the carriers, who felt as if they had walked that far—were two Wagu men, Gogomo Wiyawi and Solomon Magofa. Ma Gogomo is the village pastor. ("Ma" shows respect in addressing a man, as does "San" for a woman.) Ma Solomon treats me like a daughter because long ago he adopted my father into his clan as his brother. He and I call each other Leikim, which means "tied vines."

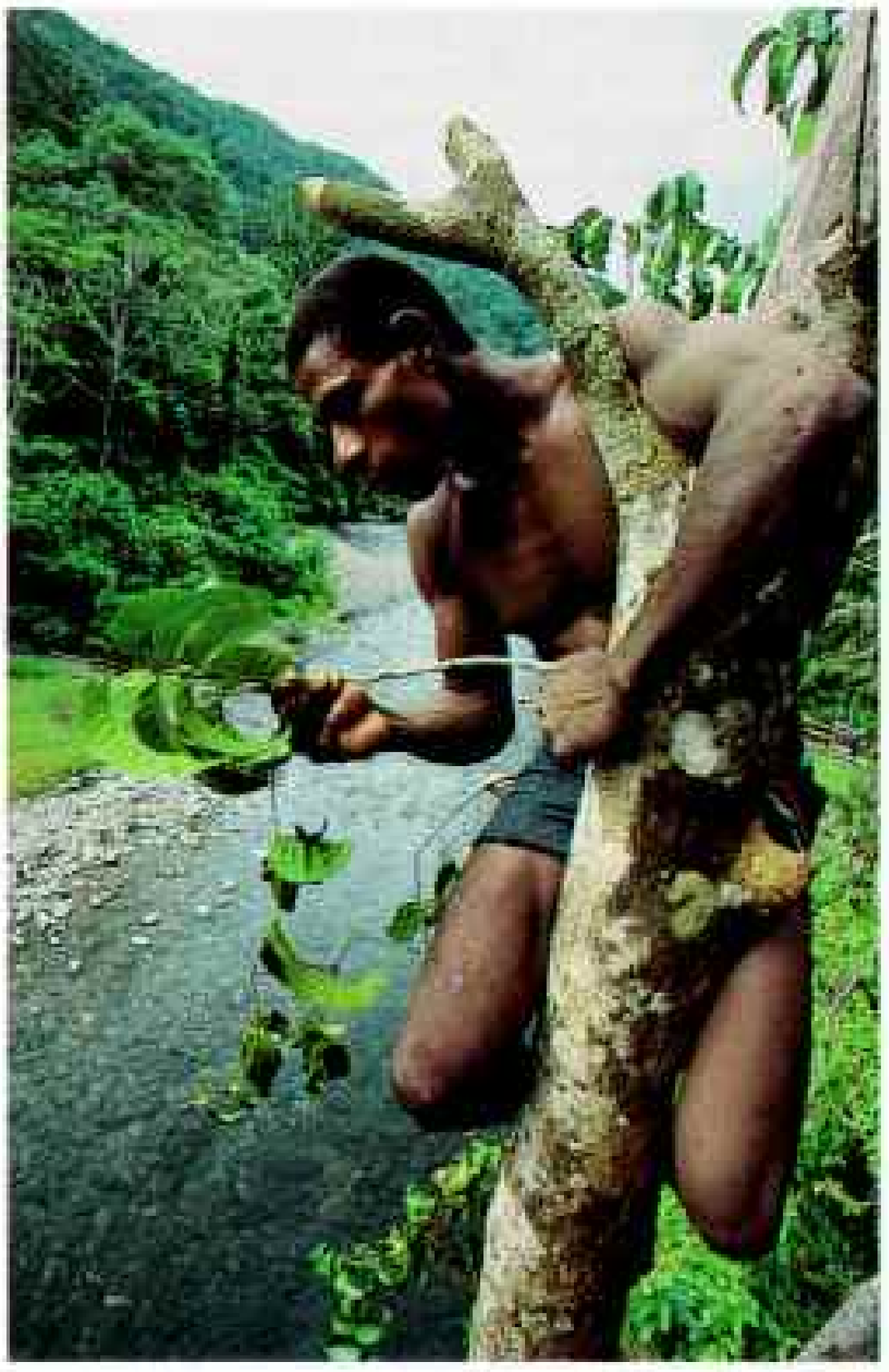
Scattered on our path were flower petals that looked like pink brushes or long yellow bells, and nuts that seemed to be wrapped with red string. We crossed the scat of wild pigs and cassowaries. Ma Gogomo peeled bark from a cinnamon tree, and we inhaled its perfume. To stretch our water supply, we cut a thick vine and drank its sweet liquid. We collected the foot-long nest of a giant moth that is used for making cloth; the larvae are roasted and eaten.

Ma Solomon told me about the hunting and gathering routes that crisscross the forest along ridges and creeks. Trails slashed along these routes grow over within weeks, so knowledge of them has been passed down from generation to generation. "Now, San Leikim, I am passing it to you."

Approaching Camp Three at 2,000 feet, we hit cool air and mist blowing from the summit. At this altitude the soil is even thinner. Dripping with water, tangled roots, mosses, and plants cling together over bare rock. The trees are smaller here, reaching at most 65 feet, but they could be logged for pulp. If they were, none could ever be replanted.

Our climb to Camp Four took us beyond the routes of the bravest hunters. Cold has prevented the Bahinemos from venturing onto the upper shoulders of Mount Hunstein; they have no clothing for coping with nightly temperatures of 55°F. The small camp overlooked a valley of unbroken green; lower peaks occasionally shed their clouds.

Persistent drizzle here strengthens into rain at night, accounting for the thick mantle of moss worn by everything that doesn't



Hired for the 1989 expedition, Francis Malekai of Gahom village collects cuttings for botanists. Researchers spent four weeks gathering samples and discovered that at least 10 percent of Hunstein's plants may be new to science. They also found large stands of kauri pine, a tree prized by loggers.

move. Tiny crimson orchids clung to it. As if to make up for the lack of stars, constellations of bioluminescent fungi glowed on the trees. A cacophony of frogs solicited relentlessly for mates. Zoologist Allen Allison of the Bishop Museum told me he had already discovered five new frog species here and spent evenings recording their songs.

Focusing on birds—the most numerous vertebrates in the Hunstein—graduate students Debbie Wright and Andy Mack found several rare species, such as shovel-billed kingfishers, harpy eagles, and vulturine parrots. "Birds that seasonally migrate from one altitude to another may find all their ranges right here on this mountain," said Debbie.

After weeks of battling leeches ("but practically no mosquitoes!" one optimistic researcher noted in a report), the expedition gathered nearly 4,500 plant specimens—at least 10 percent of them new to science. It also collected 472 animal specimens representing 115 species.

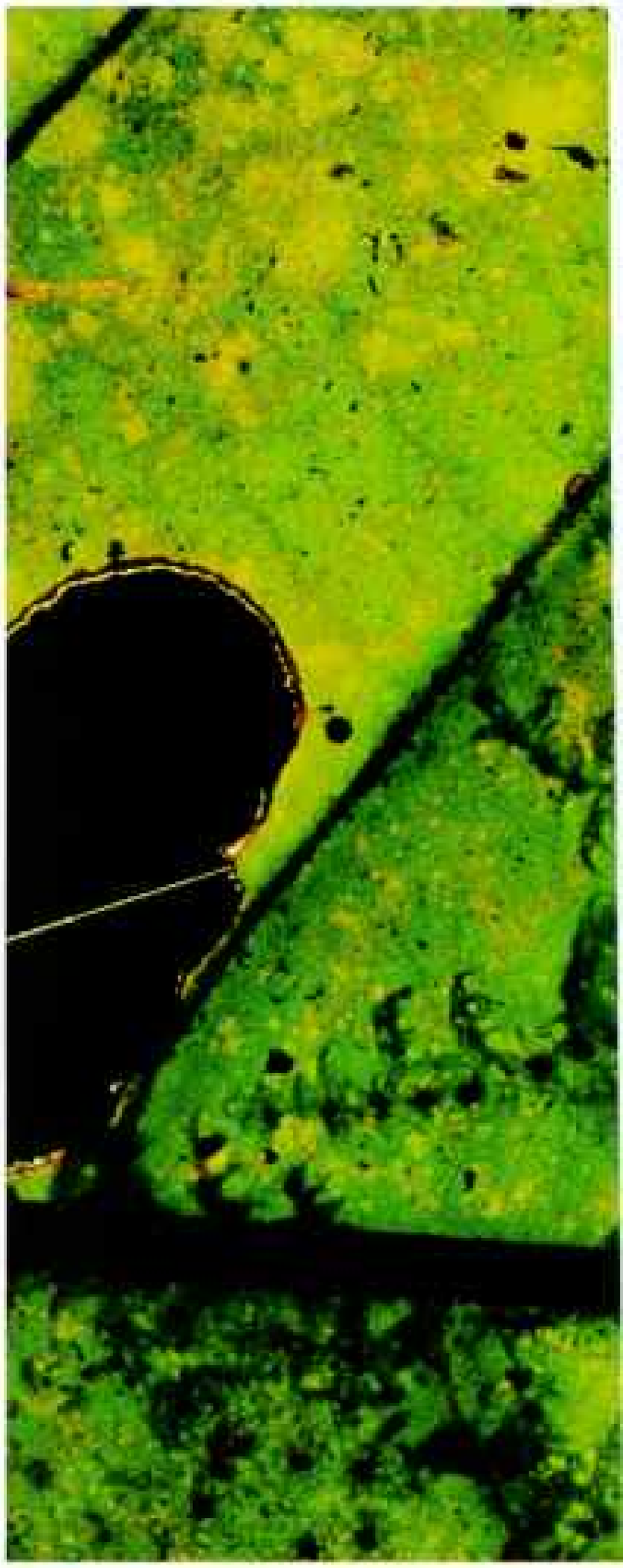
"Our findings seem to show that the Hunstein Range has many endemic plants and animals because it is isolated from other mountains by lowland alluvial forests and wetlands," said S. H. Sohmer. "If logging has to happen, perhaps at least Mount Hunstein itself could be put aside."

Few people have reached the top of Mount Hunstein. My family thought we did in 1978, but Ma Gogomo now corrected me. "We never had the heart to tell you the truth. Your guides told you it was the top because if you didn't stop then, you couldn't have returned to your camp before dark. It was so cloudy you didn't doubt them."

A Research Project Supported In Part By Your Society

On a later trip I pushed Ma Gogomo to find the summit with me. When I heard his joyful yodeling, I rushed to catch up. "San Edie, we're here. We have conquered the mountain."

I pointed out a mound higher than we were. Gogomo shook his head in fatherly exasperation: "You know what's wrong with you white people? You're never satisfied with getting on the forehead of a mountain—you think you have to get to the tip of the crown! You tell your boss that in our country it makes no difference whether something sits on your forehead or on your crown—it is still the top of your head. We've made it to the top; that spot over there is nothing. Let's go back. It will be a miracle if we get to camp by dark. And we have no flashlights."

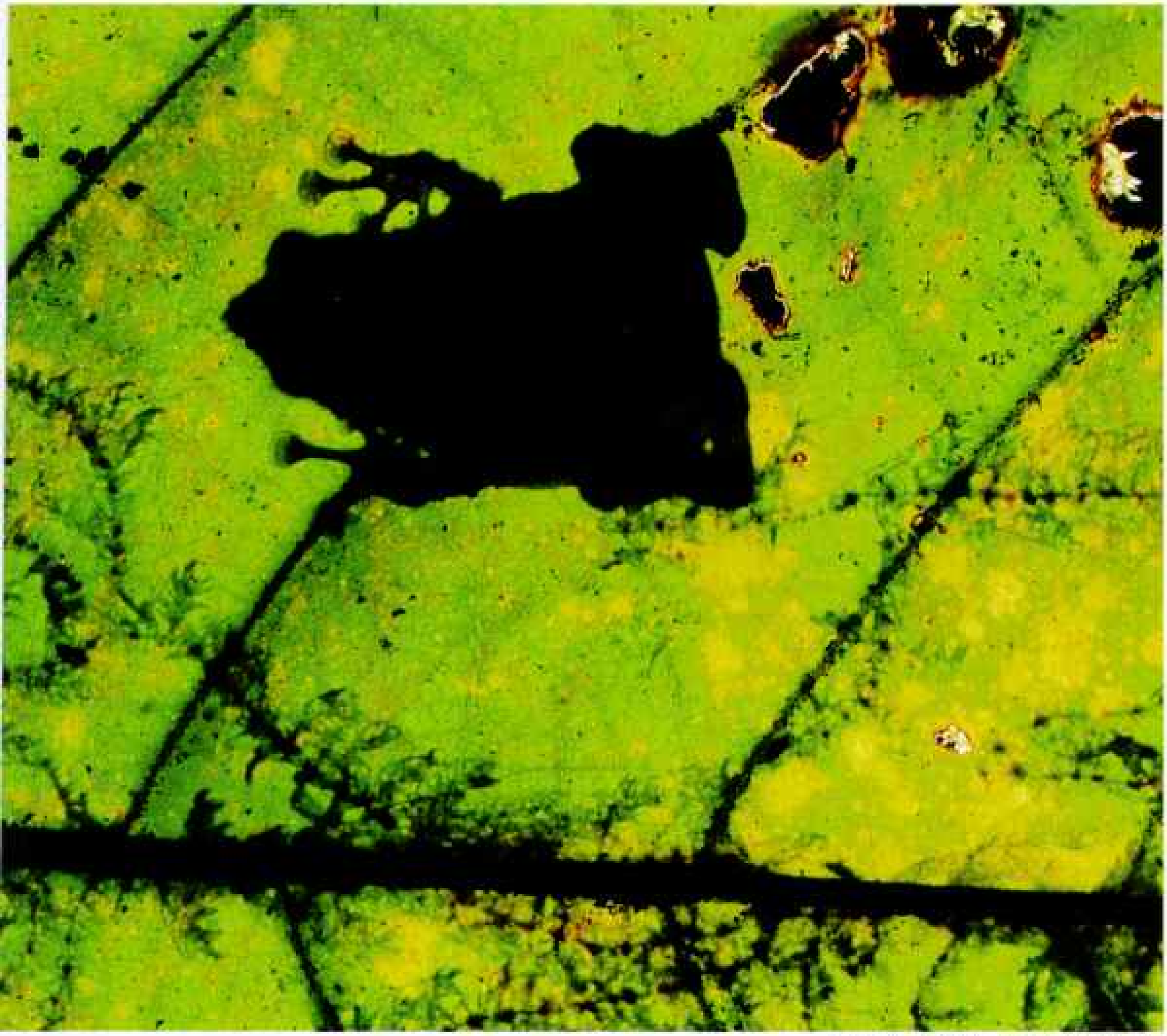


Startling shapes and brilliant colors lie like forgotten treasure beneath the forest canopy. Silhouetted on a leaf, an inch-long tree frog emerges at night near the top of Mount Hunstein. Combing for the fruits and flowers of plants, expedition botanists collected nearly 4,500 specimens, among them (left to right) members of the mistletoe, fungus, and nutmeg families.

WHEN GOGOMO QUESTIONS the thinking of "white people," he means Westerners of any color. He means someone who isn't thinking like a Bahinemo. Sadly cultural miscommunication has now clouded the fate of the Hunstein.

As I was leaving Wagu, the widow Moyali, whose clan land covers the area surveyed by the expedition, told me she was "determined not to sell to logging" now that she knew "it would destroy our forest." But subsequent events have swayed her.

With fresh ideas and the best of intentions, educators from the Wau Ecology Institute, members of the Australian Foundation for the Peoples of the South Pacific, and other conservation



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MYRISTICA HOLLRUNGII

groups such as Greenpeace, Friends of the Sepik, and the East Sepik Council of Women have been trying to help the Bahinemos find alternatives to mass logging that will bring the development so desperately desired.

They also want local owners to be paid more for their lumber. "Currently they'll make $40 for an average tree, which would sell for $2,750 on the international market," said American conservationist Glen Barry. "That's ridiculous. The price of tropical hardwood should reflect its scarcity."

Unfortunately when some conservation group members visited Wagu after my parents and I left, they dealt mainly with a resident government worker, an outsider, because he spoke English, and this insulted the village elders. Taking advantage of the muddle, forestry officials were again able to persuade Moyali and others to allow logging.

The conservationists have not surrendered. As an alternative to clear-cutting they are promoting portable sawmills. Local people can then selectively harvest trees and rotate the mills through the forest to allow regrowth. There is no need to cut a wide road and no damage from heavy machinery.

The village of Yigai has been using such a sawmill, but Moyali, for one, has not been impressed: "It looks like the forest is still being ruined, only for less money for us." Logging companies—who promise to "replant every tree"—would give her clan a larger bulk payment for clearing the land "only one time."

Could a logged Hunstein be regenerated? Renowned for his work in Papua New Guinea, German agriculturalist Reimund Kube told me: "If everything was done just right, if the foresters left the largest trees, built as few roads as possible, and replanted what they took out, in 30 years you might get a sort of artificial forest, if the soil was good. Otherwise you'd get grass and shrubs. But no matter how carefully it was exploited, certain species would be lost. The large birds would be the first to go.

"No one has ever replaced a rain forest," he said. "No one knows if full recuperation would take a hundred years or a thousand years."

THOUGH THE BAHINEMOS have abandoned some traditions they no longer consider important, I was reminded of how entwined they remain with the Hunstein by a story my father recently told me. He was traveling through the forest with a group from Wagu. In usual style two men went ahead to hunt. The others cleared the trail for the women and children, who, far behind, were carrying camping supplies and gathering food. One of the trailblazers noticed a speck of blood on a fallen leaf, then on another. He conferred with one of his companions, then turned the leaves over. When my father asked why, he said with a smile: "The men ahead must have speared a pig. We want it to be a surprise for the women that we will have fresh meat tonight."

The stability of the rain forest makes it difficult for the Bahinemos to envision the consequences of logging. Their physical world has not taught them to think in terms of cause and effect. If the Hunstein is destroyed, Bahinemo culture will die also. Not just their outer culture—what they eat, what they wear—but

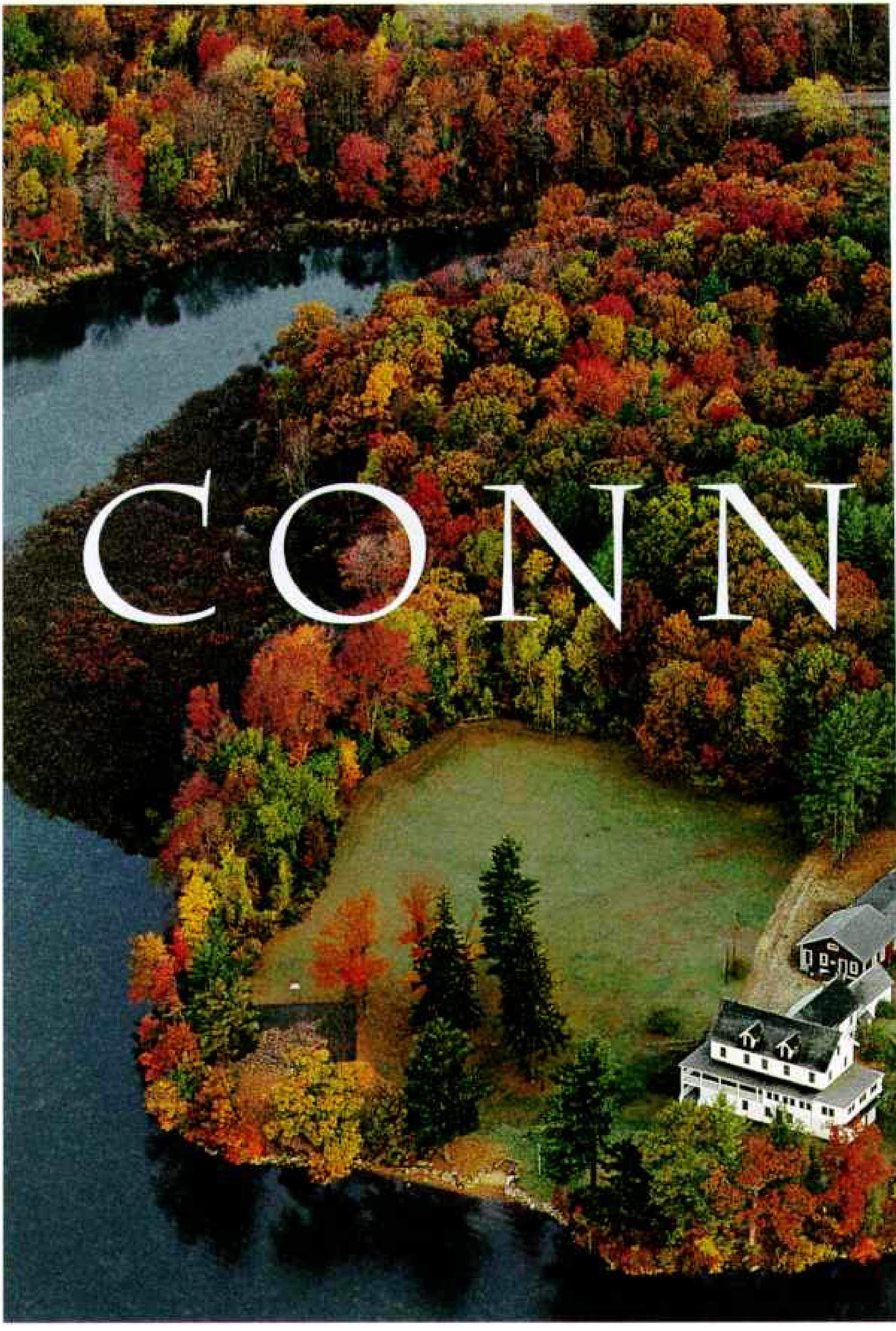
All eyes are on Sarah, the author's five-year-old, as she unpacks her American toys. Such windows on outside culture are rare. Now the prospect of tourists and timber companies has stirred the Bahinemos' interest—and sparked debate on how to manage these forces within their forest.

more devastatingly their inner culture. Who they are as a people, how they approach life, will lose its sustaining environment.

I still hear the old music pounding and sailing into the night and feel the mystery of legends whispered to my young ears about the origins of those songs. I still recall the dance of people who believed their ways were the only ways.

As things now stand, logging is still a serious threat to the Hunstein. How much will be cut is uncertain. But it can be hoped that enough of the forest will be saved so that Solomon and anyone who chooses to follow him can still walk the routes of the ancestors.

On our last trip to the crystal water hole at Gipa, he and I watched a side creek cascade from tiers of rocks into the river. Golden shafts of light broke through the canopy. He turned and said quietly, "It is beautiful, isn't it?" □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RICK RICKMAN (LEFT); JOEL SARTORE

Safe haven for those who need it most, Camp White (left) in western Connecticut, once a country inn, is now a camp for disadvantaged children from New York City. Roaming the shores of Bantam Lake, these children get a glimpse of an idyllic Connecticut, far removed from the troubles legislators confront beneath the capitol dome in Hartford (above) or citizens face in recession-weary towns like New London, where U. S. Coast Guard Academy cadets train on the bark Eagle *(below).*

Rich in tradition but beset by the problems of the '90s, Connecticut is looking for ways to reinvent itself.

By THOMAS B. ALLEN
Photographs by JOEL SARTORE and RICK RICKMAN

THE FIVE OF US, old friends, were on the deck of a beach house, watching a day end at the close of summer. The sea and sky of Long Island Sound flowed to a seamless horizon. A distant sailboat skimmed through darkening water. A big black dog and its small master ran by, splashing in the shallows. In the breezes of coming night we could feel the first chill touch of fall. This is the beach in Fairfield, and this is Connecticut.

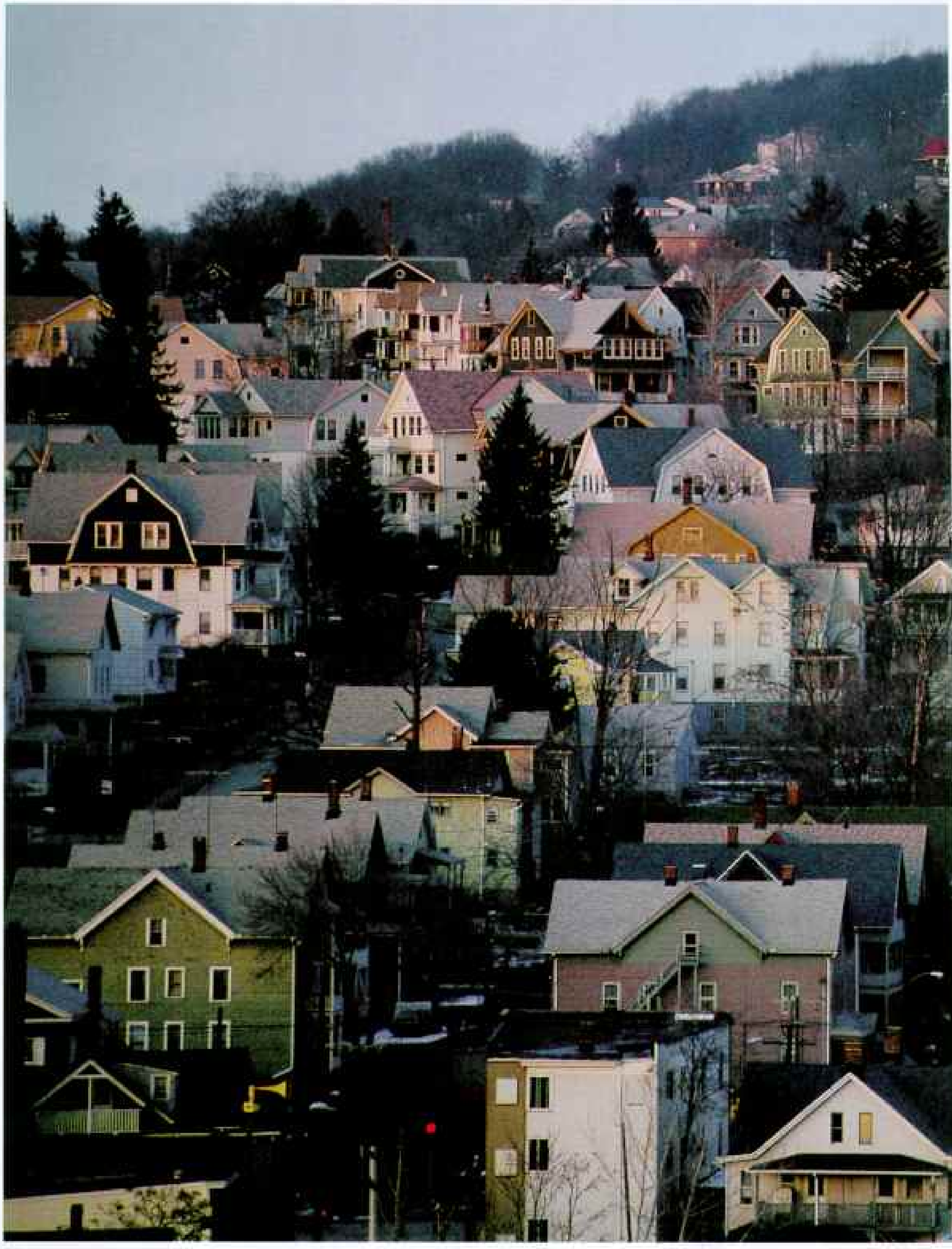
Less than an hour before, I had walked the beat between two policemen on one of their first days in a murderous, drug-drenched neighborhood. They operated out of a storefront, a former restaurant. Bullet holes pocked its steel shutters. Around us stood scarred old wooden tenements, flame-blackened vacant houses, piles of rubble. The cops call this neighborhood Beirut. This is the East Side of Bridgeport, and this too is Connecticut.

A police map marked the sites of recent murders. Three of them were on Pembroke Street, where I had lived as a boy. My home is a fire-gutted hulk. I knew it as a big, brown, three-story wooden house with 12 railroad flats, so called because the rooms were laid out end-to-end. Our flat—second-floor rear—overlooked a concrete courtyard big enough for a game of catch. The East Side was tough then, but if you got into a fight, the worst that could happen was a bloody nose, and even that was rare. Today East Side kids die in gunfights. Bridgeport's murder rate is more than four times the national average.

I have also lived in Fairfield. There is no murder map in the police headquarters there. They have their share of robberies, but more typical offenders of the peace *(Continued on page 72)*

On the manicured lawns of one of the state's wealthiest towns, connoisseurs of croquet meet each July for the Greenwich Invitational. "This is serious croquet," says a tournament organizer. "It's like putting plus chess."

RICK RICKMAN



"Brass City," Waterbury has been tarnished by scandal at City Hall and the demise of the brass industry, an employer here since 1802.

JOEL SARTORE

Now things are looking up, say civic leaders, who recently won 30 million dollars in aid from the state for downtown development.

are drunken college students making too much noise too late at night in rented beach cottages. A road from the beach leads to Fairfield's town green, complete with a gleaming white town hall and two steepled churches. For years the tourist maps issued by the state have exploited such scenes as "Classic Connecticut."

Reality is rewriting that slogan and transforming that image. Traveling around a Connecticut more contemporary than classic and talking to friends and relatives, I found a state reflecting the ills of a nation: troubled cities, deserted factories, homes ravaged by layoffs and crime. I also walked in Connecticut's beauty, through fields bordered with stone walls, those monuments to a hard land's grace.

I saw so many stone walls that I started rating them, awarding one stone for a plain gray jumble to five for a lichen-flecked masterpiece. Connecticut's stone walls, like its steepled towns, are there because they have always been there, not to win tributes from tourists.

One of those steepled towns is Guilford, on the shore of Long Island Sound. A few blocks from the town green I met Beverly Anderson, who took me back to her preferred time, the 17th and 18th centuries. She watched over New England's oldest stone house, a sternly elegant place that has stood since a company of Puritans founded Guilford in 1639. The house is a museum, but it seemed like a home that someone lived in. "I make the point to my young visitors, so interested in dinosaurs these days, that a house is different," she said. "It stays alive." Stowed in the garret is a steeple clock made by Ebenezer Parmelee in 1726. It ticked away until an electric clock replaced it in 1893.

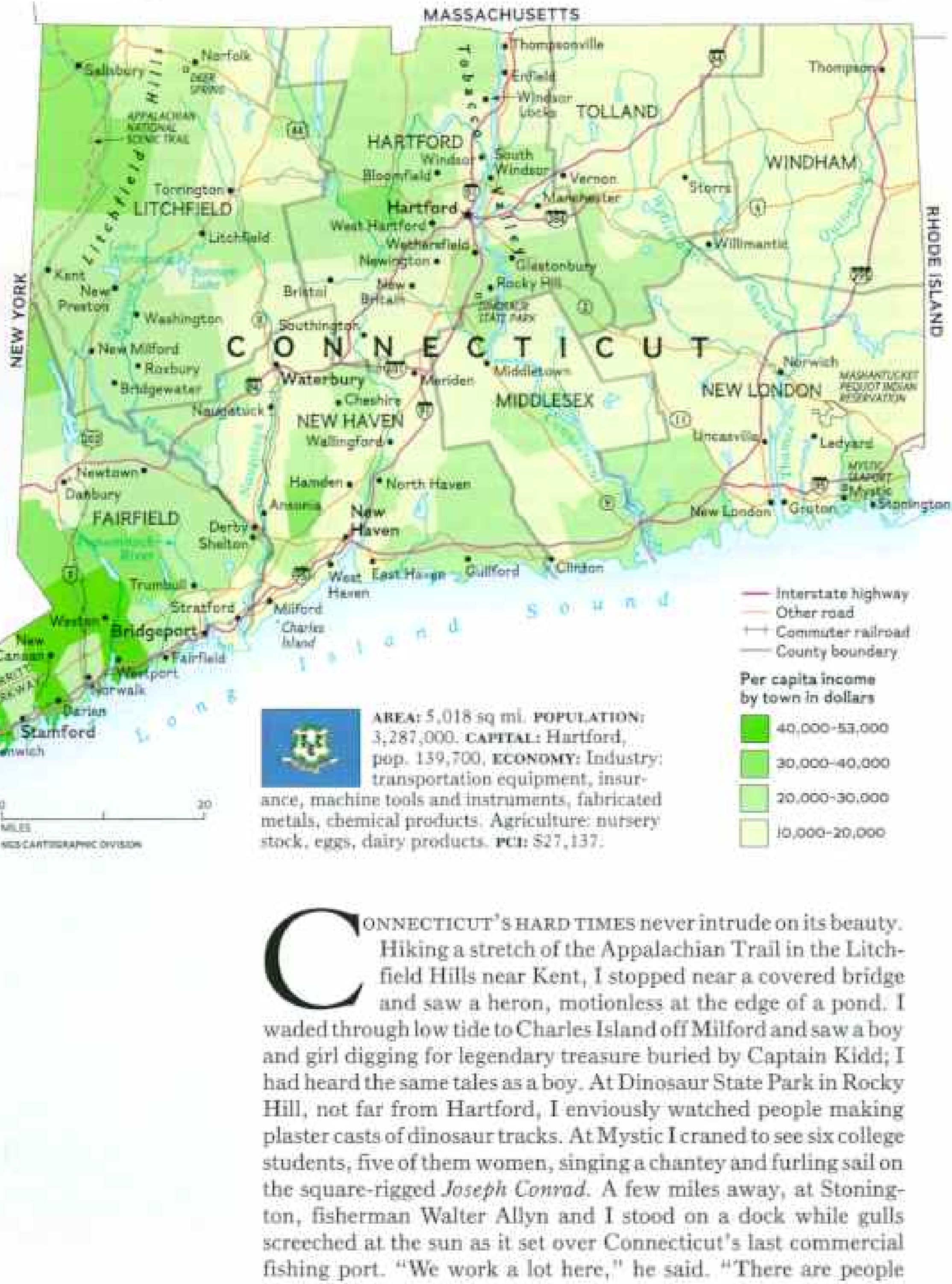
Guilford is a 20-minute drive from New Haven, where I had just met Winfred Rembert, Jr., a slim 16-year-old recovering from a stomach wound. Junior, as everyone calls him, was shot when he stepped in front of a gun that a boy was aiming at Junior's 14-year-old brother, Edgar. A neighborhood gang attacked Edgar because he and Junior had refused to sell drugs. "We knew what was right," Junior said. Edgar nodded. The brothers, their sister Lillian, and their mother and father had gathered around the dining-room table. "There are mothers who take that money," this mother said. "Mothers taking blood money."

RICK RICKMAN

Born again and again, the First Congregational Church in Litchfield was built in 1829, hauled to a new site in 1873, then converted to a theater, dance hall, basketball court, and roller-skating rink. Restored to its former station in 1929, the church now presides, with occasional face-lifts, over Litchfield's town green.

THOMAS B. ALLEN is the author of the Society's 1992 book on the Civil War, *The Blue and The Gray*. His last article for the magazine was "Pearl Harbor," in the December 1991 issue. JOEL SARTORE, a Geographic contract photographer for the past two years, illustrated "Federal Lands" in this issue. Pulitzer Prize winner RICK RICKMAN photographed "California: Desert in Disguise" for the 1993 Special Edition on Water.

Yankee ingenuity has long kept Connecticut busy and prosperous, as local industries supplied the nation with goods from clocks to nuclear submarines. Now economic hard times have chipped away at Connecticut's advantage: It still leads in per capita income but is one of the few states losing population.



AREA: 5,018 sq mi. **POPULATION:** 3,287,000. **CAPITAL:** Hartford, pop. 139,700. **ECONOMY:** Industry: transportation equipment, insurance, machine tools and instruments, fabricated metals, chemical products. Agriculture: nursery stock, eggs, dairy products. **PCI:** $27,137.

CONNECTICUT'S HARD TIMES never intrude on its beauty. Hiking a stretch of the Appalachian Trail in the Litchfield Hills near Kent, I stopped near a covered bridge and saw a heron, motionless at the edge of a pond. I waded through low tide to Charles Island off Milford and saw a boy and girl digging for legendary treasure buried by Captain Kidd; I had heard the same tales as a boy. At Dinosaur State Park in Rocky Hill, not far from Hartford, I enviously watched people making plaster casts of dinosaur tracks. At Mystic I craned to see six college students, five of them women, singing a chantey and furling sail on the square-rigged *Joseph Conrad*. A few miles away, at Stonington, fisherman Walter Allyn and I stood on a dock while gulls screeched at the sun as it set over Connecticut's last commercial fishing port. "We work a lot here," he said. "There are people

worrying about the fish. Well, we're the ones who are the endangered species."

Walter's hardworking state is only about a hundred miles east to west. On the same day you can easily drive from an art show in Greenwich, near the New York line, to a stock-car race in the town of Thompson, where the borders of Connecticut, Massachusetts, and Rhode Island meet.

But measured across the money gap, Greenwich and Thompson seem not to be in the same state. In Greenwich a house typically costs well over $500,000. An estate was selling for 14.5 million dollars when I was there. In Thompson, where a house costs around $120,000, the unemployment rate was 10.5 percent when Greenwich's was 3.4 percent.

Connecticut is politically divided into 169 communities, all called towns. The overwhelming majority of them consist of several villages and the surrounding countryside, and many trace their origins to the 17th century. Historically independent and self-sufficient, these towns are in Classic Connecticut. Most of the state's distress is jammed into a few cities—towns that have outgrown traditional government-by-selectmen and are led by a mayor or city manager.

So the Connecticut Conference of Municipalities, an association that lobbies state legislators on behalf of the cities and towns, usually finds itself speaking for two Connecticuts. One is the state of graceful living, the state whose per capita income of $27,137 is the highest in the nation. The other state has Bridgeport with its murders; New Haven, where the percentage of children with AIDS is the nation's highest; and Hartford, which is among the ten poorest cities of 100,000 or more people in the country.

Some of the places in Classic Connecticut are so sacred that even when one no longer exists it may stay on the map. My grandmother told me that her mother, as a young widow, had worked in a wool mill in Talcottville, about 12 miles northeast of Hartford. On a shiny Sunday morning I set out to find my great-grandmother's village. Talcottville was on the map but not on the roads I searched. I seemed always to be in Vernon, which the map put next to Talcottville. I had just about given up when a husband and wife out for a walk led me to a stone bearing a small plaque. It memorialized the two Talcott brothers who bought a textile mill here in 1856, built housing for workers, and named the place Talcottville. When the mill shut down in 1940, Talcottville began fading away to a name on a map, a plaque on a stone, and a family memory.

STRIP THE MAP of town and city boundaries and you find the geography that shaped Connecticut's varied character. Along the western shoreline are the rich commuter communities of the Gold Coast, linked to New York City by rail and highway. A swath of the state edged by the Pequonnock and Connecticut Rivers encloses Connecticut's major cities and much of its manufacturing base. In the northwest's Litchfield Hills are colonial towns that attract weekending New Yorkers. In the sparsely populated northeast, once a hub for mill towns and now known as the Quiet Corner, one of the roads is officially labeled scenic. The eastern shore blends old and new: the tourist port of Mystic, the nuclear submarine yard at Groton.

Cashing in on federal status, the Mashantucket Pequot Indians opened a casino on their tiny reservation, which is exempt from state gambling laws. The Foxwoods High Stakes Bingo & Casino earns more than a billion dollars a year from crowds that reach 24,000 on a peak day—though visitors hoping to discover true Indians among the waitresses may find it as hard as spotting real cowboys at the tables.

BOTH BY JOEL SARTORE

The Gold Coast's wealth comes from commuters who work in New York City and usually lead a hectic leisure life in Connecticut. Among the newest commuters are Japanese businessmen assigned to the New York offices of Japanese corporations. There are so many Japanese commuters that a Japanese school for the executives' children recently opened in Greenwich.

Kazuyuki Suzuki, a Mitsubishi executive, boards a train in Greenwich and arrives at Grand Central 48 minutes later. His commute to Tokyo took him about the same amount of time. But there's a difference. "Here I find a seat," he told me. "It's very comfortable, sitting, reading, sometimes taking a nap."

Suzuki does not join his train mates in the traditional high-speed morning bridge game. But he does partake of another Gold Coast commuting custom, the bar car. "When I go back to Greenwich, sometimes I have a beer," he says. "Good culture."

Among the commuters of the 1930s and '40s were entertainment impresarios and advertising image-makers. As weekend country squires, they conjured up an ideal Connecticut. It was put on screen in such movies of the 1940s as *Christmas in Connecticut* and *Mr. Blandings Builds His Dream House.*

A new image-builder in Mr. Blandings' Connecticut is Martha Stewart, who tells America how to live the good life. She was driving along the Merritt Parkway from her house in Westport to another of her properties when I caught up with her, via car phone.

I asked her why she had chosen Connecticut as her stage for portraying gracious living. "I have an affinity for the countryside," she said. "I like Westport for its proximity to New York City and Long Island Sound. And I like the real Connecticut, which is so rich in geography and history." Where is her real Connecticut? "It starts north of Greenwich," she said, "goes up to Litchfield, and down again to Weston and Westport."

ETHYLE POWER, a longtime friend, lives on a winding country road in Newtown, one of those towns on Martha Stewart's real-Connecticut stage. "It's true that there are towns around here that are like stage sets," Ethyle said. She invited my wife, Scottie, and me on a tour. We drove north, crossed the Housatonic River at New Milford, and headed into the Litchfield Hills. There are no expressways here. We followed narrow ridge roads or dipped down into valleys to find some of Ethyle's favorite places.

In Bridgewater two churches faced a narrow green, and old clapboard houses were tucked away in clusters of maple trees. Dozens of old farms here and in nearby towns have become weekend hideaways for wealthy New Yorkers and celebrities. "Your neighbors could be anybody—a retired schoolteacher or Arthur Miller," Ethyle said. Miller has lived in Roxbury for some 40 years and finally is not called "one of those New Yorkers."

We drove on to Washington. A few houses, then a green appeared around the bend of a road. A bride, groom, and an exaltation of followers burst out of a radiantly white church. They all drifted across the green, passing two painters who did not look up from their easels. At an inn beyond the town, we strolled gardens gracefully passing from summer into fall.

We peeked into other inns as we meandered northward,

Rush hour comes early to train platforms in Darien (right) and other southern Connecticut suburbs, where each weekday some 30,000 workers commute to jobs in New York City. Riding makes for a long day but has its rewards. "I love it," says a businessman from Westport. "At home, you can get me; at work, you can get me. On the train, no one can get me."

State capital Hartford is also the insurance capital of the nation: Industry giants with offices overlooking the Old State House (below) are asked to contribute ten dollars a year per window for the view, to preserve the building and its historic green, where the Connecticut colony was founded in 1636.

BOTH BY JOEL SARTORE

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sampling the fare and hospitality for future excursions. At Lake Waramaug, the jewel of two state parks, we ended the day. From the dining room of an inn we watched night coming to a hill of shadowy greens and reds and yellows. "Well," Ethyle said, "I think now you know why I live here."

Later in the fall, when frost glazed every morning and cold winds stroked the nights, Scottie and I explored the state's northwest edge, in the foothills of the Berkshires. Here New York, Massachusetts, and Connecticut touch, sharing a landscape of rumpled, stream-laced hills.

At our inn in Salisbury, cloth shrouds shielded front-porch flowers from overnight frost. Early one morning, back from a walk, I saw a young woman removing the shrouds. "Looks like they survived," I said. She looked up and said, "We do the best we can."

Her remark could well be the motto of the other Connecticut, the hard-luck cities. Broke and plagued by crime, they may not look like the state on the tourist brochures. But their tales of survival carry on a Connecticut tradition—a stubborn faith in knowing how to fix what's broken.

Bridgeport, hard hit by factory closings, once petitioned to have

itself declared bankrupt and even proposed the sale of its zoo and two parks to the state. While the park deal simmered, the state found another way to help. It decided to move one of its community colleges to a nearly vacant downtown shopping mall.

Bridgeport has been known as Park City since the days of P. T. Barnum, who served as mayor and benefactor and kept his circus there in wintertime. His bronze figure, the firm-jawed image of a staunch statesman, sat in a great bronze chair in 370-acre Seaside Park, which he created for the city. On the pedestal beneath him, four bronze plaques memorialized him.

But thieves had ripped the plaques from the pedestal, presumably to sell for scrap. Thieves also had scaled the onion domes of a Barnum-era building and stripped off the copper sheeting, exposing the wood beneath to rot, and swiped handrails from City Hall.

Hard-pressed police aim their scant resources at the city's worst

Letting off steam is the order of the day when cadets graduate from the U. S. Coast Guard Academy in New London. "Finishing the academy is the toughest thing I've ever done," says Peter Gassan, one of 191 cadets who graduated in 1992 after kicking up their heels with family and friends at Graduation Ball (above). "The academy

BOTH BY RICK RICKMAN

tests you by overloading your senses and making incredible demands on your time." What got him through, he says, was the support of his parents and his fiancée, Chelle (left, at center), now his wife. "I felt like handing her my commission," he laughs. "She earned it just as much as I did."

criminals, drug gangs. I walked down East Main Street with officers Jorge Reyes and Michael Sample, who stared down sullen young men and sent them skulking off. Reyes and Sample reminded me of marshals newly arrived in a tough town of the Old West. They stopped in every store and introduced themselves. In a check-cashing place a woman behind a plastic barrier held up a baseball bat. "Maybe I won't need this any more," she said. At a barbershop Mike tried out his Spanish, winning a smile from the barber and a friendly lesson from Jorge.

"There's a street market here for drugs," police captain Hector Torres told me. "The idea is to disrupt the market with our presence." When I checked a few weeks later, the idea seemed to be working. Banners fluttered along the front of a new grocery store that had just opened on East Main Street.

Although ideas are many, money is short. An old friend, a

BOTH BY JOEL SARTORE

Bridgeport lawyer, took me on a grim tour of banks that had closed their doors or lost their names in mergers. But, as always in this gritty city, people find glimmers of good news. He pointed to a couple of three-tier wooden houses in need of paint. "I've had closings on 40 houses in the past few months," he told me. "All Asians."

These are among Connecticut's newest immigrants, thousands of Laotians and Cambodians who got jobs from initially skeptical employers throughout the state. I watched a Laotian welder working on a truck in Stratford.

"I couldn't believe it when I first saw these little guys," the welder's boss said. "But one of them is worth two or three of much bigger guys I've hired and fired."

Like many of his people, James Prakuson, a Laotian leader, holds two jobs: 8:30 a.m. to 2:30 p.m. in a Bridgeport public school, teaching English and counseling Asian and Puerto Rican students; 3 p.m. to midnight at the Sikorsky helicopter plant in Stratford. He invited me to his home in a neighborhood of cul-de-sacs and ranch houses in the shore town of Milford, between Bridgeport and New Haven.

"Most Laotians are isolated," he told me. "But we find work." After a Sunday lunch of *or kai*—a gingery chicken stew—he took me shopping at a Laotian grocery store in an old Italian neighborhood of Bridgeport. Teenagers played cards and listened to Laotian tapes in a back room. He drove me next to a run-down waterfront street, near sagging buildings guarded by junkyard dogs. He pulled into a driveway and led me into a garage. Golden statues of Buddha gleamed in the soft light. From a house next door came two monks in saffron robes. We all sat or knelt on mats before the statues and offerings and garlands of artificial flowers. This is the temple where most local Laotians worship.

The younger monk, a public school teacher, had bruises on his

Caught in a cross fire over gun control, Shirley Antonelli (above) inspects Sporter rifles inching off the assembly line at Colt's Manufacturing Company in Hartford. State lawmakers, seeking to curb urban violence, recently banned sales of the Sporter, a semiautomatic firearm patterned on the M16 assault rifle.

The end of the Cold War has chilled the state's three-billion-dollar defense industry. Among the hardest hit contractors is General Dynamics' Electric Boat Division, whose Los Angeles-class attack sub (right) cruises into port at Groton.

face and his shaved head. "A robber, at my apartment," he said, sensing my question. I asked James whether anyone had ever broken into the temple, whose statues look far more valuable than P. T. Barnum's plaques. "No," he said. "I think that it is the spirit here that is on guard."

A SEARCH FOR JOBS has driven much of Connecticut's history. With limited natural resources, Connecticut Yankees made and sold whatever America needed: The alarm clocks that awoke the workers of an industrializing nation. The silks that enwrapped the flappers. The guns that won the West and two World Wars. The helicopters of Vietnam. The nuclear submarines and jet engines of the Cold War.

Well before the Cold War ended, however, Connecticut had been losing its hold on manufacturing. In the 1950s and '60s scores

Sub builders at Electric Boat, facing another round of pink slips, recall their cheers when the Berlin Wall came down in 1989. "Then it started to sink in," says their former co-worker Brian Stanley (right). "Our jobs were in danger." For Stanley the end came ten months later, when EB announced the first of some 4,400 layoffs.

of companies, seeking cheap labor and tax write-offs, moved their plants to the South or out of the country. As plastics replaced metals, the Connecticut brass industry collapsed, stilling mills from Waterbury to Bridgeport. Yet so strong was the industrial base that Connecticut continued to be a leading state in defense production. Pentagon contracts enriched workers and helped pay the taxes in cities and towns throughout the state.

One of the largest defense contractors is General Dynamics' Electric Boat Division in Groton, which launched the world's first nuclear submarine, the U.S.S. *Nautilus*, in 1954. EB kept on building nuclear submarines and enriching southeastern Connecticut. In 1989, for instance, defense spending brought in more than $9,000 for each man, woman, and child in and around Groton and accounted for nearly half of all jobs in the region. Much of the 2.4-billion-dollar cost of a Seawolf nuclear submarine reaches Connecticut. That one Navy contract, spread through the small state, was hefty enough to raise the per capita income overnight.

Then, as Brian Stanley remembered, "The Berlin Wall came tumbling down, and we knew it was the end." Brian, an engineer,

BOTH BY JOEL SARTORE

After two years of sending out résumés, Stanley adjusted to his role as a "domestic engineer" —doing laundry, cooking, and shuttling his kids to school activities. "My wife is working, so we're not suffering like a lot of people," he says. "And as a family we have so much quality time we don't know what to do with it."

had been building submarines at EB for ten years when, on October 1, 1990, "the company decided we've got a lot of people we don't need any more, and I got my notice." When I talked with Brian, about 13,000 people were working at EB; 1,500 of them would be gone within a year.

During the submarine boom of the Cold War, EB employed as many as 25,000 workers. "We invested billions of dollars and 45 years making U. S. nuclear submarines the best in the world," an EB official said, looking out his office window at the riverside submarine yard. I asked him whether EB could convert. He shook his head. "Sub work is different from anything else. It's about *stealth*. If you're making a valve or a switch, it needs exceptional quality, durability, silence. To keep that, you have to *build*. You can't mothball skill."

When Brian told me about his life as a 39-year-old man suddenly

without a job, he sounded as if he were talking about somebody else. "It's like death, really," he said. "You go through the stages. You know, the denial, the rejection, the bargaining, and finally the acceptance, and that's where I am now." He told of looking for work month after month and finally giving up. "And here I am. I don't need to be back in that rat race and be married to my job and not my family."

We were having sandwiches in the sparkling kitchen of his ranch-style home in Uncasville, about 15 minutes north of Groton. He had finished the laundry just before I arrived and would soon begin making chicken primavera for dinner.

"I've become resigned to the fact that EB was a life past and my life now is to be a house-husband first," he said. "I do all the cooking, most of the cleaning, most of the laundry, the grocery shopping. I chauffeur the kids."

Brian's wife, Debbie, is a second-grade teacher in a state where the average salary for teachers, $49,317, is the highest in the nation. "She's the bacon winner, and I enjoy what I'm doing," Brian says, proudly pointing out that their three children are all straight-A students. "We have quality time every night. Once in a while I work as a substitute teacher. I like it because it gets me out of the house. I do get bored sometimes, but I only watch one soap opera."

Brian's job is one of more than 190,000 jobs that the state has lost since 1989, not only in manufacturing but also in such stable old industries as insurance and banking. Connecticut was one of the few states in the nation to lose population in 1992, as unemployed men and women left in search of jobs. Many jobs will never be replaced, and new ones must be created. Connecticut, so proud of its inventive past, now must reinvent itself.

"WE'RE IN POST-INDUSTRIAL AMERICA," says Joseph J. McGee, state commissioner of economic development. "Our strategy is to reposition Connecticut as a manufacturing state." He ticked off the industries he expects will flourish in Connecticut's future: electronics, aerospace, biopharmaceuticals. "They all need skilled workers. But not huge workforces, primarily because of computers."

One of the places hailed as an example of the future is the Lego toy factory, which hums on a former Shaker farm in Enfield. I saw relatively few workers amid rows of computerized machines pouring out tiny plastic building blocks by the millions. Still, Lego is hiring workers, an extreme rarity in Connecticut. In a sunny room Francie Berger was transforming bins of Lego bricks into a huge castle. "I played with Lego toys as a kid," she said, "and that's what I do for a living." Berger invented her job by walking into the Lego factory with a degree in architecture and convincing the company that it needed a designer.

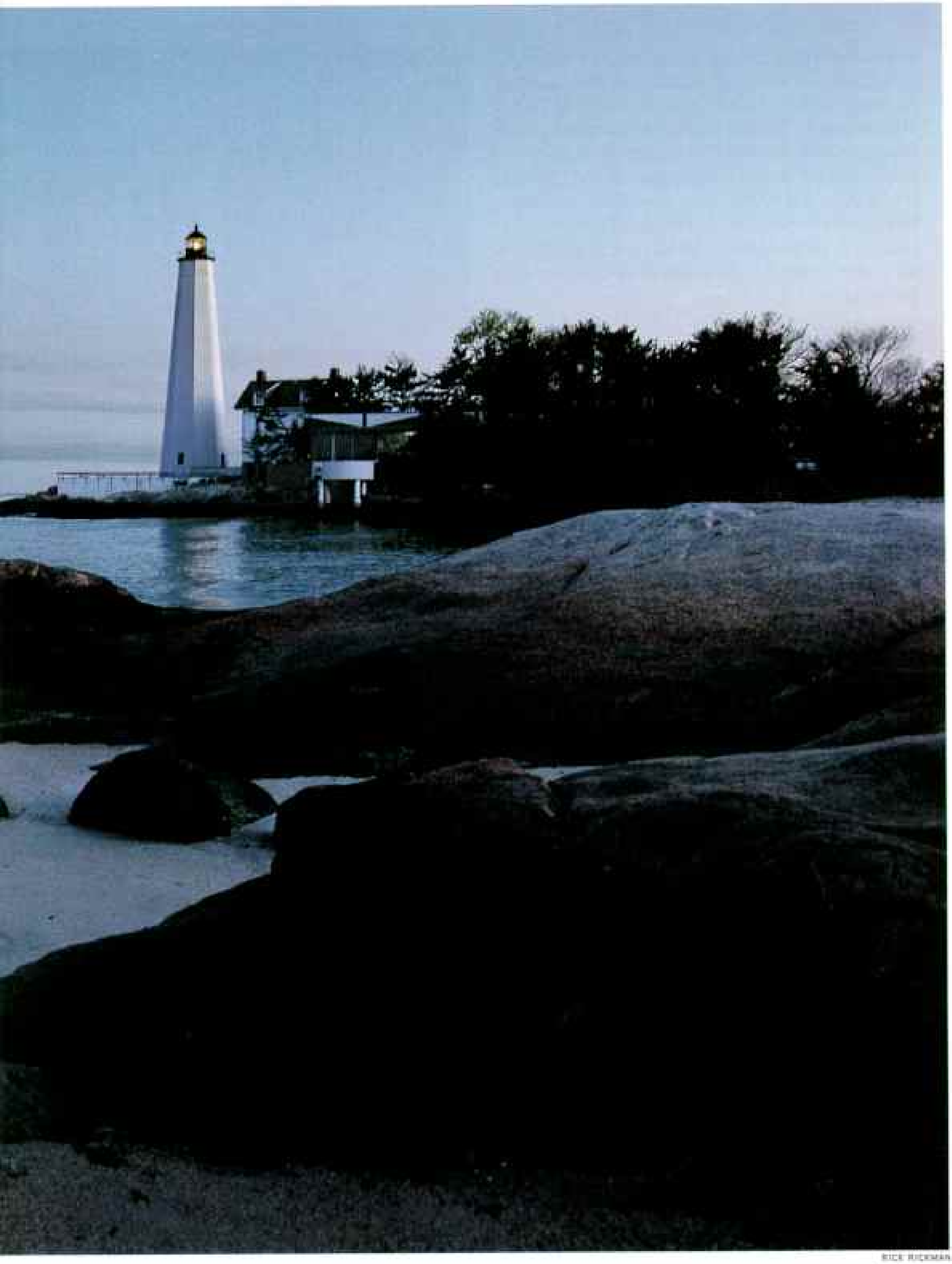
The Danish firm listens to its workers and rewards them with bonuses, a state-of-the-art day-care center, and a confidence in workers' decision-making on the production line. All this has increased productivity, inspired an expansion, and created a demand for more workers.

Pratt & Whitney, an old Connecticut firm, has been the state's largest private employer for more than four decades—and, lately, it is the largest dispenser of layoff notices. The jet-engine builder,

Drugs and guns haunt the streets of Bridgeport, a coastal city of 142,000 that in four decades has gone from a thriving factory town to a city besieged by crime and crack cocaine, with a murder rate more than four times the U. S. average. Most crimes occur on the city's East Side, where police prepare to search two youths (right) after reports of gunfire. Because of its proximity to Interstate 95 the East Side has become a drive-through drug market. "The average customer is a rich kid from the suburbs in his daddy's BMW," says patrolman Dave Reihl (bottom, at left), whose partner examines vials of crack cocaine dropped by a fleeing drug dealer. Most murders, he adds, are committed by dealers fighting over turf.

BOTH BY NICK RISEMAN

Guiding light since 1760, rebuilt in 1801, New London Harbor Light led Benedict Arnold to the mouth of the Thames River in



RICK RICKMAN

the early hours of September 6, 1781. By noon New London was ablaze—a lesson to townsfolk grown rich raiding British ships.

which is cutting back its Connecticut workforce by a third, has given up its long production lines for more manageable "business units" of 130 to 140 workers. At the Southington plant, unit manager Bob Triano compared his workers to employees of a small machine shop. "You're responsible for what you do here," he said. Workers hovered over machines guided by computers. To assure accountability, each part bears the computerized credentials of the person who worked on it.

IF CLASSIC MEANS a white, rural, Yankee Connecticut, then classic has not been the word for the state since the beginning of the 20th century. By 1910 seven of every ten state residents were either immigrants or the sons and daughters of immigrants. Another wave of newcomers came during World War II when African Americans moved north to work in defense plants. In the early 1950s Puerto Ricans began arriving in the Hartford area to plant and harvest the fields of Tobacco Valley, where shade-grown tobacco once flourished. Other immigrants from the Caribbean added to the state's multiracial workforce.

Town and city lines sharply separate races. Schools in Bridgeport, New Haven, Hartford, Stamford, Waterbury, and other urban areas have more than 80 percent of the state's minority students. And in the towns—in 136 of Connecticut's 166 school districts—more than 90 percent of the public school population is white.

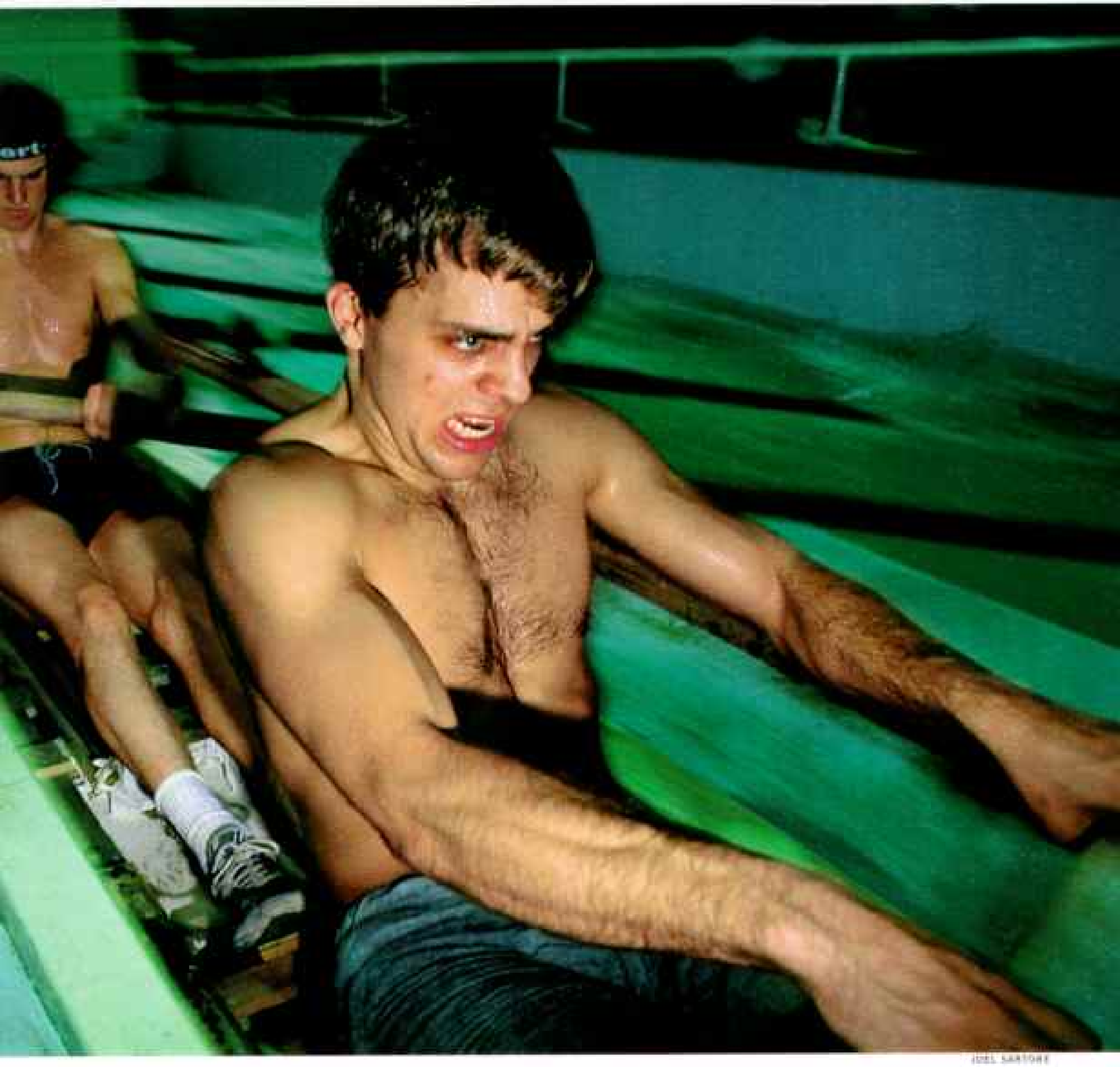
During the era of white flight from New Haven in the 1950s and '60s, many of the black families left behind were tenants of high-rise public-housing projects. Among them was a teenager, John C. Daniels. As his high school's Boy of the Year, he visited City Hall. "I'll be mayor someday," the boy confidently told the mayor.

After 14 years as an alderman and ten years as a state senator, John Daniels, New Haven's first black mayor, was in his second—and last—term when I called on him. We talked in his stark office in an old building, a City Hall that has been "temporary" since 1986. Money paces the restoration of the real City Hall, and New Haven has little money.

Both New Haven and Bridgeport are recycling old industrial sites in an effort to create jobs. On Bridgeport's East Side, an abandoned arms factory has been turned into International Enterprise Park, where entrepreneurs use tax incentives to lure international trading firms. New Haven has Science Park, an emerging center for biotechnology on a former factory site. Daniels hoped that the park would recruit workers from the needy neighborhood around it.

Hope was what kept Daniels going. I tagged along when he

Rowing an indoor river, Yale University's crew teams train through the New Haven winter, thanks to the three turbine-driven tanks installed in Payne Whitney Gymnasium in the early 1930s. "Much more enjoyable than a rowing machine," says coach Dave Vogel. "The water reminds you why you're there."



JOEL SARTORE

dropped by Wilbur Cross High School to mark the rehabilitation of the library. Students, parents, and teachers told how they had got together to do the work. The last speaker was Victorine Shepard of the Parent Teacher Student Association.

"New Haven is a paradox," she told her audience. "It is one of the poorest cities in the United States. It is in the wealthiest state in the Union. It has a high school dropout rate of over 40 percent. . . ." She continued reciting the dreary statistics Daniels heard so often.

"People are running away from our cities and public education in alarming numbers," she said.

Daniels looked grim. Shepard turned to the white, black, Hispanic, and Asian faces of the students before her. "The good news—is you. You are the reason we are here." Daniels grinned. He did not hear about good news very often.

THE NEWEST successful enterprise in Connecticut is not a factory, though it has already lured hundreds of laid-off EB workers and is already a major employer. It is the Foxwoods High Stakes Bingo & Casino, a few miles north of Mystic. On a typical summer day about 3,000 people pay to visit Mystic Seaport, and 5,000 view the marine life at the Mystic aquarium. On that same day more than 20,000 people will be in the casino, which is run by some of the state's oldest inhabitants, the Mashantucket Pequot Indians.

The Pequots were all but wiped out by English settlers in the 17th century. Colonists forced the survivors, known as Mashantucket Pequots, onto a reservation. By the 1970s the tribe was down to a few members living in shacks and trailers. Leaders, fearing the end of the tribe, sought and won federal status—and the right to run bingo games with cash prizes. State laws prohibited

Practically painless: Young ladies and gentlemen acquire social graces step-by-step in the Barclay Classes at Round Hill Community House in Greenwich (above). "Dancing is a vehicle for teaching the gentle art of civilized behavior," says Barclay president Lois Thomson.

Looking back over her four

years at Choate Rosemary Hall, graduating senior Aisha Cook (right) credits Prep for Prep, a program for gifted inner-city students that led to her admission. The exclusive school took some getting used to: "It was definitely a shock to go from the Bronx to Wallingford, Connecticut."

casino gambling, except for "Las Vegas nights" run by charitable and religious groups, which awarded non-cash prizes. Using Las Vegas nights as a wedge, the tribe fought the state in federal court, successfully arguing for the right to run a casino.

John Holder, a tribe member who is associate marketing director of the casino, picks up the legal saga. "The state appealed," he said, "and the Supreme Court rejected the appeal. Then the state tried to repeal the law approving Las Vegas nights. The legislature voted that down. The score was Indians 84, State 62."

Slot machines bring in more than a million dollars a day; roulette, blackjack, poker, and baccarat take in even more. The income has bought the reservation a community center, a child-development center, and new houses. The 280 members of the tribe now have no worries about college tuitions or health insurance.

Foxwoods, with 8,200 people on its payroll, now rivals Electric Boat as a major employer in southeastern Connecticut. Bridgeport and Hartford politicians, eager for such gambling profits, pressed the state legislature to make casino gambling legal. Instead the state and the tribe made a deal: The Indians get the exclusive right to run slot machines, and Connecticut gets 25 percent of the profits

JOEL SARTORE (LEFT); RICK RICKMAN

on the machines—a cut that totaled 113 million dollars last year. The money goes to a special fund earmarked mostly for cities. If any other casino opens, the cities stop getting the Indians' money.

Governor Lowell P. Weicker, Jr., who had fought the Indians' casino, saw the deal as a way to confine gambling and preserve Connecticut's image as a state where people make their money by working, not by gambling. He would much rather talk about his state's manufacturing future.

The governor was in shirtsleeves when we met in his office in the capitol. He began his sketch of the new Connecticut with the Naugatuck Valley. For 150 years this was Brass Valley, where an early 19th-century brass-button industry evolved into the nation's major brass producer. Then, in the 1950s, the mills began closing. "You'd see one empty factory site after another," Weicker remembers. "Ten years ago I would have said

the valley is something of the past. Now it is coming back."

But gone forever, Weicker believes, are the Brass Valley plants that employed 7,000 or 8,000 people. "You are going to have factories that employ between 75 and 175 people," he said. "The valley has a skilled workforce in it, and it has a work ethic. There's going to be a different valley but one still engaged in manufacturing—small plants, high-tech." That is what he sees for all the traditional manufacturing areas of the state: small, efficient plants with "robotics and a handful of people."

Companies dependent on defense contracts need to change their products and their manufacturing techniques, Weicker says. Connecticut is helping make that happen by financing promising projects that turn Pentagon products into civilian goods. The state, for example, invested three million dollars in the K-Max, a civilian helicopter being built by Kaman Aerospace, a Bloomfield firm that

JOEL SARTORE

Fresh faces against the greenhouse wall, schoolgirls delight in new blooms at Deer Spring, a Hutterite community devoted to old-world simplicity. Yet Deer Spring is no museum; its factory, which does a booming business in toys and furniture, now has computers. Like their Connecticut neighbors, the Hutterites show lots of ingenuity—and live in times that require it.

produces helicopters for the Navy. The state's money speeded up work on the aerial truck, whose jobs will include logging, heavy construction, and fire fighting.

Engines for the K-Max will be built at the Textron Lycoming plant in Stratford, which has been laying off employees because of cutbacks in contracts for Army helicopter and tank engines.

Another three million dollars went to Pratt & Whitney to help produce a turbine engine for generating electricity. The state gets a royalty on all successful products it helps develop.

"It's not just a money-lending operation," Weicker said. "It's a remolding of the whole manufacturing process in the state, in terms of its plants and equipment and direction."

Governor Weicker, a former U. S. senator, fought a mighty battle to get a state income tax. He's from Greenwich, and he knows about the two Connecticuts. To help cities, he founded a program he calls Urbank.

"The state will play banker," he explained. "If the banks want to go with us, fine. If they don't, we're going to make money available. There are people in the cities who want to be there, and they don't have the money to grow. I happen to believe that you achieve success through economics."

The governor's office is in a gloriously ornate, golden-domed capitol bristling with pyramid-topped towers, porches, gables, and turrets. The great stone pile rises at the edge of a vast lawn that flows into Bushnell Park, an arboretum of century-old trees and spindly young ones.

Just beyond is Hartford's skyline. Buildings of golden glass and shining granite proclaim a bustling commercial city. The venerable Travelers Tower marks the insurance capital of the nation. Next door stands the Wadsworth Atheneum, one of America's oldest public art museums and a symbol of the city's cultural grandeur.

The governor can look out one window and see the splendor of Hartford, the capital. Lately, he has been looking out another window and seeing Hartford's mean streets, the streets of the Connecticut that is not in the brochures.

A few weeks after we talked, Weicker—who will not seek a second term—opened a permanent governor's office in Bridgeport. His successor will likely have no more money for the city than it gets now. "But what the governor does have is power," he said. "If that power is located here, things are going to happen here."

He gave Bridgeport some hope, which on Pembroke Street during other dark days was about all the city had. My mother kept saying that someday our ship would come in, and when we went to Seaside Park, I would watch for a ship just beyond the horizon. The horizon is still there, and the hope. □

SEA TURTLES

IN A RACE FOR SURVIVAL

By Anne and Jack Rudloe

Photographs by Bill Curtsinger

EXPOSED AND WARY, A WILD GREEN SEA TURTLE HAUNTS A CARIBBEAN SHOAL. ONCE ABUNDANT, ALL EIGHT SPECIES OF SEA TURTLES ARE NOW THREATENED OR ENDANGERED, PUSHED TOWARD EXTINCTION BY THE HUNTING, DEVELOPMENT, AND INDIFFERENCE OF HUMANKIND.

Emerging at dawn on a remote beach in western Costa Rica, two-inch olive ridley hatchlings begin a dash to the sea—against dismal odds. Attacked in their nests by fungi and fly larvae, eaten ashore by birds, crabs, and small mammals, and caught at sea by groupers, sharks, and fishnets, sea turtles have less than a one percent chance of living to maturity. None from this nest even made it to the water.

TURTLES POURED OUT of the surf in wave after wave through the darkness. Heaving, huffing, gasping turtles plowed the coarse black sand with their noses, laboring onto shore. On this rain-soaked October night possibly 30,000 olive ridley sea turtles were converging on a half mile of Pacific beach at Ostional, Costa Rica, in a biological extravaganza called *la arribada*—the arrival.

Following instincts that scientists have not begun to understand, the turtles had gathered offshore for mating, and now hordes of females were swimming to this particular beach to lay eggs. By 2 a.m. the beach looked like a cobblestone street where the cobblestones had come to life. And still more turtles were coming. All night they advanced and retreated. They collided and piled up in jams. They filled the air with the soft sound of flippers hollowing nests in the sand and a rhythmic *thump thump thump* as turtles that had finished laying rocked their 80-pound bodies to pack sand over their eggs. The turtles wheezed and shed tears, bathing their eyes from the flying grit they kicked up.

It was dawn when stragglers plowed the last trails back to sea. Thousands of other females still laden with eggs were swimming beyond the breakers, waiting for next evening's high tide when they would begin the assault anew.

All sea turtles come to shore to lay eggs, but for most it is a relatively solitary affair. Only the olive ridley and its Atlantic cousin, Kemp's ridley, stage arribadas. Watching those legions of olive ridleys break from the night surf, it was hard to remember that sea turtles are in serious trouble.

All eight species are endangered or threatened. They are killed for meat and leather;

Previous GEOGRAPHIC contributions by ANNE and JACK RUDLOE include articles on the Atchafalaya swamp in September 1979 and horseshoe crabs in April 1981. BILL CURTSINGER's photographs appear frequently in the magazine, most recently in "Bikini's Nuclear Graveyard," in June 1992.

In a bed of gorgonian coral off Florida's east coast, a gravid loggerhead awaits nightfall. After dark she'll lumber ashore, excavate a nest, drop and bury about 110 glistening eggs, then retreat to the waves. Prime nesting ground, Florida receives some 16,000 loggerheads a year. Each nests about four times during the April to October season, then migrates hundreds of miles to feed.

their eggs are taken for food and aphrodisiacs. Their nesting sites go for development. They are ground up by dredges, run over by pleasure boats, poisoned by pollution, strangled by trash, and drowned by fishline and net.

And we hardly know them. It was only in 1954 that the father of sea turtle research, a visionary herpetologist, the late Archie Carr, set up camp on the beach at Tortuguero, Costa Rica, the largest green turtle rookery in the Caribbean. Green turtle populations had plummeted, and Carr wanted to learn how to protect them. Today one man on a beach has grown into an international army of biologists and volunteers trying to understand the ways of sea turtles and save them from extinction.

We joined those ranks in the early 1960s. Through our business—collecting live marine specimens such as squid and sea urchins in the northern Gulf of Mexico for university studies—we had become fascinated by encounters with sea turtles. Hearing of the work of Archie Carr, who was then at the University of Florida, we went to him for information. "They're a mystery," he told us, "but you can help," and he recruited us to tag Gulf turtles for migration studies. We have been following these elusive creatures all the years since.

Despite the explosion of sea turtle research, scientists are frustrated. "I don't know any branch of science where we have applied so much effort and learned so little," said Richard Byles of the U. S. Fish and Wildlife Service. "We don't know where each species grows to maturity, or how long it takes them to grow up, or what the survival rates are."

But there are signs of progress. New conservation programs aim to help turtles by also helping the people who depend on turtles for food and income. New technologies of DNA mapping and satellite tracking are beginning to answer questions about behavior and migration. "This is almost a golden age of sea turtle research," said Alan Bolten, a biologist with the University of Florida.

Though the U. S. and 115 other countries have banned import or export of sea turtle products, the pressures on sea turtles are not abating. We could be at the turning point of saving these ancient beasts—or of losing them.

SO PONDEROUS ON LAND, sea turtles swim with grace and speed in the waters off every continent except Antarctica. All begin life as tiny hatchlings dashing for the surf. Those that are not eaten by swooping birds and marine predators seem to spend at least a year drifting on the high seas, eating pelagic crustaceans, jellyfish, algae, and insects blown from shore. As juveniles, each species takes up its own niche in the environment.

The olive ridley continues to ply the high seas in the tropics of the Pacific, Atlantic, and Indian Oceans. The Kemp's ridley takes to the shallows of the Gulf of Mexico and North American Atlantic. The behemoth leatherback adapts to both Arctic and tropical waters while making the longest seasonal migration of any sea turtle. The loggerhead populates the world's subtropics, and coral reefs attract the hawksbill. The green turtle grazes sea grasses in the tropics. The east Pacific black turtle, perhaps a subspecies of the green, ranges from Baja California to the Galápagos. Only the Australian flatback is not found in the Western Hemisphere, where we chose to focus our research for this article.

Based on the number of females nesting annually—the best way to estimate the size of sea turtle populations—the olive ridley is the most abundant. *Lepidochelys olivacea* is also one of the smallest, with a shell length of 30 inches or less. Seabirds perch on its back as it rides the waves, feeding on crustaceans hundreds of miles from shore.

But the ridleys' mass-nesting pattern makes them vulnerable. Mexico alone slaughtered nearly 75,000 annually, mainly for their leather, until the killing was banned by a presidential decree in 1990. Now the greatest threat to their survival seems to be the overharvesting of eggs.

Latin Americans prize sea turtle eggs as an aphrodisiac and energizing protein. Soft and as round as Ping-Pong balls, the eggs are sold as raw snacks in bars. It's hard to be angry at the egg collectors, called *hueveros*. Most have no other way to make so much money.

Costa Rica outlawed the taking of eggs in 1966, but harvesting remains widespread.

Gripping tightly during copulation—which can last for hours—a male black turtle off western Mexico hangs on even as the camera-shy female dives to 120 feet. Most males live entirely at sea, nearing shore only to mate.

Green turtle
Chelonia mydas
49 inches

Male

Female

Leatherback
Dermochelys coriacea
74 inches

Black turtle
Chelonia agassizi
39 inches

Olive ridley
Lepidochelys olivacea
30 inches

Ancient mariners

Sea turtles have roamed the oceans for at least 150 million years. Foraging for jellyfish, sponges, grasses, or crabs in all but the coldest waters, they nest on scattered tropical and

Green turtle | Black turtle | Leatherback | Olive ridley

Hawksbill
Eretmochelys imbricata
33 inches

Australian flatback
Natator depressus
39 inches

Kemp's ridley
Lepidochelys kempii
30 inches

Loggerhead
Caretta caretta
47 inches

MEASUREMENTS ARE MAXIMUM CARAPACE LENGTH

Kemp's ridley **Hawksbill** **Australian flatback** **Loggerhead**

temperate shores. Males are most easily distinguished by long tails (top left), which help grasp the females during mating. Biologists are still trying to learn where hatchlings (left) grow up, when they mature, and how they navigate. One certainty: All species are at risk.

PAINTING BY KRALIST KRALICH

Poaching eggs from a placid leatherback, a Costa Rican villager is one of legions who illegally take turtle eggs in Latin America; eggs can fetch two dollars a dozen. Believed to enhance the libido, raw turtle eggs are hot in bars. "They make you stronger," says Victor Cascante (left), who drinks eggs spiced with salsa to mask the taste.

The one exception to the ban is part of a bold conservation program: The villagers of Ostional are allowed to gather eggs laid during the first two nights of each arribada.

The morning after we watched that mass nesting, a rainbow arched overhead as a hundred villagers hiked onto the beach. The men jabbed their heels down in a sort of two-step dance. When they felt a soft spot in the sand, they marked the depression with a stick so the women would know where to dig.

"Everyone gathers eggs," said Gerardo Ordoñez, a leader of the Ostional Development Association. "Anyone in the village who doesn't work is suspended from the association and doesn't get a share of the proceeds."

The hueveros share about half their $95,000 annual revenues with the government and the Ostional turtle station, which is staffed by biologists from the University of Costa Rica. When the scientists first arrived, the villagers beat them. Now the legal egg harvest has brought Ostional a new school, a new clinic, and a new appreciation of the turtles.

In one nesting season 20 to 30 million eggs might be laid at Ostional. Even without human interference only 4 to 8 percent will hatch. Nests are so concentrated that females often destroy previous nests as they dig. Coyotes root for the eggs, and fungi also take a toll. Biologists calculated that a controlled harvest of three million eggs here would leave enough protected eggs to rejuvenate the population.

"And this project has the potential to stop the poaching of eggs on other beaches," explained turtle scholar Peter Pritchard. "It's a matter of economics. Poachers sell green and leatherback eggs for 25 colones [17 cents]. If legal Ostional eggs can get to market in good shape and sell for only 5 colones, this project can corner the market and relieve the pressure on other species."

After the harvest we drove a hundred bumpy miles to the capital, San José, where we went into cantinas with a licensed egg distributor. In one crowded saloon the bartender spiced an egg with hot sauce as a cocktail. "Aren't turtles endangered?" a local man demanded. These were legal Ostional eggs, the distributor explained. "Then you should have a brochure," the man said. "If someone brings the bartender eggs and they aren't from Ostional, he can report them to the police."

Suddenly we felt encouraged. If the plight of sea turtles was being discussed in bars, then the conservation ethic really was getting out.

IN THE GULF OF MEXICO the nesting grounds of Kemp's ridley were a mystery to scientists until 1961. Then a film taken by a Mexican engineer in 1947 surfaced. It captured an arribada of perhaps 40,000 *Lepidochelys kempii* striking the broad beach at Rancho Nuevo, about a

hundred miles south of the Texas border.

Those numbers have not been seen since. Kemp's ridley is now the most endangered sea turtle, decimated by egg harvesting, especially for the aphrodisiac market in Mexico City, and by accidental drowning in commercial fishing nets. In 1992 fewer than 500 females—nesting two or three times in their April to June arribada season—laid 1,242 clutches.

As Florida Gulf Coast residents, we have been especially watchful for this turtle, named in 1880 for Richard Kemp, a fisherman who shipped specimens from Key West to Harvard. In 30 years of tagging turtles we've met only 200 of them.

When that enormous arribada was filmed in 1947, perhaps 5,000 U. S. shrimping trawlers worked the Gulf of Mexico. There were 15,000 full-time and 40,000 part-time trawlers in 1989, when offshore shrimpers were required by federal law to fit their sock-shaped nets with turtle excluder devices (TEDs). A TED is a small net or metal grid inside the net that is supposed to allow shrimp to pass to the back while ejecting turtles (pages 112-113). Convinced that shrimp would escape too, shrimpers blockaded Texas and Louisiana ports in protest.

"It's taken some serious enforcement efforts, but compliance has improved. It's now more than 90 percent," said Chuck Oravetz of the National Marine Fisheries Service (NMFS). "Be it reluctantly, TEDs have increasingly been accepted as a way of life—and the shrimp industry has not crashed."

The number of nesters at Rancho Nuevo is slowly rising. Since 1978 Mexican and U. S. scientists have transferred the eggs to a local hatchery, so most of the hatchlings—30,000 to 80,000 a year—survive to enter the sea. When they might reach breeding age and return to nest is unknown. Biologists speculate that sea turtles take from 10 to 50 years to mature and reproduce. Statistics are hard to come by because no flipper tag will stay on a one-ounce hatchling that grows into a hundred-pound-plus adult.

For 15 years, 2,000 Rancho Nuevo eggs or hatchlings were flown annually to labs in Texas, to be raised in captivity for ten months until they were at least six inches long, to give them an edge in survival. These turtles were tagged, and some were fitted with internal magnetic tags that may last longer. None with tags intact have yet returned to nest, but they're

out there. Six of the 33 Kemp's ridleys we caught in 1991 in our weekly netting and tagging efforts waved silver Texas tags.

The Texas experiment ended last year. "It's expensive, and it doesn't solve the problem of why the turtles are disappearing," said Earl Possardt of the U. S. Fish and Wildlife Service. The anti-TED lobby has argued that the government should raise more captive ridleys to boost the population. "But how can you bring things back to what they were," said Possardt, "if you haven't removed the threats that have gotten them where they are?"

Unlike the olive ridley, Kemp's ridleys live in the coastal shallows, staying in depths of 150 feet or less. Many of the young are carried by currents up the Atlantic coast; some eventually reach New England.

"We've radiotracked 32 juveniles in Long

Relying on sea legs and sweat, Miskito Indians haul aboard a 250-plus-pound green turtle 30 miles off Nicaragua. Turtle meat is shared with other villagers, and surplus is sold in Puerto Cabezas markets (left). This fishery appears not to diminish the species.

Island Sound since 1986," said Steve Morreale of Cornell University. "The Northeast coast seems to be one of the places where young ridleys quit feeding on open ocean plankton. They have to learn how to forage along the bottom somewhere; we think these are learning grounds."

Kemp's ridleys seen in the north were once thought to be strays. The increase in sea turtle research shows them to be regular visitors, part of a great seasonal migration that takes Kemp's ridleys, loggerheads, greens, and leatherbacks up and down the Atlantic coast.

It's a gantlet. The dredges that maintain shipping channels crush them. Trawling nets still drown thousands a year. Recreational sportfishing and boating kill too: Turtles are mangled by propellers and get tangled in discarded monofilament line and drown.

ON A HOT JULY 4 last year, 75-year-old Joseph Mohr motored out to check for crabs in Jones Creek, which flows into the southern Chesapeake Bay on Maryland's Eastern Shore. "I saw something bobbing—I thought it was a body. Then it raised its head; it was as big as mine."

A leatherback sea turtle—five feet long and some 700 pounds—had wrapped 25 feet of crab-pot line a dozen times around each front flipper and tightly around its neck.

Mohr had never seen such a turtle. Instead of a shell it wore seven keels of rubbery black skin. He and a friend loosened and cut its rope manacles. "I was thinking it was hurting," he said. "It wasn't aggressive at all. We tried to point it toward the bay, but it wanted to swim south on the creek—a dead end."

By the noon high tide 20 neighbors had gathered and pushed and pulled the turtle onto shore. They kept it wet with a sprinkler and shaded by a beach umbrella. A crew from the Baltimore aquarium arrived after a five-hour drive. "When I learned it was called a leatherback, I could see why," said Mohr. "Its skin was soft."

At the aquarium it was clear the turtle had no chance of surviving and was put to sleep; loss of circulation had rendered its flippers dead flesh. An autopsy showed it to be a mature female.

An abundance of jellyfish probably drew the leatherback into the Chesapeake as she headed north on her marathon Atlantic migration. (By flipper tag, biologist Peter Pritchard logged one that traveled 2,700 miles from French Guiana to New Jersey.) Feeding almost exclusively on jellyfish, *Dermochelys coriacea* reaches 2,000 pounds and grows to six feet, the largest of all marine reptiles.

Beneath its tender skin a layer of oily tissue insulates the titan as it dives to frigid depths of 3,200 feet, seeking giant jellyfish. A leatherback feeding this deep may get the oxygen it needs from its muscles, which are saturated with oxygen before diving.

How does the leatherback, a cold-blooded reptile, regulate its body temperature for both cold and warm waters? A team led by Jim Spotila of Drexel University and Frank Paladino of Purdue University is finding answers on a Pacific beach near Tamarindo, Costa Rica.

At midnight, loaded with equipment, we took off along a path through the jungle that fringes the coast. When we found a leatherback, we waited in the starry darkness until she finished laying. Then the flashlights came on. Six people netted her flippers to immobilize her. Hoisted slightly, she tipped the block-and-tackle scale at 703 pounds.

It took all night to surgically attach temperature sensors to different muscles. Not once did she try to bite.

The temperature probes revealed that the turtle maintained a body heat of 88.2°F, while her skin and flippers were ten degrees cooler. Tests proved that she can regulate blood flow to her extremities.

"I got involved with leatherbacks to answer questions of biology, but then I got involved in the conservation of the species," said Jim Spotila, who helped create a national park here.

Once as many as 200 females came to this beach nightly during nesting season, some having traveled 600 miles north from the Galápagos. But years of steady egg harvesting has reduced the number of nesters to 70.

"I give leatherbacks a 50-50 chance of surviving, but I'm an optimist," said Jim. "The next 20 years are critical."

IN MIDSUMMER we walked along the beach of Boca Raton, Florida. Concrete walls protected condominiums from the encroaching sea; at high tide this stretch of beach was little more than 50 feet wide, scant room for loggerheads to nest.

Eighty percent of loggerheads in the western Atlantic lay their eggs on a 200-mile stretch

Hunger lures a vulture to a Costa Rican beach for a ready meal. Florida's ocean views lure developers—equally deadly to sea turtles. On Palm Beach a sign that discourages human tampering with turtle nests (above) stands useless against high tides that can lap seawalls, drowning eggs. Urban lights can draw hatchlings inland, where thousands die from dehydration or in traffic each year.

Senseless death overtakes a male olive ridley, snagged and drowned on a longline set for sharks off Costa Rica's Pacific coast. It's an all too common end. Says one biologist, "Losing an adult sea turtle is like breaking thousands of eggs on the beach."

midway on Florida's populous east coast. Even this cramped shore in Boca Raton had not discouraged their drive to reproduce, and members of the local Gumbo Limbo Nature Center were trying to help them succeed.

The beach was covered with wire cages, set up to protect each nest from egg-hungry raccoons and human disturbances. Volunteers patrol the beach daily, looking for signs of emergence.

As we watched one nest known to be near hatching, dozens of little loggerheads erupted. In a furious flailing of tiny flippers they raced for the ocean. Some were thrown back by the first wave and lay stranded until the water reached them again. Suddenly all the turtles became water. When the next wave pulled back, they were gone.

Growing to 450 pounds, *Caretta caretta* feeds primarily in the subtropics in estuaries and along the continental shelf, using the jaw muscles that make up most of its oversize head to crush mollusks and crustaceans.

Crab and lobster fishermen curse them for mangling traps and eating their catch. Fishermen claiming lower catches of shrimp and flounder because of TEDs have argued that loggerhead declines are caused mainly by loss of nesting sites to condominiums and hotels. No scientist denies the impact of coastal development, but the turtles have put a twist on the dilemma. It seems they like high-rises.

"Most residents are not there in summer when the turtles nest," explained biologist Mike Salmon of Florida Atlantic University. "At night the buildings are dark and look like a high row of trees."

The higher the building, the more nests Salmon finds in front of it. "Loggerheads are becoming urban turtles."

But later the location can disorient hatchlings. Street light can leak onto the beach from between buildings. If hatchlings run to the lights instead of the sea, they perish.

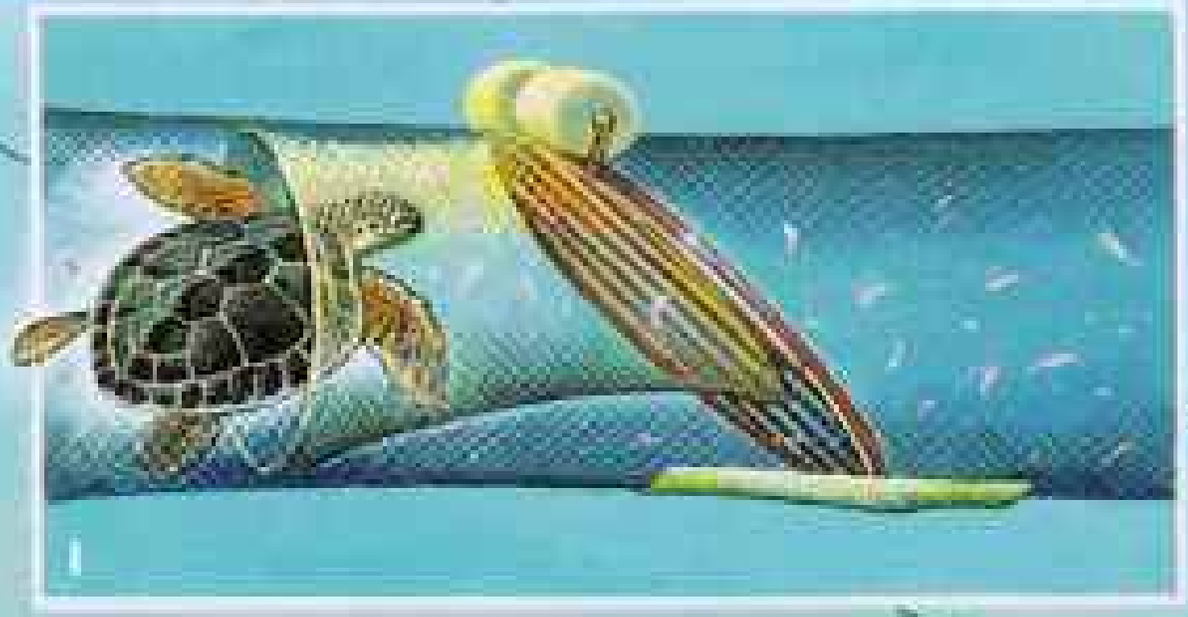
To keep some unspoiled shore for loggerheads, as well as for greens and a few leatherbacks that nest on Florida's east coast, the Archie Carr National Wildlife Refuge is being pieced together as funds become available. Named for the pioneering turtle researcher who died in 1987, nine miles of undeveloped land between Melbourne Beach and Vero Beach may cost as much as 90 million dollars to purchase.

Research by biologist Lew Ehrhart of the University of Central Florida guided the placement of the refuge. "Loggerhead nesting has been up the past four years," he said. On a 12-mile survey site between Melbourne Beach and Sebastian Inlet he now finds more than 10,000 nests in the April to October breeding season.

Escape hatch: giving turtles a break

With a push from the law, shrimp fishermen have struck a truce with turtles. Until recently, as many as 55,000 sea turtles—mostly loggerheads and Kemp's ridleys—died from U. S. shrimp trawling each year. Caught in a net and unable to surface for air, turtles can drown in 40 minutes. To reduce the slaughter, offshore trawlers have been required to use turtle excluder devices, or TEDs, since 1989. All U.S. shrimpers must install the $300 devices by late 1994.

In most TED-equipped trawls, a webbed funnel quickens the flow of water—and catch—toward the back of the net. At the end of the funnel is a metal bar grid (1). Shrimp shoot through the bars into the net. But turtles slide down the bars and hit a webbed flap (2), which pops open allowing escape (3). Full compliance would mean a virtual end to trawl-related deaths of adult turtles in the U. S. Yet thousands still die. Young turtles can slip through the four-inch gaps in TED bars, and in other nations TED use is as rare as a ridley.



"I try to be gentle as possible," says Ernest Carlisle, cooling a soft-skinned leatherback found in a trap net off Rhode Island. Unlike shrimp trawls (below), traps let turtles rise for air. Carlisle cut an old hook from this 700-pounder and set her free.

When a loggerhead hatchling—or any hatchling—breaks through the sand after 50 to 70 days, how does it know where to go? It was once thought that it headed toward the sea only because the water is brighter than the shore. But experiments by Mike Salmon indicate that it is also crawling away from the land's higher horizon.

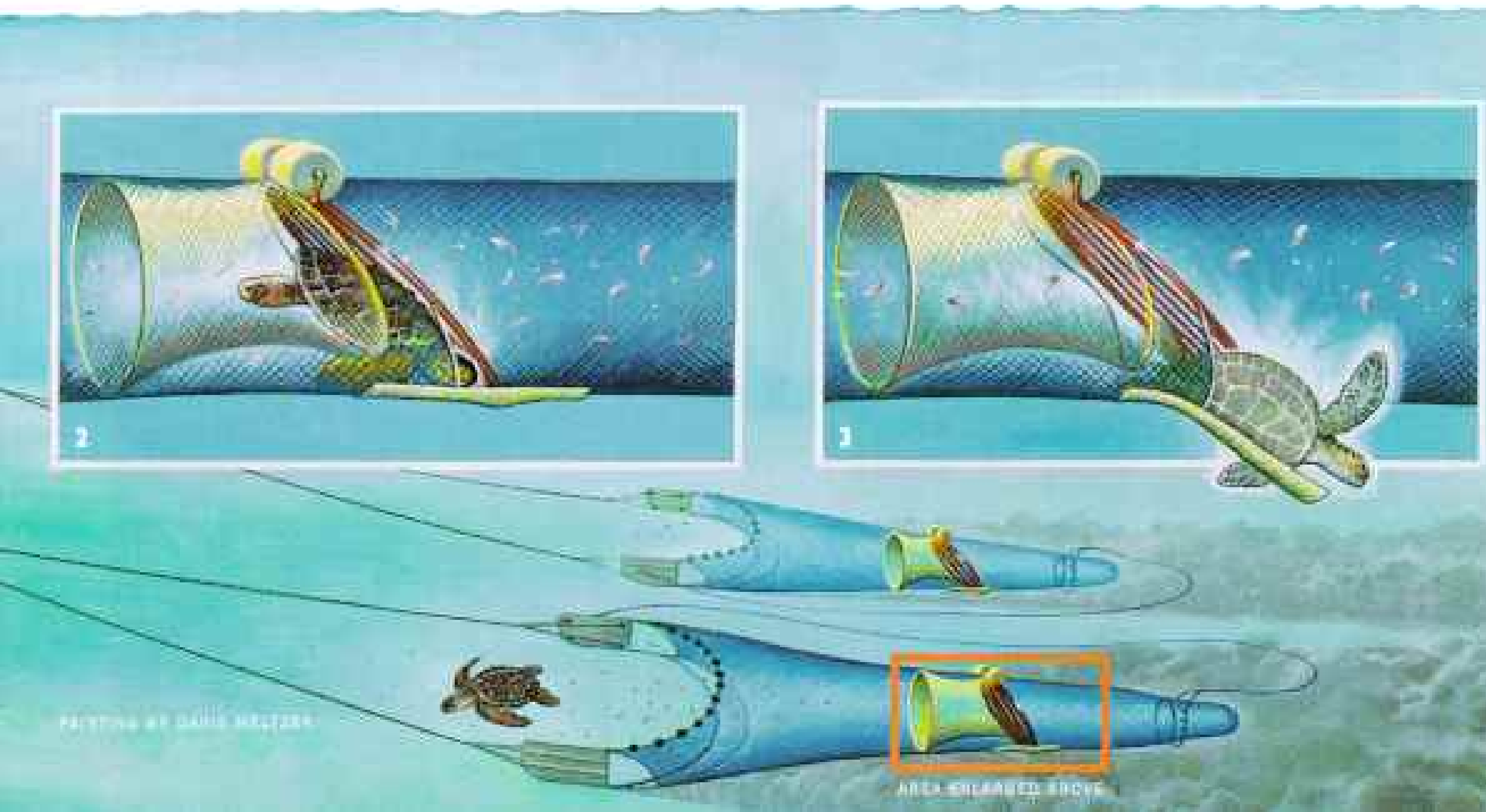
Salmon also discovered, along with Jeanette Wyneken of Florida Atlantic and Ken Lohmann of the University of North Carolina, that once in the water hatchlings orient themselves in the direction from which the waves are coming. They are also guided by another biological compass—an inborn sense of magnetic direction.*

From Florida beaches the hatchlings swim about 25 miles in 30 hours to take shelter and feed in sargassum, a bushy floating seaweed. Currents draw them farther out, where many are picked up by the Gulf Stream and carried across the Atlantic. The next time anybody sees these little loggerheads, they are at least four inches long and living near the Azores.

That internal compass and sense of wave direction presumably help the loggerheads find their way back across the Atlantic and guide the other species on their migrations as well. Folklore has held that turtles return to nest on the beach where they hatched. Now genetic evidence suggests that it is true.

The DNA in a cell nucleus is from both

*See "Secrets of Animal Navigation," by Michael E. Long, NATIONAL GEOGRAPHIC, June 1991.



Corralled and guarded, Kemp's ridley hatchlings stampede in safety at Rancho Nuevo, Mexico—the chief nesting beach for this most endangered sea turtle. To help bolster the species, Mexican and U. S. biologists fly 2,000 of the young to a nursery in Texas (below). Since 1978 thousands have been tagged and released into the Gulf in the hope that when they mature, they will return to nest.

mother and father, but the DNA in a cell's mitochondria—the bodies that produce the cell's energy—is passed directly from female to offspring. If female turtles are returning to their natal beaches to nest, the turtles on each beach would have similar and distinctive mitochondrial DNA. For the most part, they do.

The turquoise and emerald shallows surrounding the small Bahamian island of Great Inagua are feeding grounds for juvenile green turtles. Here University of Florida biologists Karen Bjorndal and Alan Bolten are using DNA to match the turtles with their native beaches and learn their migration patterns.

"We know the mitochondrial DNA pattern of most of the major green turtle rookeries in the Atlantic," said Alan. "Now we'll be able to tell where these juveniles came from based on genetics. We won't have to tag 10,000 turtles and wait to catch one."

The Inagua study shows that greens born in Florida, Costa Rica, Suriname, and Venezuela's Isla Aves are coming here to feed. "We can do our best to save the nesting beaches," said Karen, "but if we don't protect turtles in their foraging grounds, we haven't accomplished anything."

Still there remains what Alan Bolten calls the "most exciting question in sea turtle biology." How, when it's time to nest, do these turtles know to go back to Florida or Costa Rica or Suriname or Venezuela? Did they imprint as hatchlings on the smell of the sand or local waters? The same question haunts scientists researching salmon migration. But no one knows for sure.

IT WAS BEAUTY that all but killed the hawksbill. Polished and carved, the intricate black-and-yellow plates on its back were long sought for tortoiseshell jewelry and combs. Now the hawksbill sits with Kemp's ridley on the edge of extinction.

A creature of the coral reef, *Eretmochelys imbricata* uses its sharp beak to nip sponges out of crevices. It grows, very slowly, to 250 pounds. On a private 300-acre Caribbean island called Jumby Bay, off Antigua, 20 to 40 hawksbills nest each year. On this haven of million-dollar lots, hawksbills have become the most pampered guests.

"When we bought Jumby Bay, we knew little about the turtles," said developer John Mariani. "We were told 2,000 units were feasible. That would have destroyed the beach. Instead we set the limit at 125 units."

The island's wealthy residents, mostly Americans, consulted Jim Richardson of the University of Georgia to learn how to live with their hawksbill neighbors. "They realize they have an absolute treasure on the island," Richardson told us.

The biologist told Jumby Bay: Do not rake and manicure the beach the hawksbills come to—they nest under scrubby bushes. Nothing can be built too close to the water; lighting must be subdued.

"The future for the hawksbill in the Caribbean is proper management of private beaches and resorts," said Richardson. "Rich people will be paying for the bulk of it—the governments can't. I'm getting calls from other resorts asking, 'How can we keep the turtles on our beaches for the guests to see?' "

A nesting hawksbill comes out of the water fast, at times lifting herself on her flippers and walking like an alligator. Barreling into the brush, she digs a nest and lays around 150 eggs. Her return to water is just as swift. "You do not want to intercept a hawksbill," said Zandy-Marie Hillis. "They're little tractors—they'll run you over."

Hillis, a U. S. National Park Service biologist, works at St. Croix's Buck Island Reef National Monument, where 25 to 30 hawksbills nest a year. One April night she and a crew of research assistants and volunteers staked out the island's rocky beach.

They set up rows of survey markers along the forest's edge, 15 inches apart. Even if they missed the moment when a hawksbill sprints from sea to brush (a rare observance), a break in the markers would show where the turtle went. "Then you listen for them crashing around," explained Hillis. "And you smell for them—it's the smell of disturbed soil."

By 3:30 a.m. the moon had set, and somewhere in the dark sea a hawksbill was scouting our beach. An hour earlier she had started to come up, but something wasn't quite right, and she left without laying. Now, heavy with eggs, she was watching, listening, waiting.

Then Hillis's radio crackled: "We have a hawksbill. We hear her in the bushes throwing sand around." We hiked up the beach and saw the nester wedged tightly under a sea grape bush. We crouched so she wouldn't see us.

Like all sea turtles, once she began dropping her eggs, she entered a hypnotic-like state in

Born to be wild, a male green turtle at the Grand Cayman turtle farm waits to be freed to breed in the mating lagoon. Several thousand captively bred young are raised here in tanks (above, drained for cleaning). Some are released; most are sold for stew and steaks.

Promoters claim that farming boosts turtle populations and safely supplies demand. Critics argue that it fuels appetites for endangered animals, making poaching more likely. Ironically, tourists pay half a million dollars a year to glimpse the farm's greens, once so plentiful in the Caymans that one of Columbus's crew said the sea "seemed to be full of little rocks."

which little would disturb her. We turned on our lights, quickly measured and tagged her, then waited in darkness for her to leave.

Before we realized she had moved a flipper, she was bolting for the water. She made 15 feet in five seconds and swam away.

Japan was the last large importer of hawksbill shells—reportedly 31,000 a year from around the world at about $375 dollars a shell. There is a centuries-old Japanese tradition of carving tortoiseshell into ceremonial bridal combs, though most of the recent output has been earrings and tie clips and bowls. Under U. S. pressure Japan agreed to halt imports in 1992.

Cuba had been selling some 3,500 shells a year to Japan. Cuban scientists argue that hawksbills do not migrate but stay in one place, so they can be managed as a fishery. U. S. researchers counter that there is no proof; studies of hawksbill migration are just beginning. "If animals protected elsewhere in the Caribbean are harvested in Cuba," said hawksbill specialist Anne Meylan, "their conservation would be undermined."

Meylan had just returned from a sea turtle conference in Japan, where shell dealers had been lobbying biologists to give their multimillion-dollar industry a break. "They seem to have no sense that the stuff comes off a turtle and that a turtle looks like this," she said, spreading her arms. "They think of tortoiseshell as swatches in a box."

ARCHIE CARR set up his green turtle research camp 40 years ago at Tortuguero, Costa Rica. But poachers still turned the beach into a virtual slaughterhouse. "It was white with bones," Carr told us when we visited him there in 1975. "Hardly a turtle came up that wasn't killed. A creature that tastes so good, is so easy to catch, and comes back to the same place over and over again could disappear before anyone knows it's gone."

The green turtle's meat is the most delicious of any sea turtle's, perhaps because it is a vegetarian, grazing pastures of sea grasses and algae to grow to an average of 300 pounds. Its common name comes from its popularity as food. Its heart-shaped shell is gray-brown; green is the color of its fat, which, boiled with cartilage called calipee, makes a fine soup.

The gourmet craze for green turtle soup contributed to the decline of *Chelonia mydas*. But it also prompted a group of philanthropists called the Brotherhood of the Green Turtle to back Archie Carr's efforts to save the species. They formed the Caribbean Conservation Corporation to finance research, preserve nesting beaches, and promote projects to help not only turtles but also the people who make their living from them.

Since 1975 Tortuguero's beach and the surrounding forest have been protected as a national park. The local economic base is no longer turtle harvest but ecotourism. Now that people make money showing turtles to more than 15,000 visitors a year, turtles are worth more alive than dead.

"A live animal benefits the community," said park director Eduardo Chamorro. "If you kill it, you have a meal. Alive, people come again and again to see it. We want to keep this habitat for wildlife, not cattle farmers. No one comes to Costa Rica to watch cows."

Tortuguero had once seemed to us the most

Fitted with a satellite transmitter in Costa Rica, an olive ridley begins an ancient odyssey. She was one of 7,000 females that came here in one night of an *arribada*—arrival—a mass nesting unique to ridleys. Telemetry may help reveal where turtles go and what reunites them for nesting. No. 79 swam 2,728 miles before her signal faded out.

remote place in the world. Today five new hotels are full during much of the July to October nesting season, and the village population has increased to 500. But getting there remains an adventure, and along the way we would see that the turtles were still in danger.

We traveled northwest from the port of Limón along 50 miles of inland canals in the canopied boat of Modesto Watson. A passionate guide, he pointed out sloths, toucans, and crocodiles as we motored through the rain forest. Then we came upon a bulldozer and log skidder clearing the land. "Each one of those machines is a cancer cell," said Modesto.

Costa Rica has one of the highest deforestation rates in the world, and banana plantations—pushing against the borders of the park—are a major factor. Some biologists fear that without the vast forest to draw up groundwater, the water table will rise under the beach and drown nests.

And ecotourism alone is not a conservation cure-all. On Costa Rica's Pacific coast a tourist development near Villarreal hired guards to keep hueveros off the beach, without offering villagers jobs to replace the income. "That kind of tourism leaves nothing for the people," a despairing woman told us. The following season the resort decided to save money by not hiring beach patrols. All the eggs were taken.

Of all the research and conservation projects we visited, the east Pacific black turtle project in the state of Michoacán, Mexico, seemed the most promising. The legal egg harvesting that works at Ostional is only possible with ridley arribadas. The upscale ecotourism of Tortuguero cannot be sustained at every beach. But here in the villages of Colola and Maruata, scientists have involved the residents in ways that can be repeated on turtle beaches around the world.

Twelve years ago when biologists from the

University of Michoacán set up a camp in Colola, they had to request Mexican marines to stop the turtle killing and egg stealing.

Cut by rocky outcrops, the beach is one of the largest surviving nesting grounds for east Pacific black turtles, which range from the Gulf of California to Ecuador. Each nest is precious, for the black seldom lays more than 85 eggs to a clutch. Some scientists believe *Chelonia agassizi* is a subspecies of the green turtle (its heart-shaped outline resembles a green dipped in black ink); some say it is a species of its own. To the poor villagers, it was food and money.

"It became obvious that if we wanted to protect the turtles, we would have to do something about the situation of the people," said project director Javier Alvarado.

An iguana farm now aims to provide meat and cash income. An artisans' cooperative teaches crafts and sells pottery to tourists. People are paid to patrol for nesting turtles and bring the eggs to the project's hatcheries.

The scientists lobbied the government for a satellite dish for the Colola school, where they now teach courses. "We are finally entering into a sense of community," said Alvarado. "One biologist even plays in the local band."

It's a 45-minute hike up the hills above Maruata to the project's palm-roofed radio-telemetry tracking station, an open-sided shed speared by a 15-foot-high antenna.

We watched a biologist teach a 13-year-old village boy, Hugo Dominguez, how to read the chirps coming from a radio-tagged black turtle far at sea. He twisted the controls on the receiver and shared his dreams of doing this work himself someday. We hoped we were watching the future, and we dared to believe that there truly is a chance that attitudes will change and these ancient reptiles will survive.

A nearly full tropical moon was blazing when we saw our first black turtle. She was a solitary nester, far from the chaos of the arribada at Ostional. Here we could sit beside this momentary visitor to our shores, at her most vulnerable time, and marvel at her design and drive to reproduce, before she slipped back into her liquid world.

"We want our children to know the turtles," Maruata fisherman Herlindo Verduzco told us. "If there was no project, the turtles would be gone. We don't want to have to tell our children someday that the turtles were here once, but they were all killed." □

Frantic flight propels a newborn black turtle away from its natal beach in Michoacán, Mexico, one of the last major nesting areas for black turtles—which number only about 3,000 here. Concerned Michoacán citizens now ardently protect nests and promote turtle-watching, ecotourism, and food alternatives to replace the cash and protein that turtles once provided. Such programs may ensure that sea turtles will survive into the next century and beyond.

TATSHENSHINI–ALSEK
WILDERNESS PARK

Rivers of Conflict

A TANGLE of channels spreads below the confluence of the two rivers that lend their names to one of Canada's newest wilderness parks. Final link in the world's largest international preserve, the park has halted plans for an open-pit copper mine that many feared would pollute the rivers' glacier-fed waters.

By WILLIAM R. NEWCOTT
NATIONAL GEOGRAPHIC EDITORIAL STAFF

Photographs by JAY DICKMAN

In a land without roads, only the rivers run. Moose and raptors make up the local communities. Grizzlies that have never encountered a fisherman hunch over swift waters, awaiting a rosy flash of salmon.

Such is the remote glory of British Columbia's new Tatshenshini-Alsek Wilderness Park. At 2.4 million acres it is twice the size of Grand Canyon National Park. More significantly, it completes a 24-million-acre expanse that includes Alaska's Glacier Bay and Wrangell-St. Elias National Parks and the Yukon's Kluane National Park Reserve.

This international patchwork of parks, larger than the state of Maine, is close by one of the world's highest concentrations of bald eagles. Each fall some 2,500 keep watch over the Alaska Chilkat Bald Eagle Preserve (opposite), on the Chilkat River. Most move into the river valley from farther south on the Alaska Panhandle, although 200 stay year-round.

At their annual population peak, the area's eagles far outnumber human visitors to Tatshenshini-Alsek. Yet for a place seen by fewer than 1,200 outsiders a year, the area has been the subject of a surprisingly fierce tug-of-war between conservationists who want to preserve its untouched state and developers who want to exploit its natural resources. Meanwhile local native peoples claim ancient rights to the parkland.

Klondike gold rushers thought the Tatshenshini and Alsek Valleys would make good routes to the Yukon. More than 300 tried them; 12 arrived alive. Canyons white with glacial runoff make the rivers among the roughest in the region.

By Restful Waters

"It was 80 degrees out, and the brightness of the sun and snow made the water look cold and inviting," explains Jane Woodland of Victoria, British Columbia (below), who sought chilling relief in the glacier-fed Tatshenshini during a ten-day raft trip.

In 1984 just 326 people floated the Tatshenshini and Alsek Rivers, putting in at Dalton Post in the Yukon and ending at Alaska's Dry Bay. More than triple that number now make the voyage during the summer. Along the way they brave canyon rapids, explore braided channels, maneuver around icebergs, and hike on a glacier. They may even spot a glacier bear, a rare type of black bear.

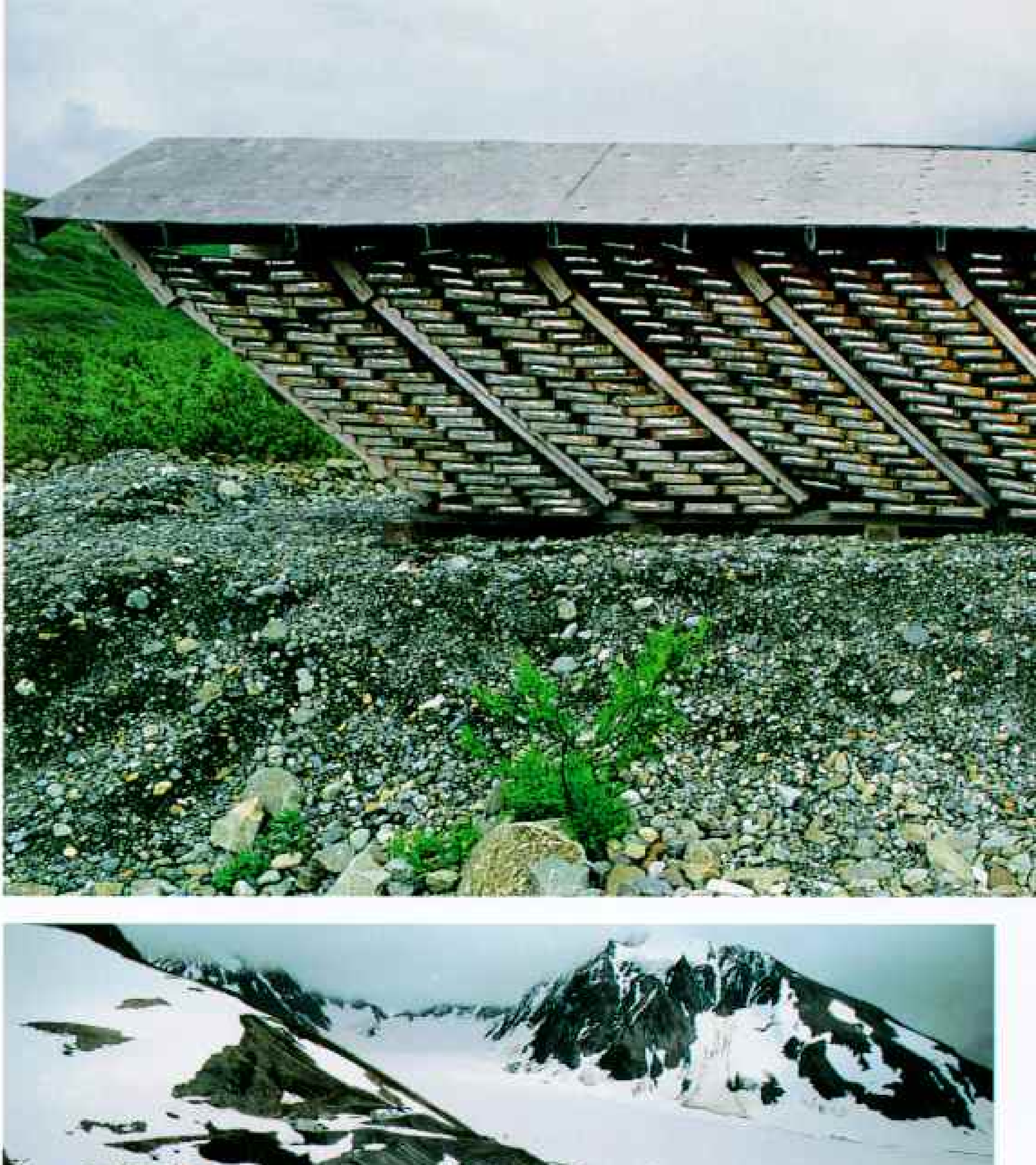
One of the world's most densely populated grizzly areas follows along Tats Creek (right), which rushes into the Tatshenshini at a campsite where Woodland and her fellow rafters spent one night. "I looked around," she recalls, "and thought, everybody needs to do a trip like this."

Trouble is, more and more people want to. At pull-outs along the rivers, groups pitch tents and set up camp. Human waste must be buried or carried out. Yet rafters, commercial and private, find increasing evidence of the humans who preceded them, prompting authorities to consider limiting the number of raft trips on the rivers.

Claims to traditional lands being pursued by native Champagne and Aishihik Indian bands may also have an impact. They hope to develop a historical center at the Dalton Post put-in—a cultural site they call Shawshe—and earn a share of the two million dollars visitors spend on the rivers each year.

More important will be the outcome of negotiations as the Canadian government prepares to return ancient lands to the bands. Says Ethan Askey, who has studied river use for the provincial government, "Any new river management decisions will be made with the Champagne and Aishihik."

BOB HERGER



Mountain of Copper

Twenty-foot winter snows nearly toppled a shed of core samples on Windy Craggy Mountain (above), relic of a planned copper mine that was killed by political pressure from environmentalists.

"Feelings are still running high on both sides of the issue," declares geologist Jay Timmerman, examining a core sample while cataloging area mineral resources for British Columbia's government.

A mining firm proposed slicing the top off Windy Craggy. Like an open treasure chest, the mountain was expected to yield eight billion pounds of copper, 1.8 million pounds of silver, and 88,000 pounds of gold. Some 600 new jobs sounded good to many folks in the towns of Haines, Alaska, and Whitehorse in the Yukon.

But when details were made public, an outcry went up from conservationists. A 65-mile road would be cut, much of it along the Tatshenshini River. Soon it would rumble with ore-laden trucks passing every 12 minutes, 24 hours a day. Acidic water from the mine might drain into Tats Creek, damaging salmon and other wildlife.

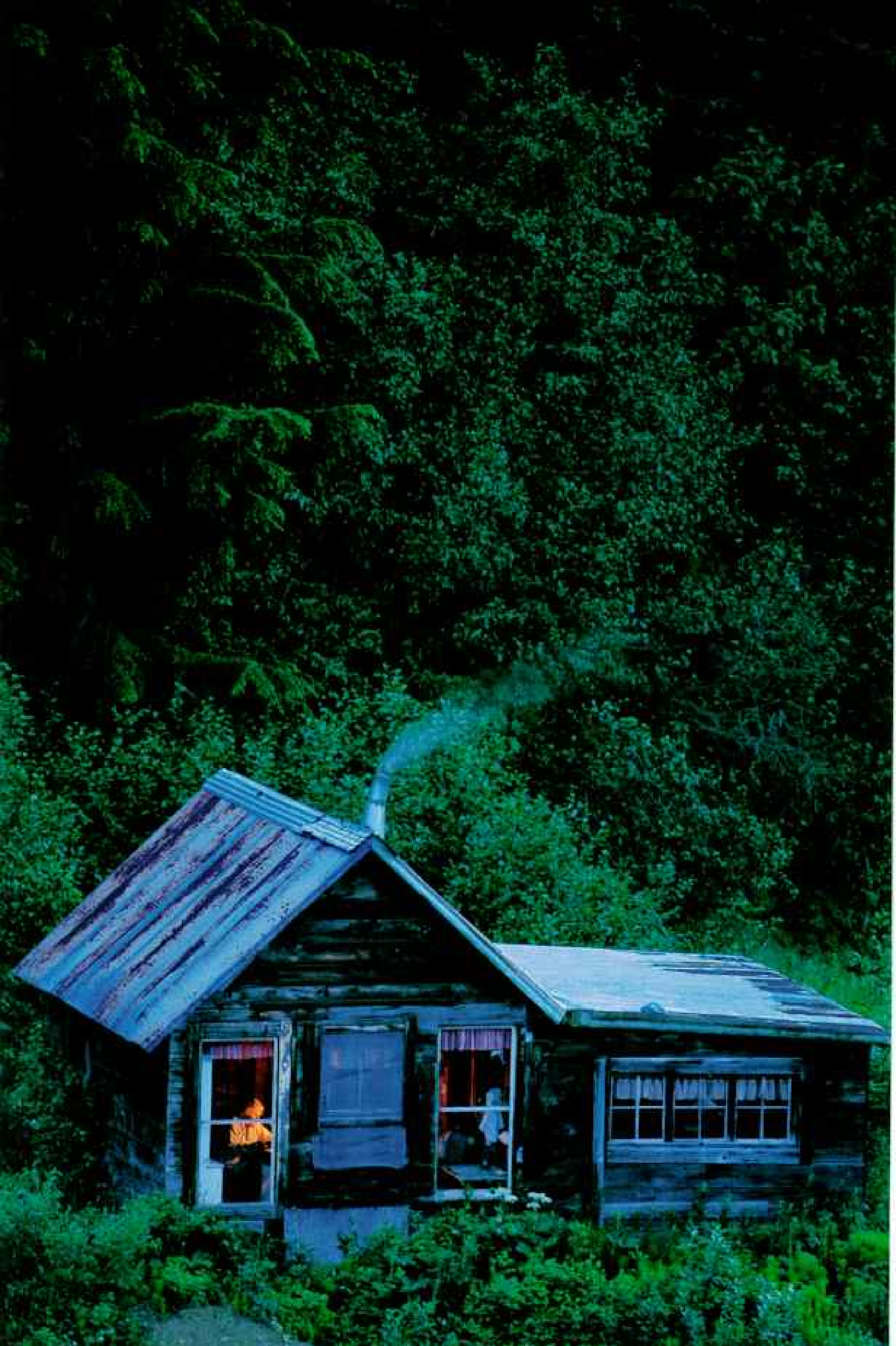
Years of heated debate divided area neighbors and rang in the halls of government. Finally, last June 22, British Columbia settled the matter, designating the area a wilderness park—off-limits to mining.

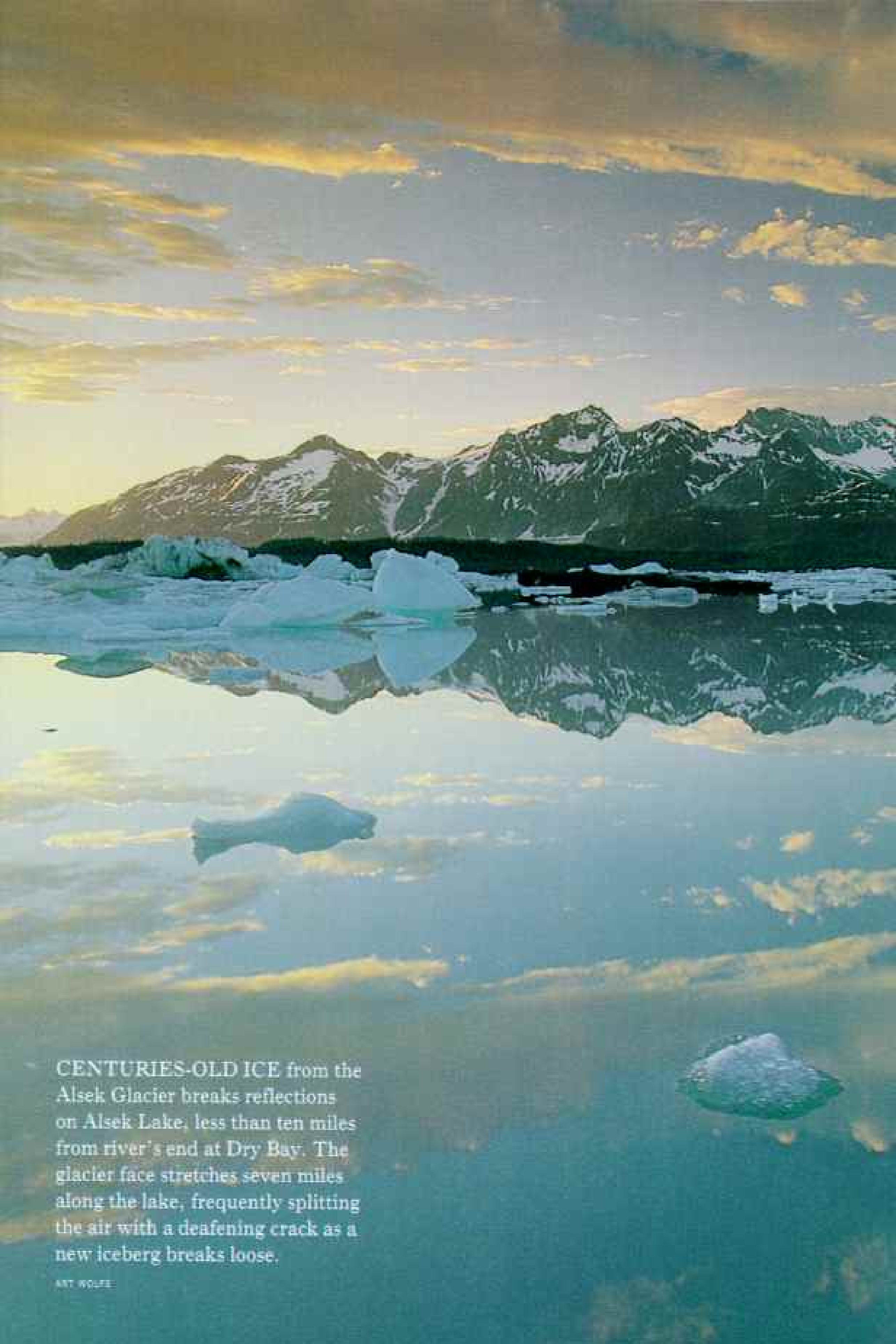
Aside from a few buildings near an exploratory shaft (left), Windy Craggy will remain untouched, yielding its mineral riches only in the rusty residue left by a natural spring.

COAXING THE LAND

Reading by kerosene lamp in a cabin she built with her late husband, Josephine Jurgeleit (opposite) can hear Alaska's tumbling Porcupine Creek, where she's prospected for gold for 43 years. "Some years the mining is good, some years it's a dud," says Jo, 78, who lost a leg to phlebitis several years ago. She winters in Anchorage—but not before her annual October hunt. "I usually get my moose."

On the Yukon's Klukshu River, Kevin Hume gaffs sockeye salmon (top). More than once he's looked up to see a grizzly on the opposite shore. "I just walk away backwards," he says. "Very, very slowly." Canadian laws prohibit all but native Indians from gaffing fish. Many native people spend summers camping along the rivers, then bring their smoked and canned harvests back to town for the winter. Hooks and lines are permitted for others, including sportfishermen and local folk like Ronald Salmon (above), who hangs his catch of trout in a Klukshu smokehouse.





CENTURIES-OLD ICE from the Alsek Glacier breaks reflections on Alsek Lake, less than ten miles from river's end at Dry Bay. The glacier face stretches seven miles along the lake, frequently splitting the air with a deafening crack as a new iceberg breaks loose.

ART WOLFE

WHERE GLACIERS RULE

Cold feet strike even the most intrepid Alsek River rafters when they reach Turnback Canyon: They don backpacks and bypass the rapids on foot, traversing the wide tongue of Tweedsmuir Glacier (above).

A handful of kayakers have managed to survive Turnback, but only one raft team has ever made it. Rapids hold extra peril—water temperatures hovering just above freezing can kill anyone thrown overboard.

Beyond are the St. Elias Mountains, at up to 19,500 feet some of the highest coastal mountains on earth. Between the peaks, one of the planet's largest nonpolar ice sheets courses through valleys.

Downstream, where the river is a swift but safe highway for rafters, glacier walking is a major attraction at several pull-outs. Atop the seemingly solid ice field, hikers are often surprised to feel rumbling underfoot—the pulse of glacial melt thundering through ice caverns, unseen rivers adding their contributions to the Tatshenshini and Alsek.

Spared development by mining interests, the Tatshenshini-Alsek Wilderness Park seems likely to remain an elusive destination, buffered from the outside world by sheer inaccessibility. Its devotees wouldn't have it any other way.

"Most places in North America, no matter how far you venture into the wilderness, you find signs of humanity—a fire ring on the shore, the sound of a logging operation, a worn footpath," says Bob Herger, a British Columbia photographer. "But here . . . here I've never even seen a jet contrail. The birds own the sky, and the only footprints come in sets of four. Along the Tatshenshini, if you're a person, you're a foreigner." □

Geographica

Lost City Found on Mexican Coast

A huge 2,000-year-old city with structures rising one hundred feet has been located in the state of Veracruz near Mexico's Gulf Coast.

Archaeologist S. Jeffrey K. Wilkerson (right, at left, with workman Roberto Razzo) has identified the site, buried under banana and citrus plantations, and called it El Pital for a nearby village. Wilkerson, who has worked in the region for 30 years, often supported by the National Geographic Society, had long believed in the existence of a Gulf Coast city that traded with inland centers like Teotihuacan. Evidence from aerial photographs, flyovers, surveys from horseback and on foot, and conversations with farmers about artifacts they had plowed up convinced him that here indeed was a metropolis dating from the first century A.D.

"Satellite communities and agricultural canals cover at least 40 square miles around the site," Wilkerson estimates.

So far, more than a hundred structures have been plotted, including eight ritual ball courts, several plazas and temples, and what appears to be a roadway. Among the objects Wilkerson found were stone tools, such as obsidian blades, and clay artifacts like this four-inch head fragment, possibly depicting a sacrificed ballplayer.

DAVID HISER (ABOVE AND TOP)

An African Coronation, Rooted in Tradition

CAROL BECKWITH AND ANGELA FISHER

Dual coronation ceremonies in Uganda last summer marked the restoration of a 600-year-old monarchy, outlawed since 1967 by bloody dictatorship.

On July 31, 1993, Ronald Muwenda Mutebi II (left) was invested as the new *kabaka*, or king, of four million Baganda, the nation's largest ethnic group. Clad in gold-embroidered velvet, he received honors from Christian and Muslim leaders. Earlier, in a traditional ceremony, he had donned bark cloth, drunk banana beer, and received the spear and shield denoting leadership.

King Ronnie, as he is known, assumes the title of kabaka held by his father, Frederick, who was also the first president of Uganda after the former British protectorate became independent in 1962. Frederick was ousted in 1966 and exiled to London, where his son lived for most of his 38 years.

The revival of ancient kingships has been controversial; some fear it will inflame tribal rivalries and encourage secession. Uganda's President Yoweri Museveni hopes the restoration will ease ethnic strains and gain the loyalty of 22 percent of Uganda's population of 18 million. The kabaka and his parliament of 52 clan leaders will wield no political power but can exert cultural and educational influence.

"What it really means is unity," says Prince Joseph K. Walugembe, the kabaka's cousin. "Since 1986 our kabaka has said it is time for the Baganda to unite. He returned in 1987 and helped bring us together."

National Geographic, February 1994

Civil War Soldiers Enter the Computer Era

English-born Fergus Elliott came to the United States in 1857 or 1858. He joined Company G of the 109th Pennsylvania Regiment in 1862, fought in Georgia, was mustered out as a sergeant (below), married, became a policeman in Germantown, Pennsylvania, and died in 1923.

From his journal we know more about Elliott than about many who fought in the U. S. Civil War. Soon, thanks to regiments of modern volunteers armed with computers, visitors to National Park Service Civil War sites will have access to a database record of every soldier and sailor of the Union and Confederacy.

The information is stored at the National Archives on handwritten index cards compiled after the Civil War. Today's volunteers, many of them genealogists, are entering the data into computers, beginning with the 179,000 U. S. Colored Troops. The 5.4 million cards include numerous duplicates of the nearly three million participants. By 1996 the completed database will give the first true count.

JAMES R. ELLIOTT COLLECTION, U. S. ARMY MILITARY HISTORY INSTITUTE (LEFT); STEVE WINTER

Kanzi's at the Joystick, More Than Just a Game

You won't find him dueling enemy aliens at your local video arcade. But when it comes to handling a joystick to guide objects around a video screen, Kanzi, the bonobo prodigy, is a whiz.

Behavioral biologist Sue Savage-Rumbaugh and her colleagues at Georgia State University in Atlanta are studying bonobos, chimpanzees, and monkeys to learn how primates think—research that is featured in the March 1992 GEOGRAPHIC and in the Society's new book *The Great Apes: Between Two Worlds*. The tests include video mazes, puzzles, and other challenges requiring both hand-eye coordination and mental agility.

Maneuvering through a maze, Kanzi demonstrates that "he can plan where he is going, go to a new place, avoid blind alleys," Savage-Rumbaugh says. "All the tests we've presented him, he's been able to do." Kanzi eagerly masters complex rules, reacts with speed, and will play for long periods of time.

Kanzi already had learned to comprehend human speech and to communicate by choosing lexigrams from an electronic board, at the level of a two-and-a-half-year-old child. His joystick skills are at the same level, Savage-Rumbaugh says.

—BORIS WEINRAUB

All Orchids Are Beautiful, But Some Have an Edge

In the world of orchids, some are more attractive than others—at least to the insects that seek their nectar and distribute their pollen. An orchid in Madagascar, *Aerangis ellisii*, relies on the hawkmoth to pick up a package of pollen and deposit it in one of its own flowers or that of another plant; like many flowering plants, most orchids are hermaphrodites with both male and female attributes.

When researchers led by L. Anders Nilsson of Sweden's Uppsala University tracked the orchid's fertilization, they were in for a shock. The team, including student Esther Razafimiandrisoa (right), applied tags to each pollen bundle in a study population to see which plants play a role in fertilization. They found a mere 9.5 percent accounted for 71 percent of all pollen exchanges. Nilsson isn't sure why. "The hawkmoth has an acute sense of smell and a well-functioning color-vision system," he says, so it is capable of choosing plants that look or smell good. Producing more than a hundred fragrant flowers may make one orchid as popular as a prom queen, while showing only five blooms turns a plant into a real wallflower.

BÖRJE PETTERSSON

National Geographic, February 1994

Forum

The American Prairie

I champion Douglas Chadwick's views that we must protect the North American prairie (October 1993). However, as a rancher I felt somewhat left out. By far the vast majority of prairie is privately owned. Some ranchers, such as myself, have reseeded native grasses and use grazing practices that promote and protect native species of plants and animals. I would like us to be recognized as a vital part of the prairie.

STEVE PAGE
Garneill, Montana

You wrote that Bob Betz and his friends protected a pocket of prairie with money out of their own pockets. We have wolves, bears, and coyotes here that prey on our cattle, and every animal they kill comes right out of my own pocket. The prevailing theme of stories such as this, it seems, is to make people like me the culprit. Not quite right. The world's population is increasing by leaps and bounds, and these disruptions of nature were caused to supply the desires of someone in New York, Montreal, or someplace else. If these people want nature returned, I suggest starting at Times Square or the Skydome in Toronto.

JACK LOZIER
Williams Lake, British Columbia

My husband and I are of the generation that left Arkansas and Oklahoma during the Depression to work in the farmlands of California and Washington. Last summer we toured the prairie described, and we were struck by the absence of wild animals and birds compared with years ago. Then, I remember seeing many prairie dog villages, jackrabbits in great numbers, and as many birds as at home in the Ozarks. This time it was eerie. No wild animals, no roadkill, no carrion birds, for miles and miles. Just that big, big sky and wheat.

SYLVIA CUNNINGHAM
Rogersville, Missouri

Dakota rangeland is alive and well; thousands of acres have never been farmed, and ranchers have followed good conservation practices. Much of the farmland too is back in native grasses with more wildlife—deer, antelope, and waterfowl—in our area than when my parents homesteaded our ranch over 80 years ago.

JOEL RICKENBACH
Oelrichs, South Dakota

To correct a point, there are only 36 million acres in the entire state of Illinois (page 116) and less than 22 million acres were ever prairie. Forest covered 14 million acres. Although the plow was responsible for conversion of most prairie to cropland, almost one million acres of prairie converted to forest because of man's control of fire.

DAN TOWERY
Champaign, Illinois

To the city dweller the prairie dog, no doubt, appears as yet another cute, furry animal. To me, a farmer, the prairie dog is vermin, responsible for countless thousands of dollars in crops lost to "the pruning of grasses," in farm machinery broken, and in horses and cattle lost to broken legs from the pockmarked pastures. A prairie dog town is a foul-smelling area that, when overpopulated, becomes denuded of all vegetation. Also, fleas infesting the animal, its burrow, and the environs are known carriers of bubonic plague. I spend some portion of every day on a crusade to eradicate this vermin, all at my own expense.

J. A. HUNSINGER
Paradox, Colorado

As I read the article, I became nostalgic to relive springtime on my pioneer family's Minnesota prairie farm, to be awakened by the song of the meadowlark, to feel the cozy warmth of the kitchen stove started with twisted wisps of dried prairie grass, and to run barefoot after a burn over virgin prairie enjoying nature's wildflower garden. But the break plow long ago devoured almost all native prairie, and there are no more burns. I have learned to look for the native grasses and wildflowers at rural church cemeteries; the sod at many was never broken. Big bluestem's feathery fronds can be seen waving above tombstones and fences.

EMMA LINDQUIST
Willmar, Minnesota

The Living Tower of London

William Harrison Ainsworth's novel of 1840, *The Tower of London*, uses the Tower almost as a character. Set in Tudor England, this novel dramatizes the nine-day reign of Lady Jane Grey—a pawn in an attempt to take over the throne—before she was executed in 1554 as a traitor by Queen Mary. Ainsworth, who made an extensive study of the Tower, used individual towers, their histories, and the fortunes of former inhabitants to dramatize the plight of his characters. He showed the Tower "in its triple light of palace, a prison and a fortress." Your article conveys the same historical sweep and carries this legacy into the present.

LLEWELLYN LIGOCKI
Bellevue, Washington

Apart from its tourist value, the Tower is the centerpiece of the annual London Marathon, which is the world's second largest [after New York's]. I have completed the route three times; it crosses

Tuamotu Sandpiper ***Genus:*** *Prosobonia* ***Species:*** *cancellata* ***Adult size:*** *Length, 17 cm* ***Adult weight:*** *Approx. 36 g* ***Habitat:*** *Atolls in the Tuamotu Archipelago* ***Surviving number:*** *Unknown*
Photographed by Roland Seitre

WILDLIFE AS CANON SEES IT

The familiar high-pitched piping of the Tuamotu sandpiper can be heard continuously as it forages for insects among the vegetation and coral rubble along shorelines. Once widespread, this small Polynesian shorebird is now extinct on most islands of its Pacific archipelago. The little-known sandpiper survives precariously on a few tiny atolls that still remain undisturbed. To save endangered species, it is vital to protect their habitats and understand the role of each species within the earth's ecosystems. As a global corporation committed to social and environmental concerns, we hope to foster a greater awareness of our common obligation to ensure that the earth's life-sustaining ecology survives intact for future generations.

Solar Cells
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NATURE
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This program is funded, in part, by Canon U.S.A., Inc.

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Tower Bridge at the halfway stage, then passes through East London and returns to the Tower at 22 miles to pound over the famous cobblestones (which are carpeted for the event) before completing the run on Westminster Bridge. I wonder if the athletes realize the importance of the Tower in shaping the England we know today.

SPENCER F. COLE
Bickley, Kent, England

One thing author William Newcott didn't mention was the miraculous escape of the Tower from the bombing of London during the last war. I remember many times arriving at work in the City of London to find that buildings had been reduced to smouldering heaps during the night. But every lunchtime I would walk down to the Tower gardens and be thankful the Tower was safe.

K. G. STONE
Cambridge, England

Although the Tower's massive outer walls survived the Blitz virtually unscathed, German bombs damaged or destroyed several buildings. Two Victorian-era structures destroyed in October 1940—the North Bastion and the Main Guard—were never rebuilt.

I take exception to the statement that Anne Boleyn was executed for "failure to give Henry a son." Anne Boleyn, at age 29, had many childbearing years left, so failure to produce a son could not be the true reason. After her marriage she unveiled her true self—arrogant, quarrelsome, and obnoxious. She believed her position was invincible since Henry violated English law and gave up his Roman Catholic religion to divorce Catherine and marry her. He also sacrificed his popularity at home and abroad because of her.

JEROME D. LEESON
Scranton, Pennsylvania

Labrador

I believe the public would like to know the origin of the place-name. Labrador was apparently named for João Fernandes, a Portuguese yeoman farmer, or *lavrador,* who explored the coast [with John Cabot in 1498]. Fernandes was born in the Azores, from which Portuguese fishermen have long sailed to Newfoundland in search of cod.

RUI CAMACHO PALMA
Queluz, Portugal

My sister-in-law, a graduate of Massachusetts General Hospital, spent the winter of 1934-35 as a volunteer with the Grenfell Mission. I remember she went by boat to Battle Harbour and then by dog team to the hospital. She slept with newborn babies there to keep them warm, and she made house calls to the sick via dog team. When the hospital was threatened by a forest fire, surgical implements were buried for safety.

DOROTHY L. LEAVITT
Pittsfield, Maine

All Quebecers learn at school that Labrador belongs to Quebec. Newfoundland had historical rights on the coast but not within the land. In 1927 the Privy Council in London stated that the border was "the share of the water" [the division between rivers flowing west and those flowing east into the Atlantic], stealing a quarter of Quebec territory.

JACQUES NOËL
Charlesbourg, Quebec

We loved the cover photograph. And the map was a wonderful bonus. But we can't believe that you published 34 pages about Labrador without mentioning its most well-recognized, brave, faithful denizen—the Labrador retriever. Bred to assist in pulling nets from the sea, with strong haunches, warm underfur, and generous personality, Labs have gone on to win the hearts of millions beyond the cold Atlantic shore.

JEFF ZIMMERMAN
Petaluma, California

The popular Labrador was bred in England from black water dogs brought there by fishermen from Newfoundland around 1800. English sportsmen developed the breed they called the St. John's dog for sporting use. It became the Lab we know today.

Atlantic Canada Map

Many of the place-names given are of Portuguese origin. St. John's River was first called Sam Joham and Cape Race, Capo Raso. The Bay of Fundy may be a corruption of Fagundes, after a man who tried to set up a fishing village. Some scholars have surmised that Cape Freels came from Frey Luis and that Fogo Island was so named because Portuguese fishermen saw an immense fire there. The Cantino Map of 1502 shows eastern Canada as Terra del Rey de Portuguall, and the Reinel Map of 1504 places a Portuguese flag there.

MARGARET W. ROMANI
Los Angeles, California

The insert map called "Fight for Control" shows French, Irish, and English—but no Scottish—immigration. Nova Scotia (New Scotland), Prince Edward Island, and Newfoundland had major Scottish settlements, the result of defeats at the hands of the British who tried to eradicate the remnants of the Celtic culture of the Highland Scots.

WAYNE H. THOMPSON
Weatherford, Oklahoma

Afghanistan

I commend Richard Mackenzie and Steve McCurry for a poignant and tragic picture of a problem left over from the Cold War that will not be settled for many years to come. The personal accounts and overwhelming dangers an Afghan must face just to survive every day brought a deep sense of empathy. The centuries-old tradition of

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warfare is evident in the contradictory words of a *mujahid:* "We're still fighting to bring peace to Afghanistan."

APRIL BURGOS-LOVÊCE
Durham, North Carolina

The photographer captured 22 guns on film, all of them Russian-made, not to mention 10 Russian tanks. Yet the caption on page 77 appears to blame the United States: "Guns abound in Afghanistan, in part the result of three billion dollars in U. S. wartime aid."

ARI LISTOWSKY
Flushing, New York

The statement that "British troops fought three wars with the Afghans and lost each time" is misleading. The three Afghan Wars of 1839-1842, 1878-1880, and 1919 were fomented by British fears of Russian encroachment. British forces won some engagements, but the results were brief occupations, destruction, and subsequent withdrawal. The third "war" was little more than a border skirmish, but the others demonstrated that British forces could defeat Afghan armies and occupy cities. The difficulty was the maintenance of order in a harsh land. Despite ostensible strategic importance, Afghanistan was not a profitable accession to the British Empire.

WILLIAM JOHN SHEPHERD
Crofton, Maryland

The Cambrian Period

I have become increasingly interested in evolutionary biology, especially the transitional periods such as the Precambrian-Cambrian, Permian-Triassic, and Cretaceous-Tertiary boundaries. On pages 124 and 129 you refer to rising levels of oxygen in the seas as contributing to the Cambrian explosion. According to Mark A. S. McMenamin and Dianna L. Schulte McMenamin in *The Emergence of Animals: the Cambrian Breakthrough,* this oxygen-threshold hypothesis is open to question. They mention an alternative hypothesis—that oxygen levels were higher in Precambrian times. They conclude that the development of active, predatory lifestyles by animals and the ecological chaos of the seas, when combined, encouraged diversification and culminated in the biological "explosion" we call Cambrian.

CARY EASTERDAY
Washington, D. C.

Stephen Jay Gould's modern concept of "contingency" is an answer to one of Darwin's regrets. In a letter to Moritz Wagner in 1876, Darwin admits that his greatest mistake was not to have paid more attention to the direct impact of the environment, independent of natural selection.

CLAUDE GIRARD
Hull, Quebec

Earth Almanac

Contrary to the implication of your article on alligators in the October Almanac, taking alligators from the wild for hides and meat is considered a better conservation practice than producing them through captive breeding. Florida and Louisiana have for the past 10 to 20 years permitted harvests of wild alligators and eggs. (Ranching—collecting wild eggs, hatching them, and rearing the young—differs from captive breeding in that it depends on a healthy wild population to succeed.) The conservation benefits of harvesting wild alligators include increased interest in managing wetlands for wildlife, increased research on alligator ecology, and diversion of trade from endangered crocodilians.

Captive propagation has few conservation benefits for species that are not endangered and is not necessary to supply the demand for crocodilian products. Strictly controlled wild harvest programs account for 90 percent of the alligator leather and meat produced in the U. S. In fact captive propagation can have a negative effect if it results in oversupply and depressed prices.

ALLAN R. WOODWARD
Florida Game and Fresh Water Fish Commission
Gainesville, Florida

Geographica

The report on the Kaliningrad Oblast of Russia in the September 1993 Geographica stated that "During World War II, its German residents fled Soviet bombs." In fact Königsberg also received heavy losses during two British bombing raids. The German residents lived there comparatively peacefully until 1945 when the Russian army invaded. Many people fled in the bitter cold on wagons, on sleighs, and on foot, some reaching the safety of Denmark or the province of Schleswig-Holstein; many died on the way. People who did not flee, women and children, were raped and shot by Russian troops or transported to Russian labor camps where many died in short order, my mother and sisters among them.

RHODA HOLZ
Guelph, Ontario

Our development company is working in Kaliningrad to turn around the devastation brought on by 45 years of socialism. Today's 100 percent Russian residents have very mixed feelings about the post-war period. Ironically most arrived in the same way the Germans left, by force of Stalin. Today's leaders are a progressive group working to attract help not handouts. Residents enjoy learning the full history; the German language is the most sought after subject in adult education.

KARL M. TOPP
New York, New York

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On Television

BEVERLY JOUBERT

A Sojourn With Giants

"We called him the ghostly one," says Dereck Joubert, who with his wife, Beverly, produced the National Geographic TV Special "Reflections on Elephants." They knew the old bull's days were numbered, and hours after Beverly took this portrait he was gored by a dominant bull at the water hole. Death came swiftly in the dusty African bush.

Here, in 40,000 square miles of northern Botswana, elephants still traverse ancestral ranges—one of the last places in the world where they roam freely in time with the seasons.

The animals' remarkable intelligence attracted the Jouberts and their camera lenses. The elephants' calm, meditative air made a distinct change from the filmmakers' previous wildlife subjects in "Eternal Enemies: Lions and Hyenas," which was also a TV Special and is now a home video.

Filming from a four-wheel-drive vehicle and underwater in scuba gear, the Jouberts focus on behavior—including burial scenes and active greetings between clan members—that reveals similarities between elephants and humans. Elephants, the Jouberts show, can cooperate in the rescue of infants in peril. The camera captures the dynamics of both the matriarchal herd, mothers and young led by a dominant female, and the independent bulls that gather at water holes.

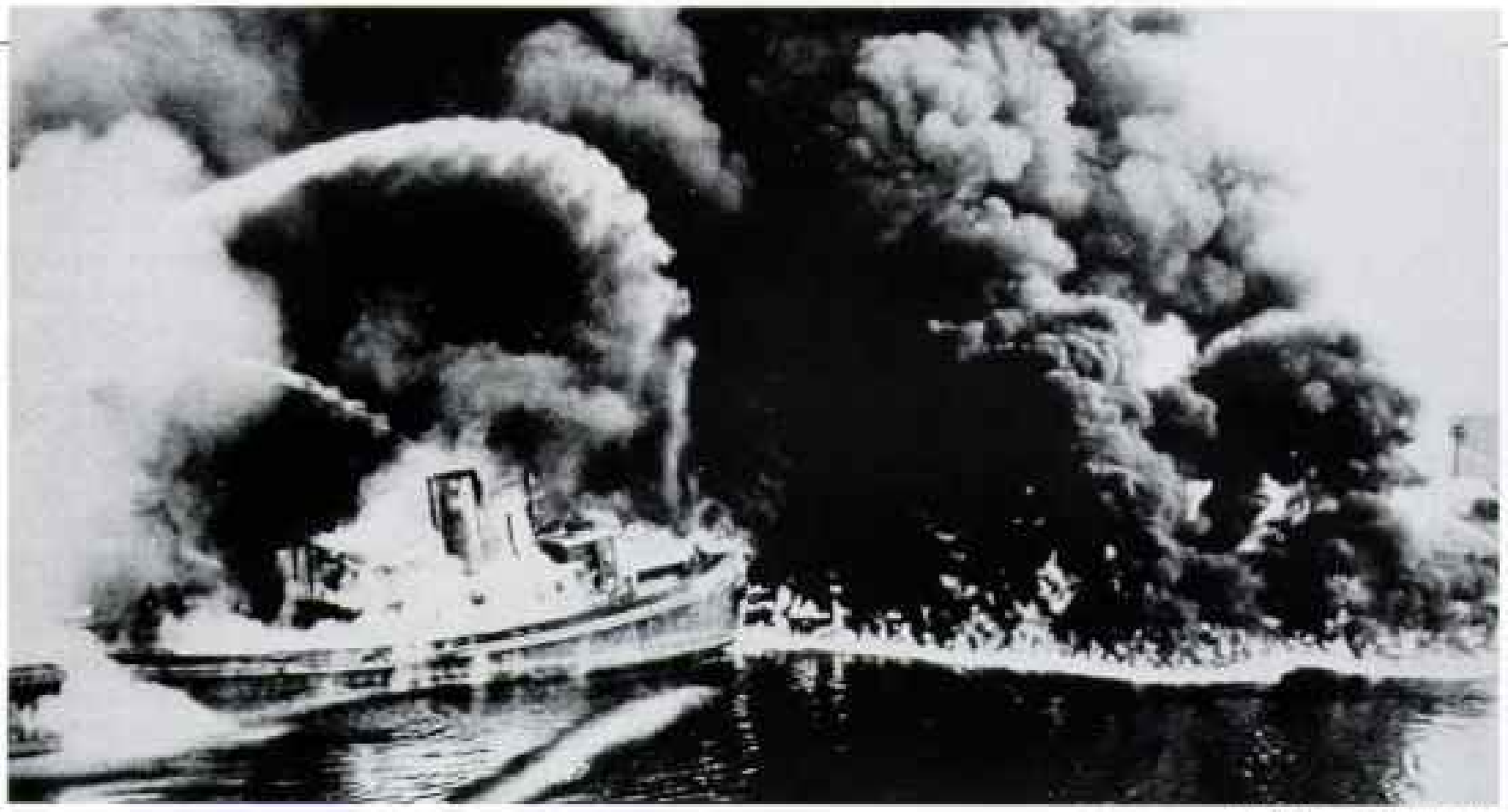
An elephant's memory is legendary. Months after this old bull's death, another male unearthed his tusk from the mud and displayed and caressed it. What are we to make, the Jouberts ask, of such haunting behavior?

The film includes dramatic footage of young lions hunting elephants and the adoption of a lone calf threatened by hyenas.

"They're complex, social animals with language and a capacity for compassion," Dereck says. "Demands for ivory and habitat are undermining this wonderful species."

"Reflections on Elephants," Special on PBS, February 9, 8 p.m. ET. A June selection of the Video Club.

Earth Almanac



PLAIN DEALER, CLEVELAND, OHIO

A Cleaner Cuyahoga Is Flammable No More

Many people recall June 22, 1969, the black day when Cleveland's polluted Cuyahoga River caught fire. But few outside Ohio know that the Cuyahoga had burned before. On November 1, 1952, this blaze (top) arose at a shipyard when oily debris ignited.

MICHAEL WOOD

But it was the infamous 1969 blaze that "got the nation's attention. It helped push Congress to pass the Clean Water Act," says Michael Kaplan. Knee-deep in his favorite subject, the Cuyahoga, Kaplan spurs continuing cleanup with a grassroots group called Friends of the Crooked River, as Indians described the Cuyahoga.

In the past two decades industries have spent heavily to reduce pollution in the river. Problems remain, however. A 45-mile section, part of which flows through the Cuyahoga Valley National Recreation Area, has been designated an "area of concern" by an international commission. The reason: urban runoff, overflows from Akron's sewage system, and other pollution.

Predator in Peril—the Shrike

Butcher-bird. Jackie hangman. Murdering bird. Strangler. Such are the nicknames for the world's 30 species of true shrikes—unusual songbirds that behave like hawks. Mainly insect feeders, they use a hooked bill with a special tooth to attack birds and mammals, break their necks, and often impale them on a sharp object. This loggerhead shrike skewers a mouse on barbed wire (below). Sometimes collecting dozens of victims, the birds thus store food or anchor large prey while they tear it apart. Males build conspicuously gory caches to attract females.

But many shrike species are declining. Like meadowlarks, bobolinks, and some sparrow species, shrikes inhabit grasslands under increasing pressure from development and farming. That explains some loss, scientists believe, but not all. A mystery: Even where shrike habitat has remained intact, their numbers are still falling.

LANIUS LUDOVICIANUS BY TOM J. ULRICH

National Geographic, February 1994

Some Bighorn Sheep Face Steep Odds

Alone in a sunbeam's spotlight, a desert bighorn sheep finds a nook amid the crags of Anza-Borrego Desert State Park in southern California. Much scientific attention has focused on this subspecies of wild sheep in recent years. In 1979 the population was estimated at nearly 1,200, most within the park. Now there are only about 400.

What happened? Many newborn lambs have not survived, and some adults have died from respiratory infections. A $300,000 study by the University of California at Davis identifies several potentially deadly pathogens in the sheep's blood. Longtime area observers suspect that the diseases have been transmitted by cattle, which were not removed from the park until 1987.

"All bighorn sheep are very susceptible to infectious disease, and this population has been more exposed than any other," says Steve Torres, coordinator for the state's bighorn sheep program. After drought-busting rains last winter, lamb survival was high, inviting short-term optimism.

OVIS CANADENSIS CREMNOBATES BY DAVID MUENCH

A Genetic Coup: Plants That Produce Plastic

Future farmers may harvest a surprising cash crop, its seeds sown in the field of genetics. Scientists have engineered a plant that produces an environmentally friendly form of plastic.

ARABIDOPSIS THALIANA BY KURT STEPNITZ, MSU/DOE PLANT RESEARCH LABORATORY

Researchers worked with a weed called mouse-eared cress, like these untreated seedlings. After two genes from a certain bacterium were inserted into the cress, it grew granules in its tissues of a plastic called polyhydroxybutyrate, or PHB. "It's like the plastic in milk containers," says Chris Somerville of Michigan State University. He foresees much greater PHB production from sugar beets or potatoes.

Some kinds of soil bacteria also produce PHB, which is biodegradable. One British company uses the bacterial process to make plastic for shampoo bottles. But such PHB costs five dollars a pound to produce; plastic-from-plants scientists are aiming for five cents a pound.

Radio Collars Track Caribou and Win Friends

Learning how scientists study caribou, Vernon Edwardsen, an Eskimo middle school student from Barrow in northern Alaska, prepares to release a female, her radio collar now in place. For several years the state Department of Fish and Game in Kotzebue has invited students to help collar western Arctic caribou on the Kobuk River. They learn how biologists track and try to protect the herd of more than 400,000 animals on which Eskimos still largely depend.

The plan also may be improving relations. "In Kotzebue there is strong sentiment against outside interference," says Jim Dau of Fish and Game. "We hope this is a way to show that we're not bad guys. When I see kids around town who have helped us, they always ask how their caribou are."

—John L. Eliot

EDWIN C. "BUD" NELSON

On Assignment

S. W. SOMMER

"I hate heights," says freelance photographer JAY DICKMAN, dangling 40 feet above the rushing Hunstein River to focus on Francis Malekai collecting leaves for a botanical expedition. "But you can't think about that when you're working."

You can think about home, though. On assignment deep in the Papua New Guinea rain forest, Jay hadn't been able to call his pregnant wife and young son for several weeks. Then he finally got a ham radio transmission patched through to them in Littleton, Colorado.

"Don't be scared," he told his wife over the phone, "but could you call the Centers for Disease Control for me? I need to know what medicine to take. I think I have malaria."

He didn't, however—and got home, healthy, in time for the birth of daughter Maggie. Jay is used to working in perilous places. In 1983, on staff at the *Dallas Times Herald*, he received a Pulitzer Prize for his coverage of the war in El Salvador. Jay has participated in ten *Day in the Life* photographic book projects. For this issue he also covered the Tatshenshini-Alsek Wilderness Park in British Columbia.

As a boy, freelance writer JACK RUDLOE found his turtles in a Brooklyn dime store. His mother, a nurse, brought home vitamins for the pets, which grew so large over the years that the family finally donated them to the Staten Island Zoo—where they promptly fell prey to the alligators.

ANNE RUDLOE

Jack is still fond of big turtles, but these days he finds them more plentiful south of New York City. At a beach near Tamarindo, Costa Rica (left), Jack checks a leatherback research subject before her release to the sea. He had spent the previous night hugging the huge creature, holding one of her front flippers as she was wired for body-temperature studies. "That was one saintly turtle," says Jack. "I was so tired at one point, I fell asleep on her head, and she just let me rest there. With some kinds of sea turtles, I'd have been hamburger."

Jack is the author of five books, including *Time of the Turtle*. This is the fourth article for NATIONAL GEOGRAPHIC by him and his wife, marine biologist Anne Rudloe. They make their home in Panacea, Florida. Jack doesn't keep turtles as pets any more, he says, "but it would be a better world if every kid had a turtle."

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Geoguide

Sea Turtles

• Most female sea turtles come ashore several times every two or three years to nest. Yet we know little about how sea turtles navigate, where they grow up, or how long they live. Why is it so difficult to study sea turtles?

• A leatherback hatchling, smaller than a child's hand, may grow to a length of six feet. Children can visualize that enormous growth by making a paper cutout of a leatherback (grocery bags opened out and taped together work well). The carapace should measure six feet by three feet. What advantages might such size give a sea turtle?

• The eggs of a loggerhead sea turtle look like Ping-Pong balls. A female lays about 110 eggs in one nest; they hatch in less than two months. Very few hatchlings survive to adulthood. What are some dangers that sea turtles face, and how can those threats be reduced?

• Discarded plastic bags resemble jellyfish—a favorite food for some sea turtles. Turtles swallow the bags, which can block their digestive tracts and kill them. A child can see how much a plastic bag looks like a jellyfish by floating one in a sink full of water. What can families and communities do to keep plastics and other trash out of the sea?

• Twice yearly, leatherback turtles migrate as far as 2,700 miles, equal to about 39 degrees of latitude. You can use the supplement map in this issue to help a child measure 39 degrees due north or south of home.

BOTH BY BILL CURTSINGER

SUE STEERE (ABOVE) MEETS A YOUNG GREEN TURTLE OFF GRAND CAYMAN ISLAND. A NEWLY HATCHED KEMP'S RIDLEY TURTLE (LEFT) SCRAMBLES TOWARD THE SEA ON MEXICO'S GULF COAST, THE SPECIES' CHIEF NESTING REGION.

USE THE GEOGUIDE PAGE ALONG WITH THE ARTICLE "SEA TURTLES: IN A RACE FOR SURVIVAL" IN THIS ISSUE TO HELP CAPTURE THE INTEREST OF YOUNG READERS AND STIMULATE DISCUSSION WITH THEM. GEOGUIDE IS PUBLISHED FOUR TIMES A YEAR.