DOUBLE MAP SUPPLEMENT: THE UNITED STATES/AMERICA'S FEDERAL LANDS

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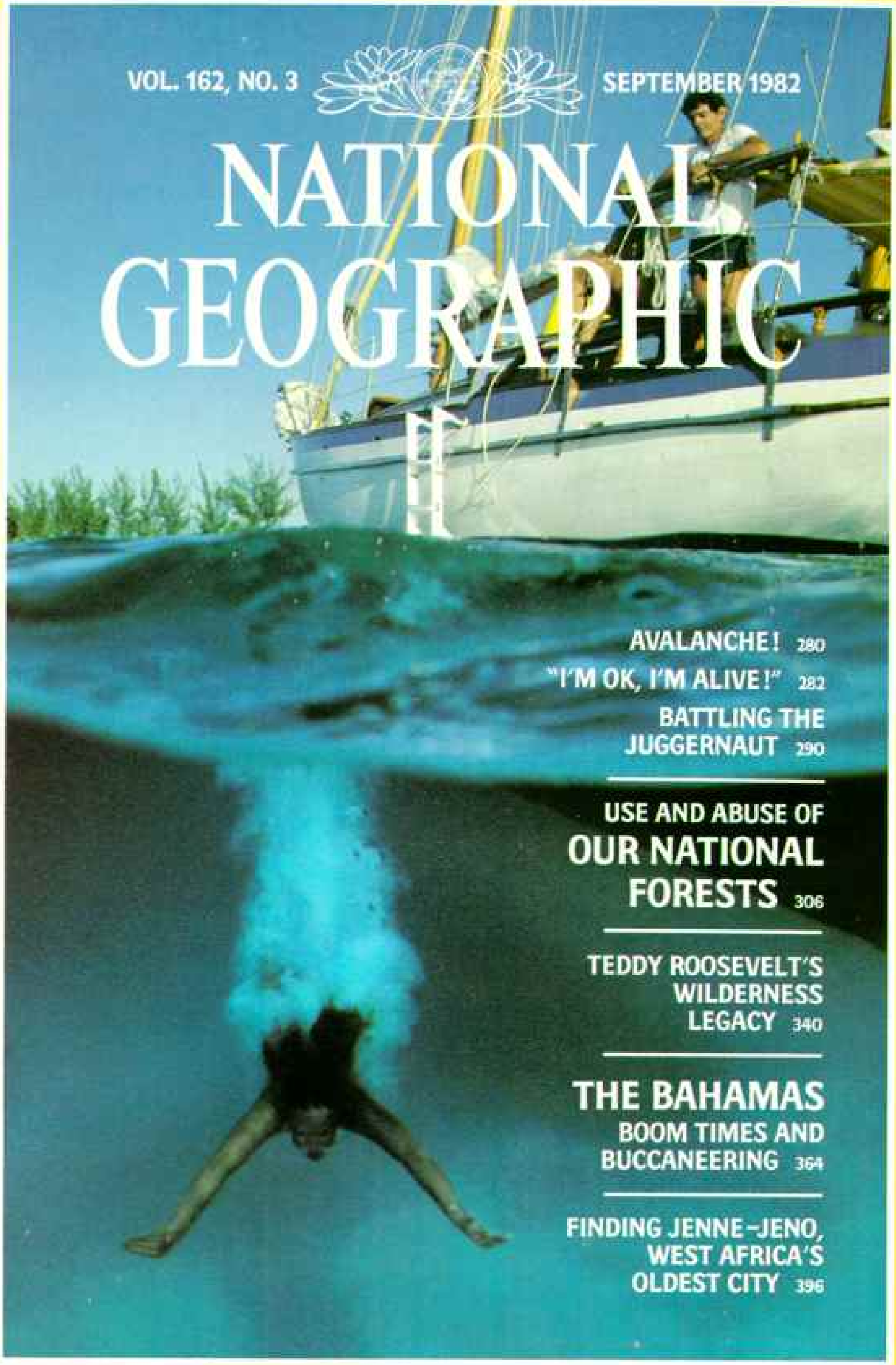

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"I BELIEVE the government ought to withdraw all timber lands it possesses and . . . appoint a competent forester who would make it his sole duty to see that the covering which nature has afforded our mountain tops should be preserved . . . and the time to act is the present. . . ."

The "present" was 1893, and the authority quoted in an early NATIONAL GEOGRAPHIC was not a John Muir or a Henry Thoreau but the president of the Arizona Lumber Company, one Denis M. Riordan, 19 years before Arizona became a state.

Now, nearly a century later, we're still concerned about our forest lands. One reason we have any left to worry about: The advice of this lumberman soon became law. When it was still considered heroic to conquer the wilderness, President Theodore Roosevelt—both an avid hunter and a pioneering conservationist—set aside 230 million acres of federal land for national parks, monuments, forests, and wildlife refuges. Also, under his administration the U. S. Forest Service was founded in July 1905.

In this issue we take a look at how well—or poorly—this controversial agency has succeeded in protecting the forests. We also study the environmental record of Roosevelt, who set aside more land than any other U. S. President. He was a land grabber to some, even today, but a farsighted idealist to most of us.

Recently, the West's "sagebrush rebellion" has challenged the legal and logical justification for withholding mineral- and forest-rich federal lands from development. Today, under the Reagan Administration, the traditional sanctity of federal lands is being officially questioned.

Under the premise that you can't tell the players without a scorecard, one side of our United States map supplement to this issue presents a comprehensive look at America's federal lands and natural resources.

To quote the Arizona lumberman further, "I believe it is the duty of every person who can give the matter thought and . . . influence any one's action . . . to make some endeavor to perpetuate our forest conditions for the benefit of future generations. . . ."

We are those future generations, and we now face a worldwide problem of how to deal with a misused planet. More than ever, for the benefit of generations still ahead, it is important to "give the matter thought."

Wilbur E. Garrett

EDITOR

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COVER: *A sailboat exploring off Great Abaco in the Bahamas drops anchor in a sea of pleasure. Photograph by Bruce Dale.*

AVALANCHE!

WINTER'S WHITE DEATH

BREAKING LOOSE with savage power, an avalanche cascades into Big Cottonwood Canyon in Utah's Wasatch Range. Among nature's most eccentric and dangerous forces, avalanches each year claim scores of lives around the world. Triggered unpredictably, they may flow like rivers of icy cement, entombing everything in their path. Or they may hurtle like rockets, throwing before them blast waves that can blow houses apart and toss trucks like toys.

Villagers try to tame them with barriers. Snow rangers seek to control them with explosives. Scientists strive to understand their structural, thermal, and mechanical properties. Yet an avalanche remains as unstoppable and mysterious as the beast of the German folk riddle that flies without wings, strikes without hands, and sees without eyes.

Last March its force was demonstrated yet again when a mountainside of snow roared through the Alpine Meadows ski area in California, tragically taking seven lives but—miraculously—sparing four.

DAVID CUPP

"I'M OK, I'M ALIVE!"

BY DAVID CUPP

PHOTOGRAPHS BY LANNY JOHNSON AND ANDRE BENIER

WHEN THESE WORDS from Anna Conrad, a ski-lift operator, drifted out of the wreckage of the ski-lift terminal building at Alpine Meadows, dreams beyond dreams became reality. After five days of icy entombment under tons of snow and debris, Anna was alive. Workers stripped away the rubble, and the young woman was lifted out (***facing page***).

Little did she suspect the ordeal to come when, ten days earlier, snowflakes began to fall. But the snowfall became a blizzard with winds gusting to 125 miles per hour. Snow pounding out of the skies packed into perilously unstable masses. Avalanche danger soared. On March 30, 1982, Alpine Meadows closed its mountain; the next day it ordered most of its employees home.

In spite of the extreme hazard that afternoon, Anna Conrad and visiting friend Frank Yeatman decided to ski the half mile from her house to the ski area. As they approached, mountain manager Bernie Kingery watched grimly, then called Anna into the ski-patrol office and lectured her on the incredibly dangerous thing she had just done. When Bernie finished, Anna went back to the locker room, looking for Frank.

It was at that moment—on the afternoon of March 31—that the avalanche thundered down the mountain. Shock waves hit first. Massive steel beams flexed, bending and twisting as if made of rubber. As snow-laden wind shrieked through, the structure exploded. A third force, rampaging snow, destroyed almost everything still standing.

When the avalanche struck, a row of heavy wooden lockers crashed down on Anna, injuring her head. Instead of crushing her, however, they fell across a wooden bench, forming a five-foot-long, two-foot-high space in the snow. Anna awoke to find herself wrapped in a cocoon of snow and wood. "It was black; I had no idea where I was or what had happened." She also had no way of gauging the passage of time. For perhaps 24 hours she drifted between unconsciousness and agonizing periods of wakefulness.

Sometime on April 1, she found some matches. Lighting them, she discovered names on the lockers above her. Finally she knew where she was. But, more important, she had discovered a defense against the cold. "I kept pulling clothes out of the lockers whenever I felt chilly." When Anna was rescued, she had on three pairs of ski pants. Her diet, though, had been meager—snow.

The effort to rescue Anna and the others had begun on March 31, when dogs were brought in to help 150 searchers. Bridget, a German shepherd, caught Anna's scent and led a search party to her tomb on Friday, April 2.

"I heard voices yelling, 'Anna, Anna, are you down there?' And I yelled back, 'I sure am.' But they never heard me," she recalled. Then the voices stopped, and Anna could hear the muffled crunch of snow as the searchers walked away.

Unknown to Anna, the snowstorm had turned vicious again, increasing avalanche danger and aborting all rescue efforts. Two

days passed. Finally, on Monday, April 5, Anna heard once again the sounds of human activity above her. She knew she couldn't survive much longer; running out of snow to eat, she could feel herself becoming increasingly dehydrated. "I was just grabbing snow and eating it as fast as I could. . . . I also prayed a lot that day."

Once again, Bridget had caught her scent, the first time in North America that an avalanche dog had found a person alive. Fifteen searchers, working ten feet above her, began removing debris. "All of a sudden," Anna remembered, "there was a small area where some light shone through, and I saw snow sifting in. I was thirsty, and snow meant water! I grabbed for it." When her rescuers saw her hand, one shouted: "Anna, is that you?"

"I'm OK, I'm alive," Anna called back.

As the debris was being stripped away, Bernard Courdurier reached into the hole to hold Anna's hand (***right, top***). Then she was given oxygen (***right, bottom***). Gently the young woman was lifted into a waiting helicopter. As the aircraft lifted off the ground, euphoria soared. A tumultuous cheer came from the searchers, so loud Anna heard it above the roar of the jet helicopter.

Looking down, she saw, for the first time, the havoc of the storm. A stark steel skeleton (***left***) was all that remained of the summit terminal building. Wreckage covered five acres. Huge trees had been snapped off like toothpicks; snow was piled 20 feet high. The magnitude of damage was beyond anything even imagined.

The nightmarish experience cost Anna much of her left foot and all of her right foot. But unlike seven others, Anna survived.

Deadly white torrent

IT WAS WAR for the men on the avalanche-control team at Alpine Meadows. For four days a blizzard had been heaping two to three feet of snow daily on an already deep pack. They fought back with explosives, throwing 250 charges a day to trigger slides and pounding the high ridges with cannon. Still, it was a battle they couldn't win.

The avalanche came on March 31 at 3:45 p.m. Flying on layers of light snow, weighty slabs thundered across the entrance road, catching trail crewman Jake Smith (1) in an icy grasp. Ripping across the mountain, the slide swept over visitors Leroy and Laura Nelson and David Hahn (2) and roared into the summit terminal building (3)—all this within ten seconds. Amazingly, four of the seven people inside survived—maintenance man Randy Buck, night security man Jeff Skover, and lift operators Tad DeFelice and Anna Conrad. Visitor Frank Yeatman died inside. The bodies of mountain manager Bernie Kingery and lift operator Beth Morrow were found 150 feet away.

PAINTING BY JACK UNRUH

If Alpine Meadows had a heart and a soul, it was Bernie Kingery (***above***). He was also the leader in the struggle against avalanches. For those five days last March he waged a losing battle against the snow. But when the risks to avalanche fighters rose too high, he sent the troops home. Only a skeleton crew remained to protect the lodge and the road.

Kingery himself stayed on, of course. Pacing in the ski-patrol office in the summit terminal building, he planned what to do next. Jeff Skover, Randy Buck, Tad DeFelice, and Beth Morrow waited with him. Suddenly a garbled message from road guard Jake Smith blared from the radio. One word was clear: "AVALANCHE!" Seconds later it struck in all its fury, starting with a low whistle and swelling instantly to a screaming crescendo.

As the building exploded, Jeff grabbed a countertop. Randy and Tad dropped to the floor. In the slowed motion of Jeff's mind, time almost stood still, he remembered later. Beth lifted her eyes beseechingly to Bernie, before bending her head against the wind. Bernie was standing so close, Jeff could have reached out and touched him. The avalanche expert turned slightly, then, as if in a dream, floated away across the

room, caught up in the first blasts of wind.

The sound changed pitch, to a roar louder than anything Jeff had ever heard. He dived beneath the counter as the wall behind him disintegrated. Tad saw his friend Jeff release his grip, then he too floated across the room, disappearing into whiteness.

When the snow stopped, Randy and Tad were nearly buried inside the shattered building, but their lives were saved by a massive, 22-ton concrete ski-lift counterweight a few feet behind them. Jeff was hurled 100 feet and, except for one hand, buried. Randy was able to quickly dig himself out and help excavate the two others.

Six were not so lucky. Within 24 hours searchers had pulled the bodies of Beth Morrow, Jake Smith, Frank Yeatman, Leroy and Laura Nelson, and David Hahn from the snow.

On the fifth day, Anna Conrad emerged alive. An hour later they located the body of Bernie Kingery, his hand clenched as if continuing the battle (***above***). Friends wouldn't have expected less.

In the United States, the Alpine Meadows slide was the worst avalanche disaster in 20 years, but its tragic loss of life was but a fraction of the toll exacted by avalanches on a worldwide scale. * * *

AVALANCHE!

BATTLING THE JUGGERNAUT

TEXT AND PHOTOGRAPHS BY DAVID CUPP

ALPINE MEADOWS was not the only mountain where the silent snow thundered this year, and people died. Around the world, snowslides took a mounting toll.

January 31: An Austrian avalanche kills 13 skiers, 12 of them children.

March 14: Ten slides in France claim 13.

March 22: Two slides in 24 hours kill 16 in Japan.

March 25: 15 killed in Turkey.

In the United States an estimated 100,000 avalanches occurred in the mountain West, about average for a typical snowy year. Yet the number of people killed in snowslides has quadrupled since the 1950s.

The reason: More people are venturing into steep, avalanche-active areas in winter. Backcountry sports such as skiing and snowmobiling are becoming more popular each year, and while recreationists may excel at these sports, many do not understand the nature of avalanches, hair-trigger killers that rarely permit a single mistake.

An avalanche is born when a mass of snow accumulated on a slope is overloaded with large amounts of new snow, or changes internally so that its bond with the slope beneath is loosened. The mass can be so unstable that the weight of a single skier can break the delicate cohesion, sending a mountainside hurtling down (pages 294-5).

At the start, an avalanche slab breaks off and fractures. As it gains speed, the descending mass breaks up into a river of flowing snow, generating a cloud of snow dust that may roil upward hundreds of feet. Inside the avalanche the dense core picks up more snow as it advances, accelerating in growth and speed. Fully developed, an avalanche may attain a mass of a million tons.

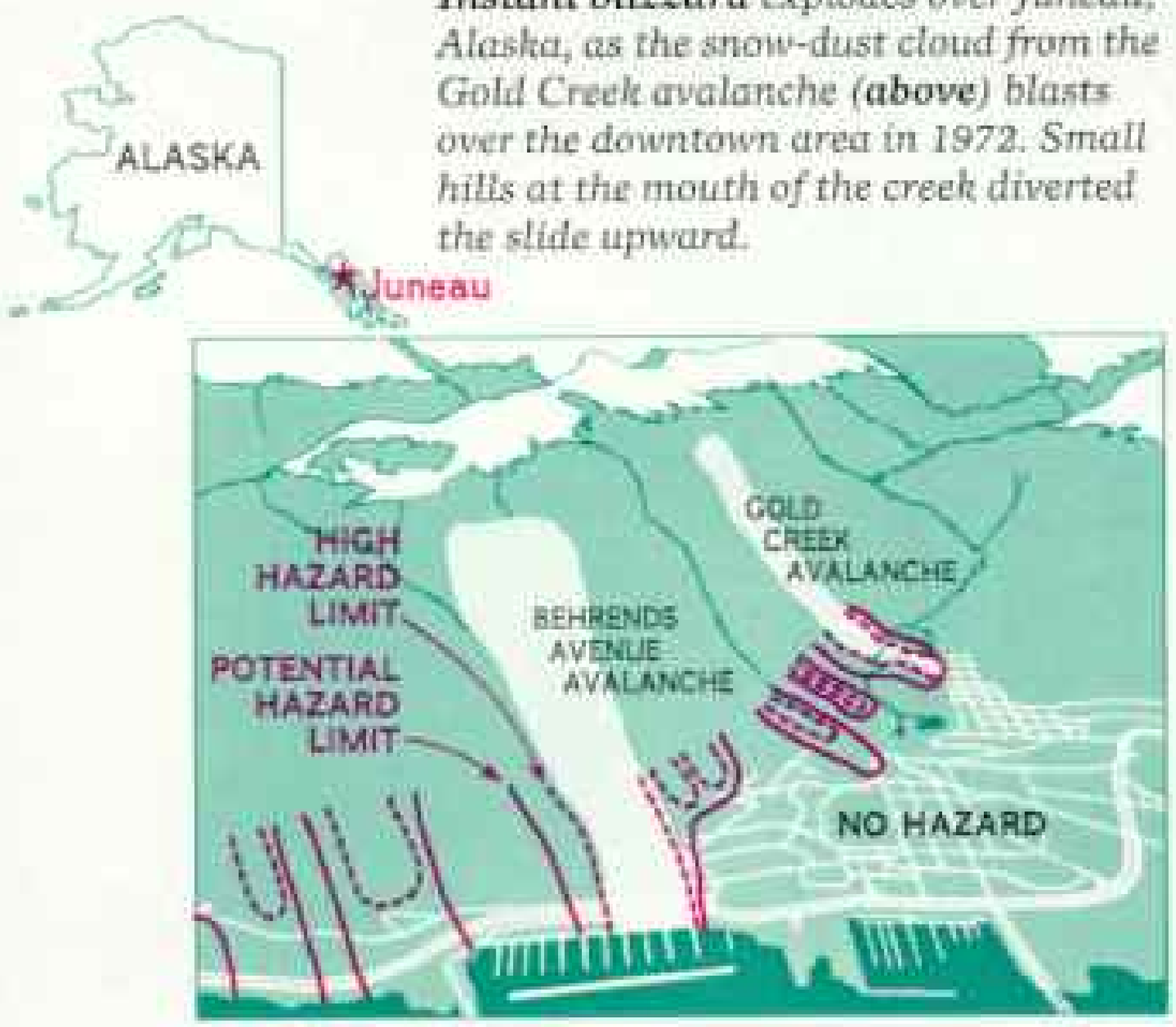
As velocity increases, the onrushing mass may rise and become airborne, riding almost friction free atop a cushion of air. In flight it can attain a speed of 200 miles an hour, twice that of a free-falling sky diver.

Such avalanches possess awesome power. In slide-prone Japan monster avalanches have registered impacts of 145 tons per square meter, 48 times the force that can demolish a frame house. These juggernauts often push before them an invisible air blast—probably the force that collapsed the building at Alpine Meadows.

Yet avalanches need not be large to be lethal. In Utah I saw a slide that had moved only 50 feet, yet buried and suffocated a skier. Like most avalanche victims, he was

Forbidden forest *to citizens and livestock alike, a triangular patch of woods shields the Swiss village of Andermatt from avalanches. An edict to protect the vegetation was issued in 1397 after nearby forests were stripped bare. Preserving wooded slopes is but one way to survive in the shadow of an avalanche.*

Instant blizzard *explodes over Juneau, Alaska, as the snow-dust cloud from the Gold Creek avalanche* ***(above)*** *blasts over the downtown area in 1972. Small hills at the mouth of the creek diverted the slide upward.*

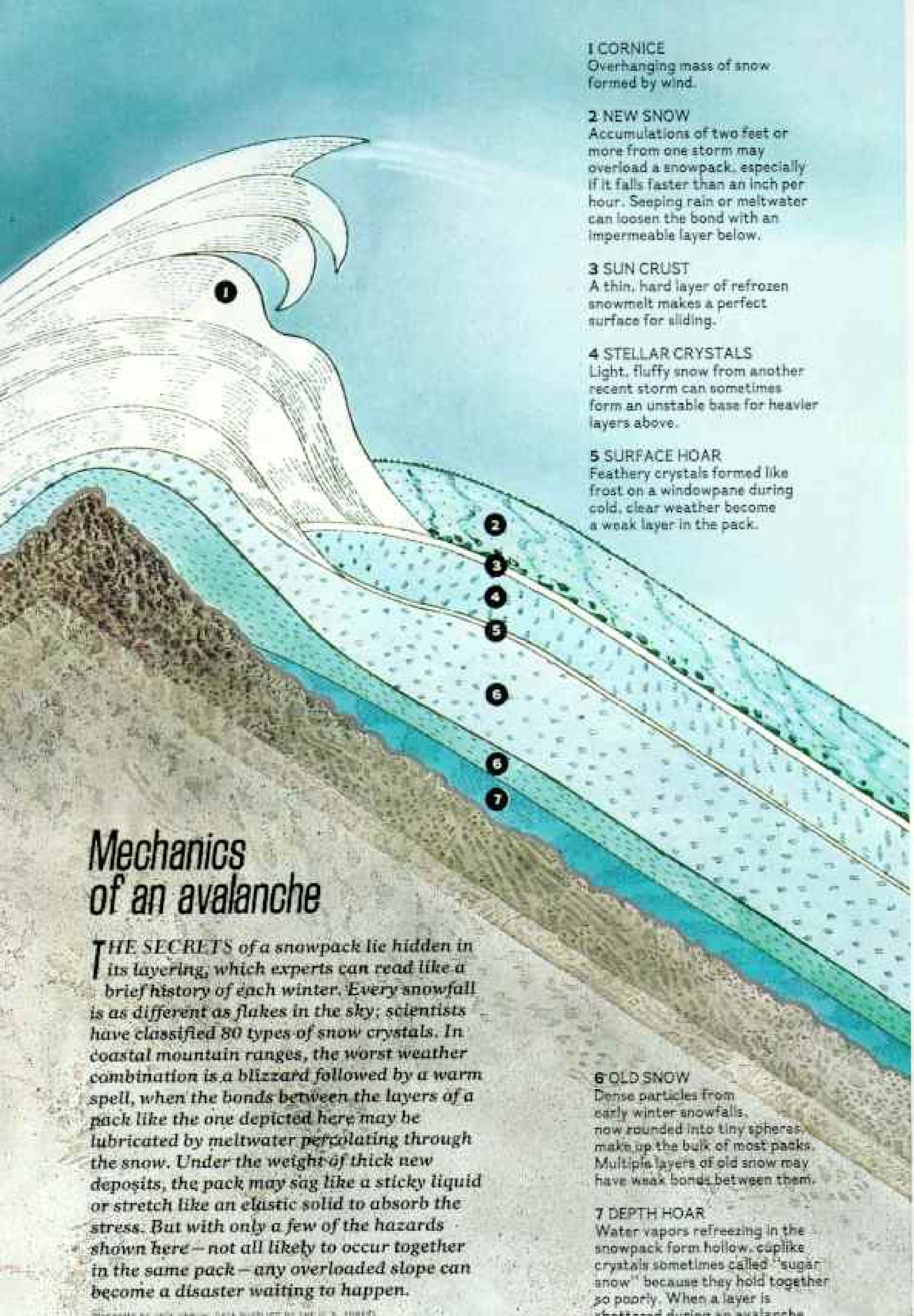


KEY TO PHOTOGRAPH AT RIGHT

Called the nation's worst risk for a major avalanche disaster, Alaska's capital ***(right)*** *has expanded into avalanche paths. One subdivision, along Behrends Avenue* ***(drawing, left)****, was built in the slide path of avalanches that at least once reached the waterfront. But because no major slides have hit in the past 20 years, residents there say they aren't afraid. "If it comes down and does a little bit of damage, we could eventually replace that," one homeowner explained. "If it comes down and wipes us out, then it will be too late to worry."*

In Switzerland many towns enforce restrictions against building in such high-risk areas. But Juneau's government and many citizens have been reluctant to adopt such measures, despite grim warnings from leading avalanche experts.

JONATHAN GRAY (ABOVE)



1 CORNICE
Overhanging mass of snow formed by wind.

2 NEW SNOW
Accumulations of two feet or more from one storm may overload a snowpack, especially if it falls faster than an inch per hour. Seeping rain or meltwater can loosen the bond with an impermeable layer below.

3 SUN CRUST
A thin, hard layer of refrozen snowmelt makes a perfect surface for sliding.

4 STELLAR CRYSTALS
Light, fluffy snow from another recent storm can sometimes form an unstable base for heavier layers above.

5 SURFACE HOAR
Feathery crystals formed like frost on a windowpane during cold, clear weather become a weak layer in the pack.

Mechanics of an avalanche

THE SECRETS of a snowpack lie hidden in its layering, which experts can read like a brief history of each winter. Every snowfall is as different as flakes in the sky; scientists have classified 80 types of snow crystals. In coastal mountain ranges, the worst weather combination is a blizzard followed by a warm spell, when the bonds between the layers of a pack like the one depicted here may be lubricated by meltwater percolating through the snow. Under the weight of thick new deposits, the pack may sag like a sticky liquid or stretch like an elastic solid to absorb the stress. But with only a few of the hazards shown here—not all likely to occur together in the same pack—any overloaded slope can become a disaster waiting to happen.

DIAGRAMS BY JACK UNRUH. DATA SUPPLIED BY THE U. S. FOREST SERVICE MOUNTAIN SNOW AND AVALANCHE RESEARCH PROJECT

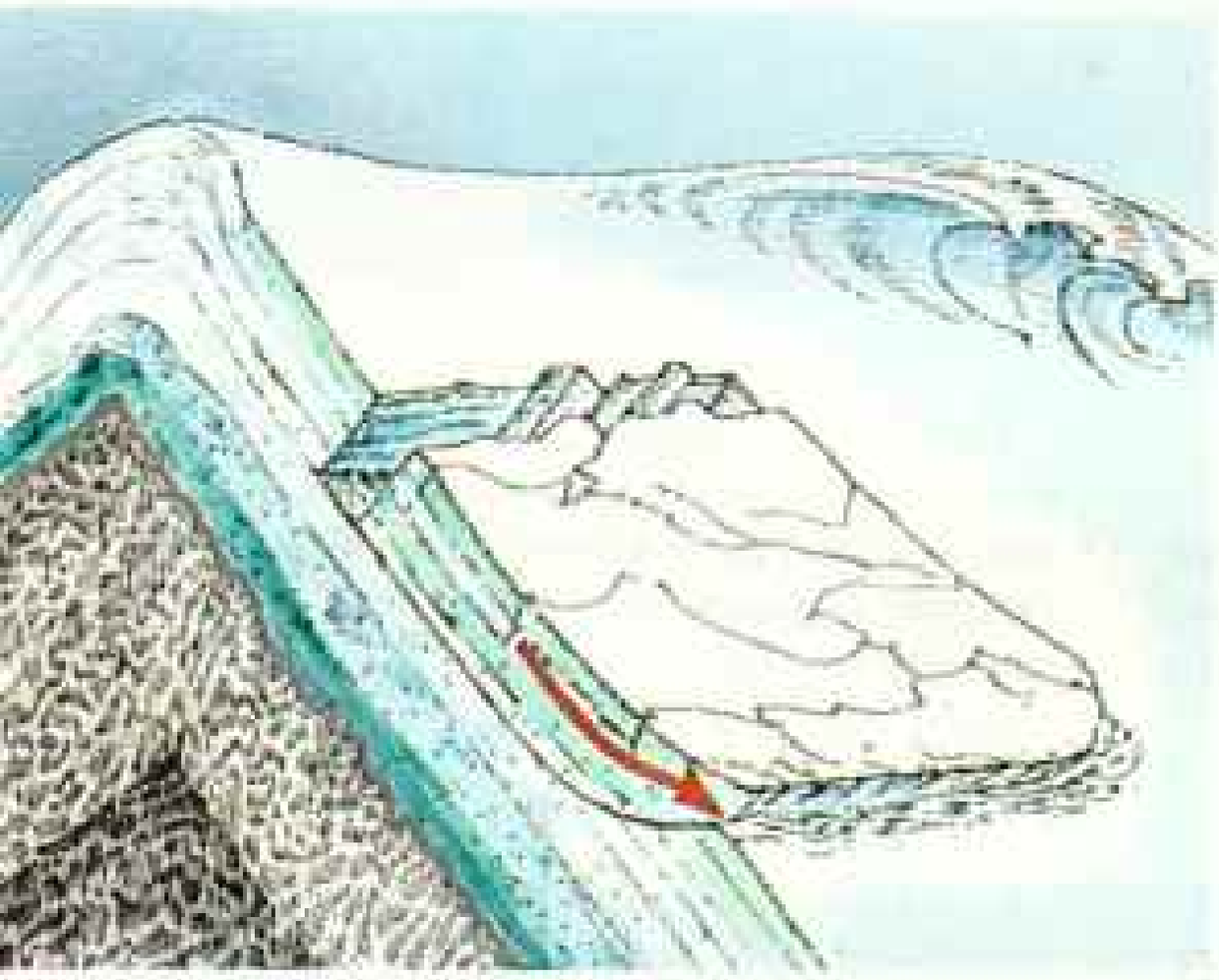
6 OLD SNOW
Dense particles from early winter snowfalls, now rounded into tiny spheres, make up the bulk of most packs. Multiple layers of old snow may have weak bonds between them.

7 DEPTH HOAR
Water vapors refreezing in the snowpack form hollow, cuplike crystals sometimes called "sugar snow" because they hold together so poorly. When a layer is shattered during an avalanche, they act like ball bearings, whisking the entire pack down the slope.

trapped only a few feet under the surface.

Why hadn't he clawed his way to safety? When a spent avalanche piles up during runout, the coalescing snow compacts to ice-like consistency. In Colorado a skier trapped only ankle deep had to free her feet from her boots to escape an avalanche's icy grip.

THE GREATEST known avalanche disaster occurred in 1970, when an earthquake-triggered ice slide obliterated the town of Yungay in Peru, killing 18,000. The worst U. S. avalanche buried two snowbound trains near Stevens Pass in Washington in 1910, taking 96 lives. In Canada four days later an avalanche struck railroad workers as they cleared the tracks of snow from an earlier avalanche. Sixty-two died. In 218 B.C. the snowy Alps killed half of Hannibal's 38,000 soldiers.



TRIGGERED by rapidly accumulated snow, earth tremor, or perhaps an unsuspecting skier, a slab avalanche (above) shatters only seconds after fracturing from the slope bed. Great blocks of snow disintegrate as they tumble, raising a cloud of icy particles (right) that spills down the mountainside like a heavy gas, often propelling a blast wave before it. Nearly frictionless, a few dry, powdery avalanches have been clocked at more than 200 mph, while even denser slides often move faster than the swiftest downhill racer.

The most bizarre devastation, however, occurred during World War I, when avalanches became weapons of war.

In 1916 Italian and Austrian troops were fighting for control of the Dolomite Mountains, which both claimed. Erwin Aichinger, then 22, was a lieutenant in an Austrian ski troop.

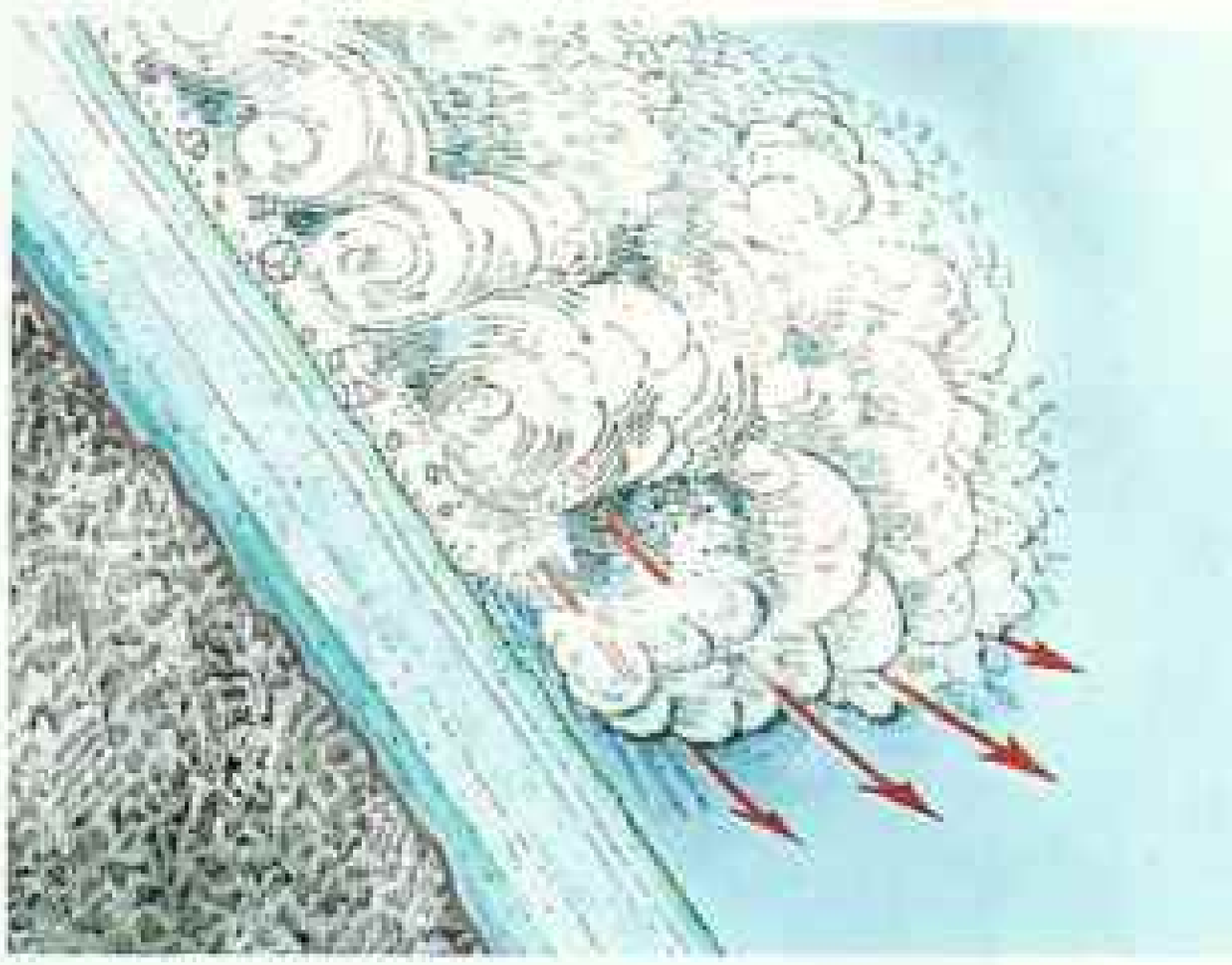
"It was December," the old soldier recalled, "and we had three days of snow. Gale winds packed the snow into the slopes where avalanches form.

"When the storm stopped, the fighting resumed. Both sides noticed that their shellfire triggered avalanches. A dreadful idea took hold. Gunners raised their sights to the mountaintops, where the great snow masses hung, and sent them crashing down.

"The terrified soldiers below retreated to their shelters, but the avalanches destroyed them. Rescuers were killed too. In 48 hours 6,000 Austrian troops died. The Italians . . . who knows how many perished." (An estimated 18,000 men died on both sides in those two days.)

IRONICALLY that battle was the forerunner of modern avalanche control. Today, cannon deployed at safe distances routinely blast accumulations of snow, releasing them while still small enough to be managed.

This warfare with nature is most intense along Rogers Pass in Canada's Selkirk Mountains, in eastern British Columbia. Here one of the world's largest avalanche



***Howling winds** build a potential avalanche on Mount Stephen in the Canadian Rockies' Yoho National Park by loading it with drifting snow (**above**). Windblown snow can form dangerously deep slabs on leeward slopes.*

*Outside Anchorage, Alaska, a wind blast from an avalanche wrapped a van around a tree as if it were a candy wrapper (**below**). Its owner, away skiing, returned to find it flattened to less than a foot thick after flying about 35 feet.*

programs is fought by two Austrian-born brothers, Fred and Walter Schleiss, and a detachment of the Royal Canadian Horse Artillery. Together they protect 25 miles of Canadian Highway 1 as it runs a gantlet of 160 massive avalanche paths.

It was a little past midnight, and snowing. Suddenly Highway 1's avalanche warning lights changed from yellow alert to fiery red: Rogers Pass was too dangerous to travel. Soldiers quartered at the summit of the pass sprang out of bed, attached their modified 105-mm howitzers behind their vehicles, and headed out into the storm. Walter Schleiss and I followed.

A mile from where the soldiers set up their cannon, Schleiss stopped our truck directly in the path of an avalanche, where he could best observe the gunfire's effect. Over the radio the gun crew informed Schleiss that they were ready to shoot.

"Let her go," he ordered.

For a moment the wind stopped. I heard the cannon's report, then a sound like tearing paper as the projectile ripped the sky. In seconds the flash of the shell threw a circle of light on the distant mountain.

Twelve more seconds ticked off, then the sound of the explosion reached our truck. Walter leaned forward, straining for another sound. "You can hear it," he said. "I hear the avalanche coming toward us."

I heard it too. A rumble, then a roar, growing more intense; the sound that scientists associate with the largest avalanches. Suddenly clouds shrouding the mountain parted, and an apparition of churning snow plunged toward us.

Walter jammed the truck into reverse and roared backward. In the farthest reaches of the headlights the avalanche dust cloud crashed like a tidal wave across the spot we had left. "The core stopped just short of the road," chuckled Walter, "but the dust cloud could have swept us away if we hadn't moved." I understood his sense of satisfaction: Another perilous section of Highway 1 was safe again, for a while.

Back at headquarters on the summit, Fred Schleiss recalled another even more harrowing day at the gun position.

"A tractor trailer stalled right under the avalanche, but we had to shoot—the pack was getting too big to handle. The driver had left the truck. The gun crew fired, and the slide started down.

"The air blast preceding the avalanche lifted the rig 80 feet in the air, carrying it directly over the gun position. Then the avalanche, which had become airborne half a mile up the mountain, sailed over both the flying truck and the gunners. My vehicle and another were lofted 150 feet, and a mile of highway was buried under a million cubic yards of snow. By a miracle no one was killed."

LIKE CANADA, Switzerland calls on elite troops for avalanche control; their tunics bear a unique insignia: a snowflake. Yet shooting avalanches is not the rule there. Because of the heavy mountain population, releasing avalanches artificially can only be done on a limited basis.

Historically, Swiss villagers have shielded their homes behind massive masonry structures or man-made mounds of dirt. Called splitter wedges, these were shaped like a ship's prow, facing uphill (page 303).

After the winter of 1951 unleashed a horror of avalanche deaths, the Swiss demanded greater protection. The little nation launched a vigorous program to build defense works high up the slopes, in the avalanches' starting zones.

One of the mightiest of these defenses protects the 150 inhabitants of St. Antönien, a remote village cradled by the towering mountains near the Swiss-Austrian border. In this oft struck hamlet, villagers talk about bad avalanche years the same way the French talk about good wine years. On a steep slope high above the village bristle rank upon rank of fencelike structures made of concrete and steel, anchored in the rock. Now, when a slab releases, it is slowed and finally stopped by these defenses.

Yet fear still haunts St. Antönien. "One problem is tourists who come for cross-country skiing," Adrian Graemiger, who supervised construction of the fences, explained to me. "They come, but for two days and nights there may be nothing but snow falling, and they can only drink. When it stops, they explode from their lodgings and go skiing, before the fresh snow has consolidated. This triggers avalanches that kill not only the skiers but also the villagers below,

Catching dynamite *tossed by a fellow member of the Squaw Valley ski patrol, Jim Mott* (**above**) *plants a string of 60 two-pound charges in a huge snow overhang in the backcountry of California. Secured by three lifelines, Mott moves gingerly toward the cornice edge* (**above right**) *to poke a hole for the charge. The explosives, set off together* (**right**), *bring down the overhang, making the slope beneath it safer for cross-country skiers.*

"We use 300 to 350 charges in the morning for every six inches of snow that falls overnight," he explained. Yet, despite these precautions, avalanches can still occur. Mott was buried by one in January. "I had a radio strapped to my chest, so I could direct friends where to find me," he said. "But it took me 35 to 40 minutes just to get my hands to it because the snow was cemented all around me."

To save the town *of Wengen in the Lauterbrunnen Valley, Swiss authorities are erecting steel snow bridges on steep avalanche slopes above it. Designed to stabilize snowpacks before they build into*

monster slides, the 12- to 20-foot-high structures on this mountainside will cost millions of dollars and take decades to fully install. But to residents of the valley they are worth many times their weight in snow.

who know better than to go out onto the slopes then."

DEEP in Switzerland's past, it had the most effective avalanche deterrent: forests. Unfortunately, many Swiss forests are gone, cleared by woodcutters as much as 600 years ago. In so harsh a climate and such steep and rocky terrain, the forests have never grown back.

Where remnants still provide protection, they are considered so important that no one, not even children, can enter them. They are aptly called *bannwalds*—forbidden forests.

One of the most critical bannwalds clings to a slope above the village of Andermatt, amid mountains denuded centuries ago. From the air this battered triangle of dark trees looks like what it is, an old defender's final stand against roaring white hordes.

Forests seem an ideal solution: You plant trees and prevent avalanches. But most avalanche starting zones lie above timberline, or in otherwise adverse terrain.

Yet the promise of trees remains great; reforestation efforts are emphasized at the Swiss Federal Institute for Snow and Avalanche Research, the world's foremost facility for avalanche-protection study.

Another area of research is snow itself. Remarked Hans Gubler, an experimental physicist at the institute, "Snow is so complicated, we really know little of its physical

properties. As these mysteries unfold, science will come to understand the effects of time and temperature on the snowpack, and how they lead to avalanching."

The institute also focuses on avalanche rescue. "The most significant advance," said researcher Walter Good, "is a device known as a transceiver, invented by John Lawton of the U. S. It has led to the development of companion rescue. Each skier in a party carries a small transceiver, which can send or receive, and sets the device on transmit. When a skier is caught in an avalanche, his companions switch to receive. By listening to the intensity of the victim's transmitted tone, they can soon locate him."

In 1961 a skier's death gave new stimulus to avalanche-rescue research. Vanni Eigenmann, a young Swiss, was caught in a slide near St. Moritz. Ruth Eigenmann, the skier's aunt, became the spark plug of the protracted search effort.

"We found nothing with dogs or probe sticks, so we tried sonar. That was useless. We tried a magnetometer and found one ski, which at least gave us the direction the avalanche carried him. After three weeks we cut channels in the snow and found a ski pole. Finally we found the body of my nephew, using the magnetometer again. One of our probes had come so close it cut his trousers. Forty days had passed. . . ." Her voice faded into a memory. "The search techniques seemed medieval. That's when we had the

Last defense *for the 17th-century church at Frauenkirch in Switzerland, this bow-shaped wall* ***(above)*** *has split many avalanches. At St. Antönien* ***(left)*** *villagers have constructed similar barriers on the uphill sides of their houses, which were built only in places normally missed by slides. Avalanche bridges guard the ridgeline.*

idea of the Vanni Eigenmann Foundation."

The wife of a wealthy Milan industrialist, Mrs. Eigenmann assembled avalanche and scientific experts from all over the world to staff her foundation. They experimented with laser beams for searching the snow, but these penetrated only half a meter, and the average victim is buried a meter deep. They tried infrared beams and radar as well as sonar and magnetometers.

"There were drawbacks to everything," Mrs. Eigenmann told me. "No magic answer. Snow is so complicated, so difficult. But we didn't give up. Today we concentrate on companion rescue, since there is so little chance that rescue teams will arrive on time. The teams find only 5 percent of the victims alive."

A FIVE PERCENT CHANCE . . . the dreadful odds gnawed at Rogers Thomas, a U. S. Forest Service snow expert, when I joined him at a command post in Utah's Wasatch Range. For four days a storm had raged, dumping 80 inches of new snow into the mountain canyons. The Forest Service avalanche forecast center, one of four in the West, blitzed the airwaves with warnings of extreme avalanche hazard. Rangers manned backcountry trail heads, describing the danger to recreationists. But because the lands are public, the rangers were powerless to prohibit entry.

"Even if we're 99 percent sure a guy will get killed, we have to let him in," growled Thomas. Events bore him out. Within a month two skiers died in avalanches in Big Cottonwood Canyon. Flying over the Wasatch, Thomas was appalled. Tracks revealed where snowmobilers had been temporarily caught up in avalanches. "Incredible," the ranger said disgustedly.

A partial answer to this madness lies in education. "Every backcountry user should know certain basics," said Dr. Edward LaChapelle, an international avalanche authority. "He must know an avalanche risk when he sees one. Avoid slopes where chutes have loaded with windblown snow. Stay on the windward side. Avoid terrain where, if you get caught, you'll be carried over a cliff, buried in a deep gully, or swept into water."

Doug Fesler, an avalanche specialist with the Alaska Parks Division who teaches avalanche education to thousands of children and adults throughout the state, sounds a call for awareness on the part of recreationists.

"The main thing is to look and listen for the little clues mother nature is kicking out. If the snow settles with a 'woomp' beneath you, she's screaming in your ear."

***Welcome sight** to any slide victim, the cold nose of an avalanche rescue dog pokes into what might otherwise be an icy grave. This German shepherd, named Tansy, sniffed out the author beneath three feet of snow during an exercise at the Snowbird ski area in Utah. The only things more effective than trained dogs for avalanche rescue are small transceivers, which emit a signal to guide searchers to buried persons wearing them. For slide victims, there is a 50 percent probability of being found alive if discovered within the first half hour.*

STUDYING these signs becomes second nature for the cadre of experts who maintain snow safety at the nation's many ski areas. I watched them at work at Alta and Snowbird, two Utah resorts separated by a single ridge but bound together by the most severe ski-area avalanche problem in the U. S.

A storm had ended. In the blue predawn, gunners rode the first tram to the mountaintop and skied to their gun emplacements. Explosions reverberated like sonic booms across Little Cottonwood Canyon, blasting out avalanches too high or too dangerous to bomb with hand charges.

A second tram brought ski patrolmen, who would run the hand-charge routes. At a heavily loaded chute, a pair of ski patrollers ignited a one-kilogram explosive and lobbed the charge into the starting zone. Ninety seconds later it erupted in a gray geyser of snow and smoke. Shock waves shot through the unstable snow, and the pristine slope split in a spiderweb of faint fracture lines. The lines widened, and the avalanche hissed downhill. Another slope safe for skiers.

During a typical U. S. winter, some 80 ski patrolmen are swept up in avalanches. But few, if any, are killed. This is because of an unwavering respect for the snow and adherence to a crucial axiom: Keep avalanches small by repeated triggering, so they can't build into unmanageable monsters.

Snowbird blossomed a decade ago as a ski resort; Alta, its neighbor over the ridge, started as a mining town in the 1860s. Time has not been kind to Alta. Slides ripped it in 1884 and '85. Old newspaper accounts detail a train of other disasters.

In more recent episodes, houses have been damaged, a church partially destroyed, the Peruvian Lodge hit three times, the roof ripped off the Snow Pine Lodge, an automobile hurled into the second story of the Peruvian Lodge, and more than 20 cars were wrecked in parking lots. In 1964 danger became so extreme that the entire town was evacuated for two weeks.

But in recent years Alta also has been lucky—no one has been killed.

Juneau has been lucky too.

Mere mention of the Alaskan capital triggered a frank assessment by Dr. LaChapelle: "Juneau probably has the greatest danger of suffering an avalanche disaster of any U. S. city—an entire subdivision could be wiped out."

He was talking about the massive Behrends Avenue avalanche. If it again runs as big as it has in the past, it will crash through at least 30 homes, part of a high school, and a motel, and thunder on into the harbor where 500 boats are docked.

Before 1946 a single building occupied the slide path. Then suburban sprawl invaded, and with it came the Juneau luck. Major avalanches have swept the Behrends chute six times in the past century. But since the area was occupied, only an avalanche air blast has roared through, causing property damage but injuring no one.

In a report on this perilous situation—one of three such foreboding documents published by experts—Dr. LaChapelle calculated that a house with a 40-year life span had a 96 percent probability of an encounter with an avalanche. But, just as Californians live so easily with their earthquake threat, many people along Behrends Avenue calmly accept the almost inevitable slide.

Down at city hall Mayor William Overstreet put forth the explanation for inaction. "I think life would be awful boring if it were 100 percent safe." He smiled. "I'd like to paraphrase a former mayor of San Francisco: It's better to live a week in Juneau than an eternity in Anchorage.

"There's some danger in living in certain parts of the community, but I incline to the view that it's greatly overstated. The government has bitten off more than it can chew in protecting everyone from everything. We would be wiser to caution people, but let them run their own affairs."

PERHAPS THE AVALANCHE is like the proverbial tree falling in the forest. If no one is there to hear it, is there any sound? For eons avalanches have crashed down mountains, but, because people rarely visited the steep terrain, the dust clouds and snow debris settled harmlessly. No one heard them.

Today skiers and climbers seek out the very conditions—steep slopes, deep snow—that breed avalanches. Homes, too, infiltrate hazard areas. Too many can hear the avalanche's awful howl. □

Our National Forests: Problems in Paradise

WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE

Wealth of sylvan beauty and other natural resources, America's national forests are set aside to "best meet the needs of the American people. . . ." How that is done is a question of rising debate.

By ROWE FINDLEY
ASSISTANT EDITOR

Photographs by
DAVID CUPP

New growth reclaims spoil at a privately leased phosphate mine in Caribou National Forest's Mabie Canyon (left). Sulfuric acid adds toxicity (above) to a stream flowing from an abandoned sulfur mine on a private claim within the Toiyabe National Forest.

I CAN NEVER OWN a forest, even though the deed be in my name, and I think that is the Indian in me. But that forests own me, I have no doubt, for I have been making pilgrimages to them, summoned by every change of season, as far back as my memory goes.

So when I write of national forests, I confess that in any tug of loyalties, I am for the trees. This would pose no problem if the forests were solely living museums, to gladden eye and spirit. But from their beginnings they have served a multiplicity of uses, some of which consume the tree itself, or the soil it roots in, or mineral wealth far below. Some of these uses I applaud and others I abhor, which makes me like every other citizen. The task is to sort out the priorities.

It was no task at all before the 17th century, for horizons full of trees unrolled endlessly—a billion wooded acres of the continent. My mind's eye pictures how it was when the first little wooden ships from Europe slipped into the bays and estuaries of North America, to explore the shining rivers running inland and see everywhere the dark trees. The trails led over the Appalachians; those who followed, like Daniel Boone, seldom saw an unobstructed sweep of sky.

Daniel late in life reached the edge of the trees in western Missouri, a thousand miles from the Atlantic shore. But by then he and the country lived by the God's truth that, no matter how reckless we were with our axes, we could never run out of trees.

Hence when President Benjamin Harrison in 1891 proclaimed the first forest reserves, powerful foes called his action undemocratic and un-American. When President Theodore Roosevelt in 1905 formally created a Forest Service to be steward of the trees, he heard the same outcry, even though increasing numbers were by then aware that our forests could run out, or change in ways that would impair their beauty and wildlife.

I have heard many variations on the theme in recent months. I set out to gauge the health of our National Forest System, an array of real estate half as big as Alaska, containing many scenic jewels of our land. In a score of national forests from Alaska to Puerto Rico, I feasted my spirit on leafy solitudes, glaciered mountains, and gleaming lakes, and communed with creation's oldest and biggest living trees—the bristlecone pine and the mammoth sequoia.

My journeys also taught me what a behemoth of complexity the system has become—155 national forests and 19 grasslands on 191 million diverse acres variously labeled wilderness, primitive, scenic, historic, recreational, experimental; containing ski resorts, marinas, campgrounds, mines, oil wells, research laboratories, nurseries, fish hatcheries, mountaintop clusters of communications masts, one of the world's coldest, windiest weather stations atop New Hampshire's Mount Washington, the nation's most active volcano at Washington's Mount St. Helens, and some 280,000 miles of road including that cliff-hanger of a highway up Pikes Peak in Colorado.

I learned, too, what a firestorm of controversy centers on questions of how to use and not abuse our national forests. This barrage of discord has cadenced the national forest drama from the outset—but now the voices are more numerous and strident, because now we are a more numerous people leaning harder on public lands to cover shortfalls of energy and natural wealth. There are even some who think we must reassess those diadems of rugged splendor—our 80 million acres of designated wilderness, a third of it entrusted to Forest Service keeping. (See the supplement, **America's Federal Lands**, with this issue.)

NATIONAL FORESTS by law sustain a mix of uses—timbering, mining, watershed protection, grazing, recreation. In 1964 Congress passed the Wilderness Act, to set aside and preserve federal lands unspoiled by man. But the act allows exploration for minerals, gas, and oil in such areas until January 1984. Permits must be obtained, however, if such exploration involves probing beneath the surface, and federal agencies could recommend against applications deemed irreparably harmful to environment. A negative atmosphere discouraged applications.

Federal laws on minerals exploration and leasing give the final say to the Secretary of the Interior, and Secretary James G. Watt in a May 1981 staff memo on goals included one to "open wilderness areas." There followed a surge of applications to explore

wilderness for mineral wealth; as 1982 began, the number pending topped a thousand. A dozen bore the "recommended" stamp. Preservationists rallied and attacked with words, marches, and lawsuits. It was environmental warfare.

Oilmen saw it as a last chance to tap wilderness fields before they were locked away forever. "Congress never intended to deny public access to mineral wealth," Don Allen of the Montana Petroleum Association told me. He cited the Wilderness Act's provision for leasing through 1983.

Preservationists noted that this same act required mineral surveys of potential wildernesses to prevent locking away big deposits. The Wilderness Society, after making its own assessment, declared that present wilderness held only about 1.1 percent of national oil potential and 1.2 of gas, while other federal lands held 30 and 22 percent respectively; why not fully explore those nonwilderness lands first?

The fight soon focused on those million and a half roadless acres astride the Continental Divide in the Bob Marshall, Scapegoat, and Great Bear Wildernesses of Montana. With the best habitat for grizzly bears and the largest herd of bighorn sheep south of Alaska, with room to roam for thousands of deer, with eagles riding the skies, with cutthroat trout teeming in the sparkling headwaters of the Missouri and Columbia Rivers, this favored national forest realm spelled paradise to outdoorsmen.

Raising the ante for oilmen was the area's location squarely in a north-south swath across the intermountain West known as the Overthrust Belt. Here pleats in the earth's crust—the handiwork of massive overriding eons ago—contribute not only to scenic grandeur but also to mineral enrichment. I talked about it with Don Allen, whose Montana group is one of several whose members are eager for petroleum bonanzas.

"The Overthrust Belt has oil as well as gas," he said. "The gas prospects look best. Down the road this country will need much more natural gas—and not just for heating. Most people don't realize that 30 percent of our crop yield is due to fertilizer made from natural gas."

Some 700 lease applications soon had the three Montana wildernesses in their sights, and growing opposition coalesced into the Bob Marshall Alliance. The battling soon embroiled the Secretary of the Interior with Congress, the courts, and the media. The contest carried more than the usual freight of emotion, for at stake was not just any wilderness but the one that honored Bob Marshall, revered with Aldo Leopold as a father of our wilderness system.

Secretary Watt put wilderness leasing on hold—for the purpose, he said, of letting Congress consider amending the law, in effect a moratorium until after the November elections. Defenders momentarily lowered their guard against what they had come to call the "bombing of the Bob" (the expression plays on the oil prospector's need to explode small charges just above ground level or at shallow depth in order to record their seismic bounce). But leasing and exploration continued on nonwilderness lands, including some recommended as wilderness. Since exploration often includes, besides seismic blasts, the building of roads for test-drilling rigs, the quest will rob an area of the very quality that defines it as wilderness.

I SAW WHAT may happen to the Bob by visiting two nearby game ranges already being explored. The Sun River elk range, whose herd of 3,000 is the largest in the lower 48 states, still awaits its first drills. I saw it on a glowing October day when cottonwoods and aspens laced the Rocky Mountain Front with pure gold amid the light-devouring greens of pines and firs. The elk still ranged the heights near the Bob, spurning the gentler valleys while Indian summer lasted. The only jarring sights were a few square yards of mangled brush at intervals along a line of seismic soundings.

Next door, the 9,000-acre Blackleaf game range is already cored by three gas wells. The rig of a fourth rose just inside the adjacent Lewis and Clark National Forest.

Around each finished well, 10,000 or more square feet of trees and brush had been abraded away. The clearings included a dumping pool for oil wastes, a noisome goo. From each well a 50-foot-wide bald swath will delineate a pipeline leading to a collecting plant. Because this gas is heavy with poisonous hydrogen sulfide, the collector will be a "sweetener plant," which reduces the

The fate of A cross section

USFS archaeologist MADONNA MOSS:

"We made a lot of advances in archaeology in national forests in the past ten years. Now priorities have shifted, and our recent gains may be lost."

Montana rancher GEORGE SWAN:

"Here in this forest is probably the best rangeland in the United States. We don't want to abuse the range.'

USFS fire officer JOHN MARKER:

"The national forests' resources are this country's savings account. Maybe we're withdrawing the capital."

Former forestry school dean DR. ARNOLD BOLLE:

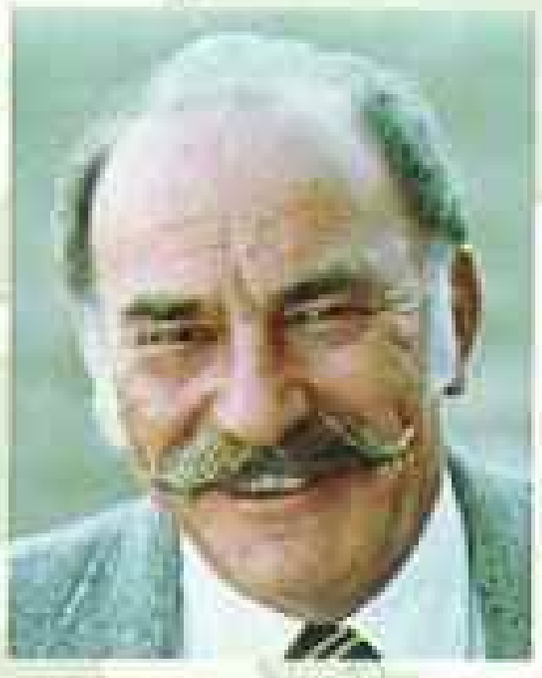
"The administration wants to log old growth, but 200-to-800-year-old trees are not a renewable resource. We need the scientific knowledge gained from them."

Wildlife biologist ROCKY GUTIÉRREZ:

"If the administration has its way with increasing clear-cutting, it's going to be pretty grim for wildlife that depends on old growth."

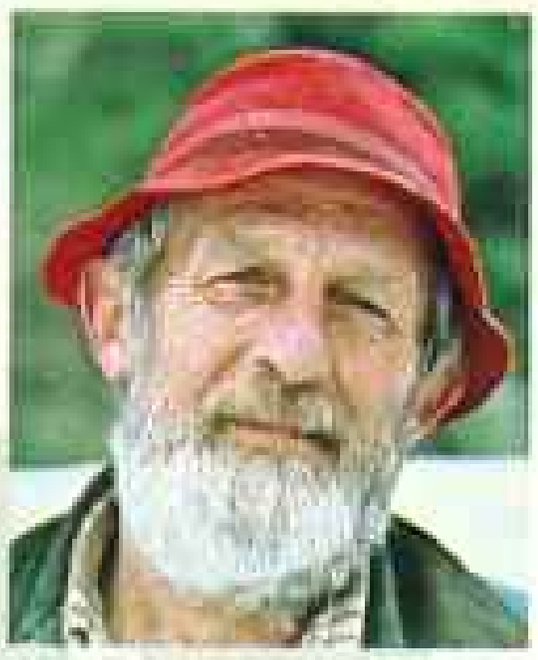
Watershed manager SID WILSON:

"The most important product of the national forests is water."



USFS regional forester CRAIG RUPP:

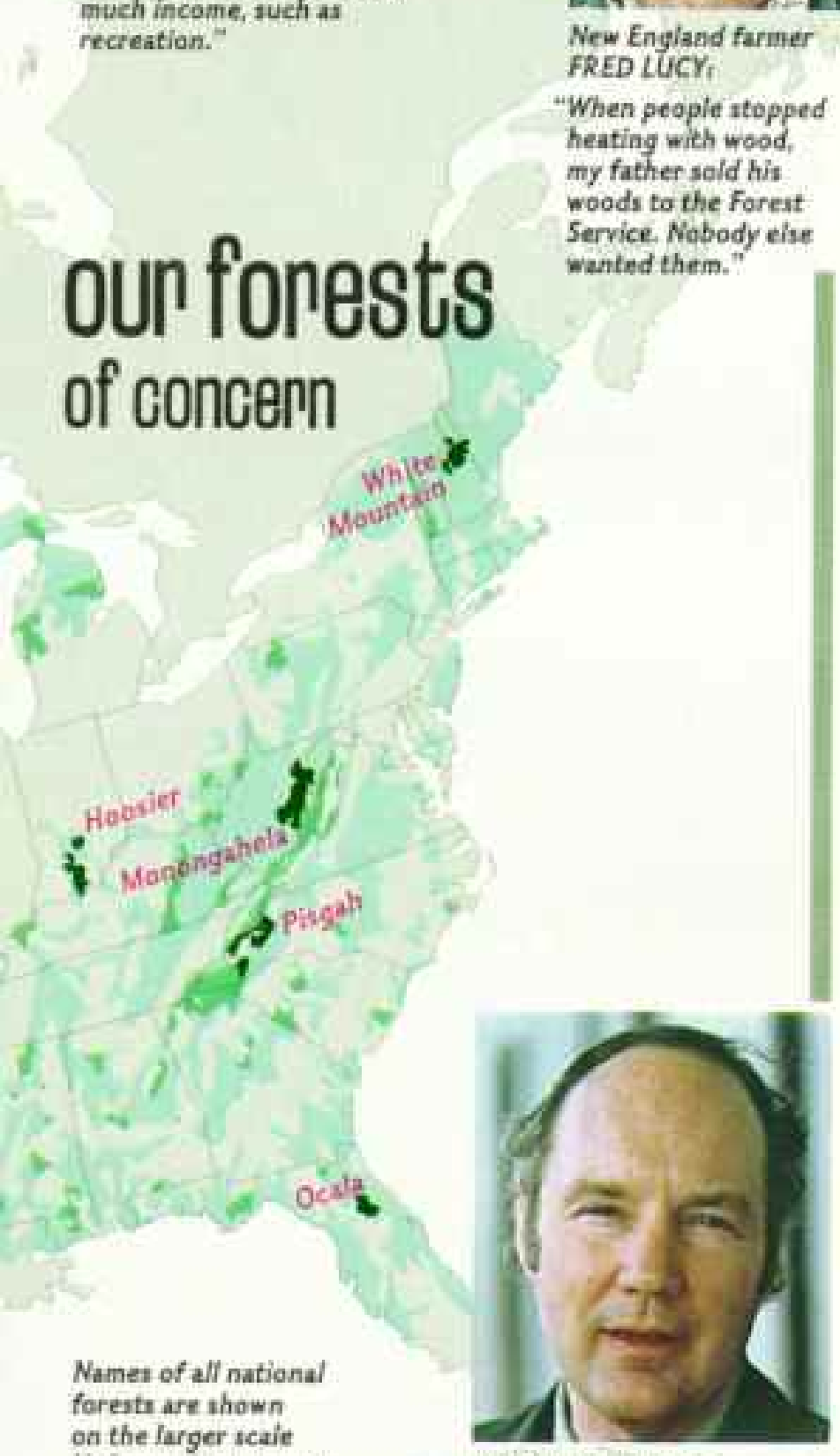
"The times are changing. Today it's a matter of dollars and cents. That makes it tough on uses that don't produce much income, such as recreation."



New England farmer FRED LUCY:

"When people stopped heating with wood, my father sold his woods to the Forest Service. Nobody else wanted them."

our forests of concern



Names of all national forests are shown on the larger scale U. S. supplement map in this issue.

USFS district ranger JACK CAMERON:

"Mineral royalties from my district can make more money than timber. These forests are more than trees."

DRAWN BY JOHN WEBER, COMPILED BY DON CARRICK
NATIONAL GEOGRAPHIC ART DIVISION

rotten-egg-smelling component to commercial sulfur that will be trucked away.

My Blackleaf guide was Neis Thoreson, supervisor of Region 4, Montana Department of Fish, Wildlife, and Parks. Nels's district, where the Great Plains run into the wall of the Rocky Mountains, is prime country for scores of grizzly bears.

"We're anxious to see what effect the wells will have on the movements of the grizzlies," Nels told me. To that end, radio transmitters have been fitted to several bears to trace their foraging rounds.

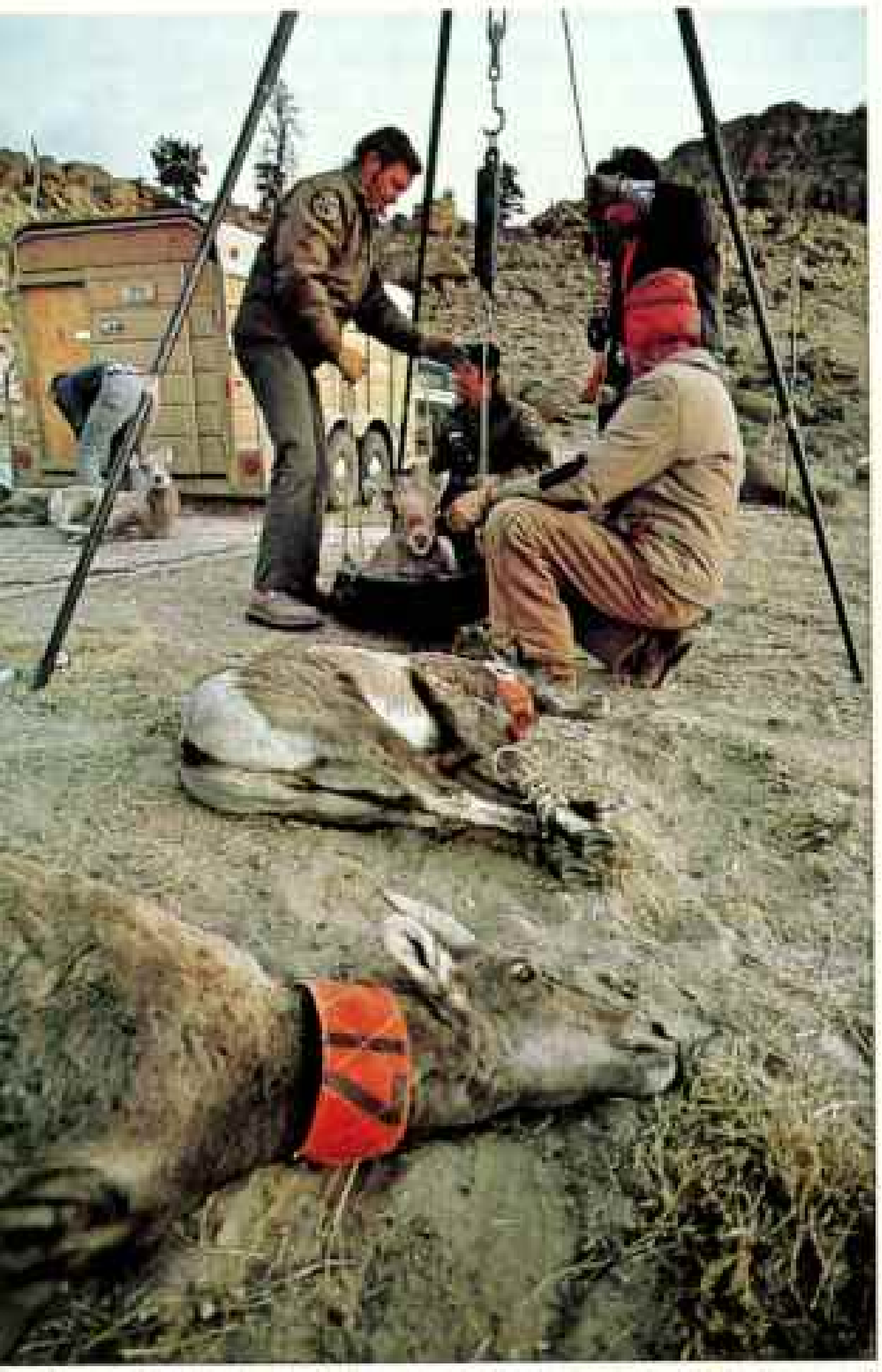
In-depth research must precede any trucks and pipelines in the Bob, according to Dr. Charles Jonkel of the University of Montana School of Forestry, who has devoted years to study of grizzlies: "All our studies have been contingent on the Bob's remaining a wilderness. If its status changes, much of what we've learned will be negated. And with increasing people pressure on grizzly habitat outside the wilderness, the Bob assumes more importance as a key to grizzly survival in the 48 states."

Over in Wyoming's Bridger-Teton National Forest, where several gas wells pump away, there has been a nasty by-product: gas-company vehicles sabotaged, tires slashed, oil plugs loosened.

In other forests other people battle over other treasures: coal in Utah's Manti-La Sal, where the so-called longwall system of mining is causing a forest to subside by several feet; grazing rights in Arizona's Tonto, where ranchers buck Forest Service efforts to reduce the number and acreage of permits; clear-cutting in Montana's Flathead, where the Forest Service overrode citizen opposition to a timber cut in grizzly habitat only to have the sale go begging because of sagging markets; geothermal power by drilling in Idaho's Targhee, where 160 lease applications have raised fears for Yellowstone's scenic geyser basin; the nearly extinct California condor in Los Padres National Forest, the northern spotted owl in Oregon, and the red-cockaded woodpecker in Florida. (But no one objects to efforts to save the engaging Puerto Rican parrot,

Spirits of the free range, *wild horses run a race they must lose near California's Modoc National Forest (**right**). With mountain lions and other predators eliminated, herds have expanded and now compete with livestock that also may graze national forest land under multiple-use policy. Unprotected by law until 1971, wild horses were captured to be sold for pet food or killed indiscriminately. Now wards of the federal government, horses and burros find homes through an adoption program.*

*Preservation of wildlife habitat by national forests often comes under pressure from other uses. Shrinking range, competition from domestic livestock, and lack of predators cause bighorn sheep to overuse prime habitat. The resulting concentration of feces fosters the spread of lungworms, which decimate bighorn herds. In Colorado, state wildlife biologists weigh bighorns (**below**) before transporting them to areas without sheep.*



which dwells in the system's only tropical rain forest and walks like John Wayne.)

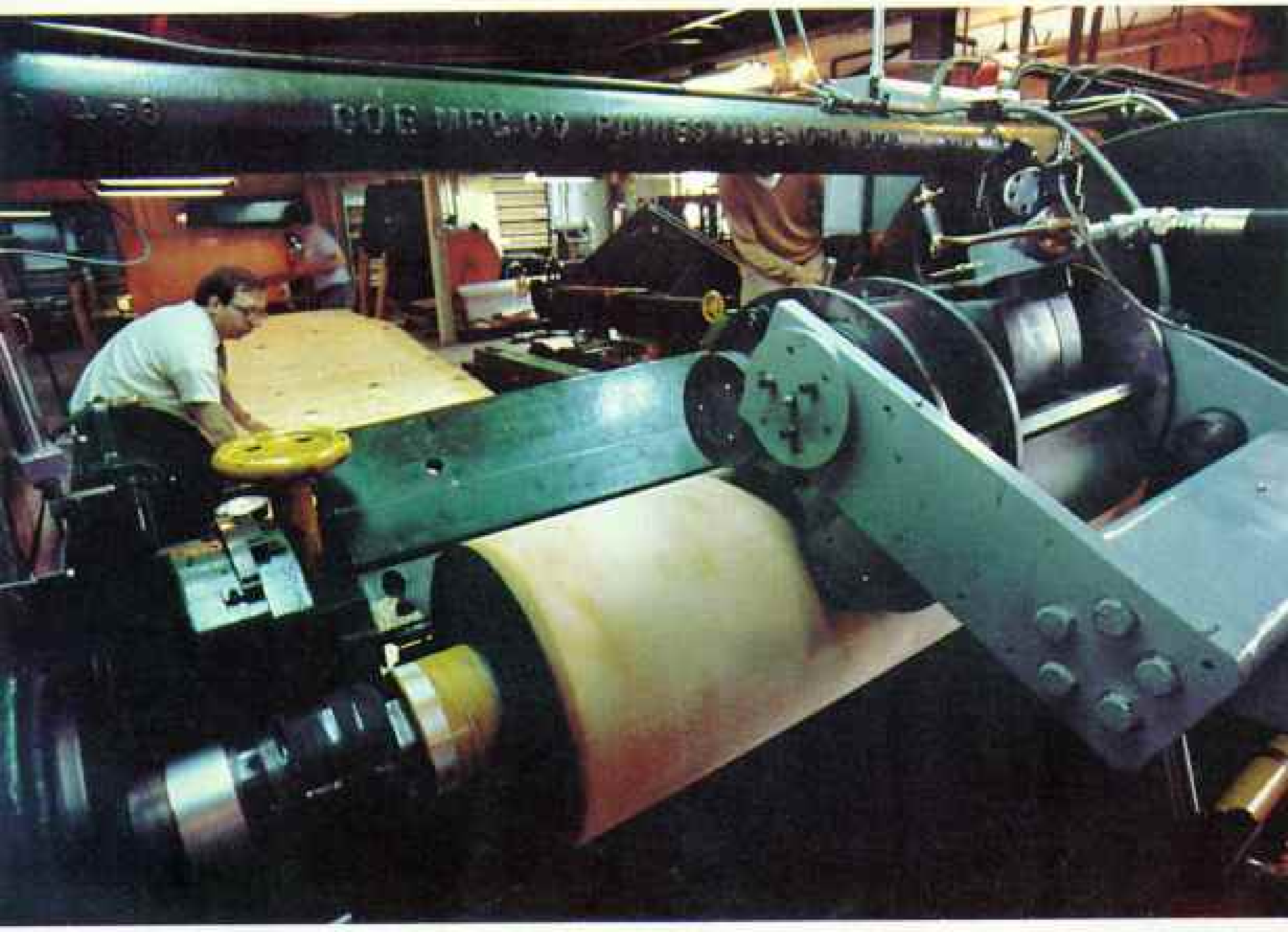
Other problems flare over watersheds, herbicides, off-road vehicles. There are even drives to repeal the state enabling acts that permit the federal government to acquire land for forest and watershed protection.

SUCH STORMS of controversy tend to obscure a basic function of national forests: growing wood. The Forest Service routinely sells timber on selected tracts by competitive bid to private harvesters. The volume historically has not exceeded the forests' rate of growth, and conservationists want no departures from this even-flow, sustained-yield policy. But the timber industry, noting predictions that wood use will double by the year 2030, presses for increased cutting to meet the need.

"Many western forests contain overage stands that will die and rot if they are not cut," John F. Hall of the National Forest Products Association told me. "They should be harvested over the next few years to make way for young productive forests.

"Together, private and public forests can serve domestic needs and again make this country a net exporter of wood." The U. S. last year imported about a third of its softwood lumber from Canada. The increased cutting, in the industry view, would compensate for a temporary shortfall from private timberlands, which need a breather after absorbing most of the rising demand of recent decades.

These views dovetail with the thinking of John B. Crowell, Jr., President Ronald Reagan's Assistant Secretary of Agriculture for Natural Resources and Environment, whose portfolio includes national forests. "Each year that we fail to cut a share of this old growth, we lose some of it to decay and insects. We also lose the growth potential of land occupied by old trees." Cutting orders hinge on completion of management plans



for the overage forests. "We want to consider all aspects, including effects on wildlife." He pledged that no species would knowingly be eliminated, though the numbers of some might be reduced.

Crowell was formerly general counsel of Louisiana Pacific Corporation, leading cutter of national forest timber. His Senate confirmation last year was delayed by fears that giving him the stewardship of national forests amounted to putting the wolf in charge of the sheepfold. He pledged to aim for balance among forest uses and to stay out of matters involving his former employer.

By more productive management of the 89 million acres of national forest land labeled commercial—that is, suited to growing wood profitably—he believes more use demands can be met.

"We could become the wood basket of the world," he said, "and without robbing future generations."

Acting on that conviction, the Forest Service announced plans to increase fiscal 1983 timber sales—in the face of a three-year backlog of national forest trees sold to timber harvesters and still uncut.

The virtual collapse of the housing industry torpedoed the lumber market. National forest tree buyers have had as long as five years to cut the timber, and prices bid only a year or two ago would now mean selling to the mills at a loss.

Across the nation at midsummer some 800 mills had closed or cut hours, and 86,000 mill hands needed work. In Northwest timber country the jobless rate was considerably above the national average; whole towns wrestled disaster. Many timber cutters teetered near bankruptcy; defaults loomed on sales contracts for 10 billion board feet.

In the emergency, Congress pondered long-term relief while Forest Service Chief R. Max Peterson extended deadlines for harvesting uncut timber sales. "Defaults not only cost the contractor," he said, "but also

Ideas grow from trees *at the U. S. Forest Products Laboratory in Madison, Wisconsin. The fermentation of yeast mixed with sugar derived from wood* ***(above)*** *produces alcohol that, combined with gasoline, yields a petroleum-saving motor fuel.*

In making veneers and plywood, manufacturers must often scrap logs too soft to stay in a lathe during peeling. This prototype of a modified lathe ***(left)*** *uses a powered backup roll, at right, that presses against the cylindrical log, center, ensuring even rotation. The innovation could save 50 million cubic feet of timber annually.*

Working in Alaska's Chugach National Forest, a researcher ***(right)****, armored against insects, gauges new growth in a marsh raised above tidewater by a 1964 earthquake.*

Giants of the forest *meet their match in the king-size vehicles of the lumber industry. Trucks such as this one in Alaska's Tongass National Forest* ***(left)*** *are equipped with beds ten feet wide that can carry logs 46 feet long, giving them twice the capacity of the largest log carriers allowed on highways.*

At Mount Hood National Forest in Oregon, John B. Crowell, Jr. ***(right,*** *at left), Assistant Secretary of Agriculture, discusses growth management with silviculturist Dave Ellen. A former lumber-industry executive, Crowell favors stepping up production by increasing the cutting of old growth—200 years old and older—and replanting with fast-growing species.*

delay reforestation and receipt of revenues, which are shared with local governments."

On timbering, as on most other issues, the Forest Service finds itself a target, often in a cross fire. Forest-management laws now call for public airings before significant changes in program are made. Usually the discussions help, but sometimes they thrust the forester into a clay-pigeon role.

STRIFE and vicissitudes, palaver and problems. Whatever happened to Smokey Bear?

"Smokey is alive and well and on the job," Chief Peterson told me in Washington, D. C. We talked about the barrel-chested, fire-preventin' bear in the ranger hat who became a celebrity to a generation of Americans for proclaiming: "Only you can prevent forest fires." The cartoon and poster bruin had a real-life counterpart, a black bear cub rescued from fire in New Mexico's Lincoln National Forest who became a star of the National Zoo in Washington, D. C.

Smokey is credited with saving many lives and avoiding losses of 20 billion dollars—and earning royalties of 2.5 million dollars, which go back into prevention.

Chief Peterson wondered if Smokey had succeeded too well, shaping a public image of the Forest Service as the unyielding guardian of woodlands, barring not only fire but chain saws and deer rifles as well.

"National forests have always been managed under a multiple-use concept," he said, noting that even those first woodland reserves set aside by Benjamin Harrison were timber in the bank against a day of need.

"Until the 1950s our role was largely custodial," he went on. "Because private forests filled most of our timber needs, demands on national forests were minimal. By then commercial stands had become mostly stumps and saplings, and industry looked to national forests for supply. That's when the timber question began to heat up."

A heat-provoking word was "clear-cut." Though the Forest Service had long allowed some clear-cutting—the felling of every tree on a specified tract—it had showcased the selective cutting of mature or overage trees. Forests thinned by selective cutting still pleased the eye, but clear-cutting left only a wasteland of brush and slash. Smoldering resentment flared in the 1960s into organized opposition, most heatedly in West Virginia's Monongahela National Forest and Montana's Bitterroot.

Edward P. Cliff, then Forest Service chief, remembers trying to convince West Virginians that the Monongahela cuts were good silviculture, part of a reforestation program: "The whole area had been logged in the 1890s or early 1900s. It was railroad logging, pushing spurs up every main drainage, clear-cutting everything they could reach."

The Forest Service argued it was replacing helter-skelter second growth with quality, even-aged timber. Opponents said virgin stands also were falling, costing wildlife, watershed, and recreation. After a decade of protest they sued in 1973, charging the Forest Service with violating the Organic Act of 1897, which specified cutting only "dead, matured, or large-growth" trees. They won, shutting down sales in Virginia, West Virginia, and the Carolinas until Congress voted the Forest Service new authority to cut trees. The National Forest Management Act of 1976 allows clear-cutting where deemed best. The debate goes on.

Clear-cuts are usually limited to 100 acres or less. Is that a reasonable maximum?

"There's no simple answer," Dr. Arnold Bolle told me. As dean of the University of Montana's School of Forestry, he led a study for a Senate committee on clear-cutting in the Bitterroot. The report assailed Forest Service economics and philosophy in the Bitterroot cuts. "It depends on the kind and age of the trees, slope of the land, kind of soil, amount of rainfall, species and numbers of wildlife affected," Dr. Bolle said. "Some places should never be clear-cut."

There were also problems for rangers in the 1930s in the Missouri Ozarks: woodland burnings set almost ritually each spring in the belief they hastened the grasses' greening; struggling peckerwood sawyers who fed their mobile mills with poached timber as an unwritten birthright; moonshiners whose smoking stills could draw an unsuspecting fire-fighting crew into a hail of gunfire.

"The first thing a ranger had to do," said Claude Ferguson, "was to convince the moonshiner he wasn't a 'revenooer.'"

CLAUDE AND I grew up in those hills, where, half a century earlier, the straight-grained yellow pine had drawn in big lumber companies. In less than a generation the prime conifers had been logged and hauled along narrow-gauge railroads to the mills, leaving the denuded hills to recloak themselves as best they could. What came back was mostly blackjack oak, and much of the land, considered nearly worthless by private owners, was eventually purchased by the federal government. It was a familiar pattern in our southeastern woods,

***Reduced to rubble** by the logger's saw, vast areas of private forest in Oregon's Cascades show the bleak result when entire mountainsides are logged (**facing page**), a practice called clear-cutting. Decrying the soil erosion and loss of wildlife habitat, critics advocate selective cutting of only the most mature trees. In nearby Willamette National Forest (**above**) a Forest Service team assesses possible damage by clear-cutting, now limited in national forests.*

a rape of the forest and a jilting of the land. But those woods accounted worthless became the nucleus of our national forest lands east of the plains.

The first units of the Mark Twain National Forest were being formed, one of them cradling the valley-and-hill town of Willow Springs, where I was born. With Claude and other friends, I did a lot of growing up in that forest, drawn by an inborn need to hike and camp and swim and fish in it. My dad hunted squirrel and quail in it, and an uncle farmed rocky fields bordering it.

Claude led our forays into the woods by dint of superior woodsman's lore, and went on to a career in the Forest Service, which was inevitability itself.

When I was a high-school senior, I earned a dollar or two from the same service—at 32 cents an hour, as I recall—fighting forest fires. When flames threatened, our school permitted seniors to go help save the Mark Twain's trees. Trading stuffy classrooms for a ride in green trucks into the glories of autumn woods, we seniors could not have been more pleased.

Feeling the pinch *from a depressed lumber industry, jobless workers line up for benefits at the state employment office in Eugene, Oregon (**right**). Lumber-related employment in Eugene and surrounding Lane County stood at 10,300 early this year, down from a high of nearly 17,000 in 1973. Mills began shutting down in Oregon and elsewhere in the Northwest in 1979. "Many will never reopen," says a state labor economist.*

*Work was still fairly steady in 1980 for third-generation lumberman Keith Miller and his father, Eugene, who takes a chain saw to a Douglas fir (**top left**). On-the-job injuries later ended the father's lumbering career, while unemployment idled the son for five months in 1981. Keith has since been employed only sporadically on a month-to-month basis. Here, at his Eugene home with one of his three children (**left**), he contemplates an uncertain future. "I don't want my kids to get into the lumber industry. There's just no security any more."*

FIRE IS A CONSTANT on the Forest Service's list of concerns, though its role and control have been significantly redefined. Once it was perceived as total villainy, and the attack strategy was absolute: "We had what we called the '10 a.m. policy'—when a fire broke out, you had to have it contained or a plan to contain it by 10 a.m. the next day," said Al Defler, then deputy supervisor of Idaho's Sawtooth National Recreation Area. "Now we look at the total picture on each fire, assess its effects on the resources, and decide when and where we want to control it. We learned we were doing too good a job of preventing fires and were paying some penalties for it."

Such as inhibiting the natural reseeding of the lodgepole pine, the jack pine, the sand pine, even the giant sequoia, whose seed cones spring open in response to the heat of the fire.

And allowing a forest floor to build up such a flammable layering that one spark can set off an all-devouring firestorm—one that generates its own gales and cooks the ground sterile deep down. Even the trees

whose thick bark protects them from normal fires cannot survive these holocausts.

"Fire is a natural process that prunes and cleans the forest periodically," Al said.

In a race with wildfire there's no time to change teams when flames cross a boundary of forest or county or city. Southern California has long been a model of fire-fighting teamwork. I saw the ultimate example of joint readiness at the El Cariso Station in Cleveland National Forest, where Forest Service-green fire engines await the alarm beside the red trucks of Riverside County.

I talked about it with Gene Bach, who wears two badges—county deputy fire chief and California state ranger.

"We're responsible for protecting state and federal forests, county land, and eight cities," he said. "In effect, we're one big fire department, including the U. S. Forest Service. When we have a fire, whoever's closest goes out and does the best he can."

Not only the threat of fire troubles the Cleveland. Its Trabuco district—161,632 acres of knife-sharp ridges, deep canyons, pinewoods, chaparral, and grassland—faces inexorable enclosure by Greater Los Angeles and its environs, which now press in on three sides. In this decade the Trabuco is doomed to become a rustic island in an urban sea, and already it is reeling under many of the problems of being within an easy drive of 12 million people.

WAS THERE EVER a once-upon-a-time when sylvan serenity cloaked the forest system? Gifford Pinchot, first professional American forester and first Forest Service chief, would remember battles rather than serenity. Trained in Europe's forestry schools—because the U. S. had none—the patrician and puritanical Pinchot found battle lines drawn when he returned home in 1890: "The exploiters were pushing farther . . . into the wilderness. The man who could get his hands on the biggest slice of natural resources was the best citizen. . . . I proceeded cheerfully to tackle the dragon. . . ."

With crusader fervor young Gifford believed forestry science could save the forests while yielding a sustained harvest. A chance to test his faith came in an offer from George Washington Vanderbilt to manage several square miles of timber around the latter's palatial Biltmore estate in North Carolina. Learning as he went, Pinchot tried selective logging, relied on nature's reseeding, fought fire and erosion, coddled the scattered stands of virgin oak, hickory, beech, and black walnut. With the project on track, he left it in the care of an assistant, and it thrived and ultimately became part of a national forest called Pisgah, after the Old Testament mountain that helped show the way to the Promised Land.

Armed with experience, Pinchot hung out his shingle as a forestry consultant, then became chief of the young Division of Forestry in the Department of Agriculture. As such he was sought for advice by New York's robust young governor, Theodore Roosevelt.

By 1905 T. R. was President, Pinchot was still the Agriculture Department's chief forester, and there was a Forestry Division under Interior's General Land Office, whose historic mission had been to pass the public domain into private hands, which it did with such dispatch that the language gained a new phrase: "a land-office business." Impressed by the 2,000 leaders who flocked to the second American Forest Congress in Washington, D. C., the U. S. Congress passed the fateful Transfer Act, shifting the Forestry Division from Interior to Agriculture and wedding it to Pinchot's little team of professional foresters.

Soon the forest reserves became the national forests; soon Pinchot's few professionals were augmented through a more generous budget. Pinchot also recruited free expertise by naming an advisory team from university faculties, including his alma mater, Yale, which in 1900 founded one of the nation's first schools of forestry. For four decades Yale graduates fired by Pinchot's vision led the Forest Service.

And just at the zenith of his career as chief forester, the post he coveted most in the world, Pinchot was brought down by the Achilles' heel in an otherwise impregnable character—a super zeal against any despoiler of the public domain. The name of his target, ironically, was Richard Achilles Ballinger, Secretary of the Interior. Pinchot saw him as party to a scheme to hand over valuable Alaska coal lands to a group of Seattle businessmen. When President Taft

rejected the charges of conspiracy, Pinchot took his case to the people. He won a full-dress congressional investigation but only after he had been fired for his trouble by a President who confessed unease around Pinchot and his radical ideas.

Though Pinchot later twice won the governorship of Pennsylvania, life never gave him another post to rival his Forest Service duty. "I have been a governor now and then," he said in his 80th year, "but I am a forester all the time—have been, and shall be, to my dying day."

PINCHOT set the Forest Service into a commotion of research that has never stopped. Through eight forest experiment stations, 970 scientists conducted 4,000 studies last year. Soils, watersheds, fire as an enemy and as a tool, how to wage war on the pine bark beetle and the tussock moth were among the diverse subjects.

In the 72-year-old Forest Products Laboratory in Madison, Wisconsin, I talked to scientists seeking new uses for wood. I saw a locomotive-size press that stresses logs to splintering destruction and powerful new glues that weld throwaway chips and slivers into attractive boards and paneling, even into beams that can support a steeple.

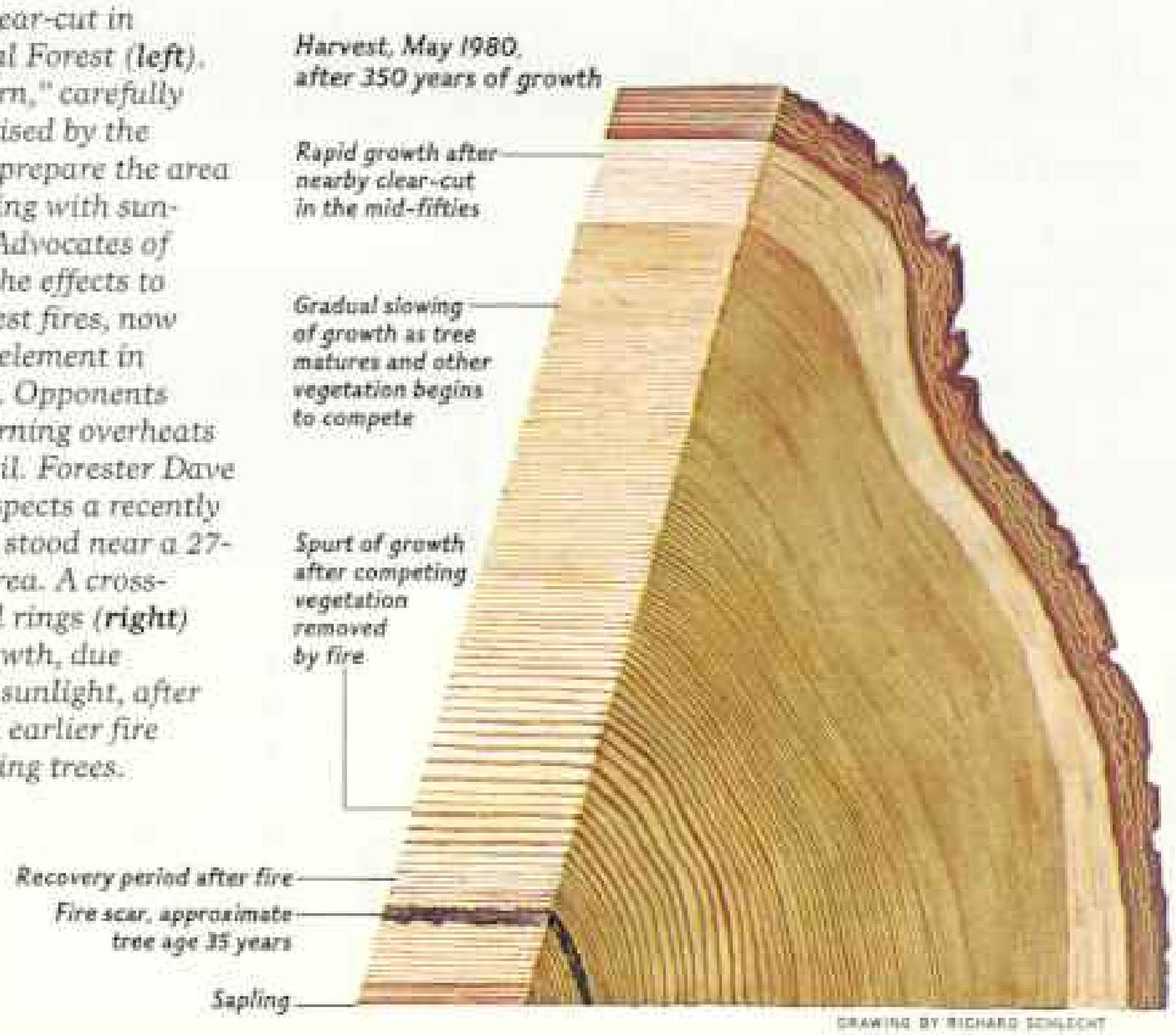
Beneath the blasted crown of Mount St. Helens volcano in Gifford Pinchot National Forest, an 84,710-acre Volcanic Area has been set aside for special management and study of the destructive impact of the May 18, 1980, eruption.

The battles that trees wage ceaselessly to survive are the life's work of Dr. Alex L. Shigo, known as the "tree doctor." In a Forest Service lab in Durham, New Hampshire, he told me that a tree wears the scars of every battle it ever fought.

"A tree can't heal itself," he said, "so it has to wall off the wound—to compartmentalize." Whenever the protective bark is broken, by a snapped-off limb or an axman's blaze, the fungi and bacteria that cause decay invade *(Continued on page 332)*

A virtual library of studies *for a single coal strip mine in Wyoming's Thunder Basin National Grassland awaits review by Forest Service officers Geoffrey Hulse, left, and John Lott. Contingent upon a host of federal and state regulations, the approval process for mines often takes five years.*

Fiery rain *from a "heli-torch" ignites slash on a clear-cut in Willamette National Forest* ***(left)****. This "prescribed burn," carefully planned and supervised by the Forest Service, will prepare the area for uniform replanting with sun-loving Douglas fir. Advocates of clear-cutting liken the effects to those of natural forest fires, now seen as a necessary element in forest growth cycles. Opponents charge that such burning overheats and sterilizes the soil. Forester Dave Burwell* ***(above)*** *inspects a recently cut Douglas fir that stood near a 27-year-old clear-cut area. A cross-section of its annual rings* ***(right)*** *shows a jump in growth, due largely to increased sunlight, after the clear-cut and an earlier fire that killed neighboring trees.*



DRAWING BY RICHARD SCHLECHT

Fighting Forest Fires

"FIRE ON THE MOUNTAIN, run boys run!" The eastern folk song fits well in southern California, worst hit wildfire region in the nation. Here Santa Ana winds, near hurricane force, hurl flames over ridges thick with tinder-dry chaparral in Angeles National Forest (**above**). *The week-long, arson-*

CHRIS JOHNS

kindled blaze burned 5,043 acres before 1,653 fire fighters brought it under control. Arson destroyed 38 percent of the 308,400 acres of national forest incinerated in 1980, a particularly bad year. Property losses can run high near the crowded coastal strips. Seven jurisdictions fight back with Firescope, a pace-setting computerized federal, state, and local alliance. Such efforts, and such modern weapons as bulldozers and chemical-bombing aircraft, have brought the science of fire control a long way since the record 1871 Peshtigo, Wisconsin, fire that claimed 2,000 square miles and more than 1,000 lives.

BACK-LIT BY BURNING FOREST at midnight, sawyer Kim McKillop shows the strain of battle in Oregon's Deschutes National Forest ***(above)****. An incendiary bomb of brush explodes onto a fire line* ***(above right)****. In a murky dawn, McKillop and others* ***(right)*** *collapse into weary sleep beside the line. They are part of the Forest Service's 20-person Rogue River Rough Riders, one of 54 elite Hot Shot crews that operate at the most dangerous points of major forest fires anywhere in the United States.*

Intensive training, peak conditioning, the best equipment, and high esprit de corps produce fire-fighting shock troops capable of manning a fire line for 24 hours with little or no support. "You don't let up because you'd be letting somebody else down," says McKillop. Many Hot Shots are college students. Steady pay and plentiful overtime keep some returning each spring for the fire season. There's also a deep-down conviction that they're the best.

ALL BY CHRIS JOHNS

(Continued from page 325) the exposed wood. The tree loads cells around the wound with substances that inhibit microorganisms—a sort of Great Wall.

When a forest giant is felled, a knowing eye at the planing mill can read in its dissection the story of all its wars—when lightning struck, a woodpecker drilled, a hungry deer gnawed, fire raced by (diagram, page 327).

Alex has found a way to detect those scars in living trees—an invaluable aid to science as well as wood users. He helped devise an electronic box with sensor wires. It was dubbed a Shigometer (accent the second syllable), and the name stuck. "It measures electrical resistance in wood," Alex said. "Dead wood cells—and that includes decayed areas—have less resistance than living ones."

There's a commercial market for Shigometers now, but no riches for Alex, because a federal employee can't profit from inventions made in the line of duty. Alex has no regrets, for his work is its own reward, as I found by following him on a diagnostic sortie among gleaming birches and pines on a sunny winter's day.

Taking a Shigometer reading on a patriarchal pine, he talked of trees as nature's factories, efficiently capturing solar energy, moisture, and soil elements to make an organic bounty that serves much other life, giving us shade and beauty, the myriad uses of wood, enriching the soil, depositing the makings of fossil fuels, adding vital oxygen to the air we breathe.

He talked of violins, of how wood quality helps determine tonal richness, of how the Shigometer could locate uniformly prime wood, so that every instrument from the hand of a master maker could be a masterpiece. Stradivarius was born too soon.

U. S. DEPARTMENT OF AGRICULTURE

*"**Only you** can prevent forest fires." That message from Smokey Bear, here seen on a shoulder patch, has paid off. Since 1945, when the Forest Service began using Smokey, the number of fires caused by carelessness has been cut drastically even as the number of forest visitors increased tenfold. "We had to make Smokey appeal to all age groups," says Rudolph Wendelin, who was artistic director of the Smokey program for nearly 30 years. "He had to have the right combination of friendliness and firmness." In 1950, Smokey's name was given to a real black bear cub rescued from a fire in New Mexico's Lincoln National Forest. After treatment for burns, Smokey was given a home at the National Zoo in Washington, D. C. Following his death in 1976, he was buried at Smokey Bear State Historical Park in Capitan, New Mexico. A new Smokey, also from Lincoln National Forest, continues to attract three million visitors a year.*

SOME NATIONAL FORESTS pose a problem for me because I'm a camper and not a cowboy. I recall a time when my wife, Virginia, and I found a piece of paradise cupped within the saw-blade horizon of Idaho's Sawtooth Range. Stanley Lake's snowmelt waters hid trout but reflected alpine majesty, and a campground invited us to stay and feast on serene beauty.

Serenity vanished, though, when cattle ambled across my campsite, aswarm with

hard-biting horseflies, letting the chips fall where they may. It made me wish that grazing permits could be so managed as to keep cattle from alpine lakeshores. That would be paradise regained.

But it might mean a grazing permit lost, part of a cattleman's life and livelihood. In the intermountain West the Forest Service has issued permits on 14 million of its 31 million acres for 1.1 million sheep and cattle.

LINGERING EFFECTS of overgrazing scar high country in Utah's Manti-La Sal National Forest. I could see them as I threaded undulating Skyline Drive along 11,000-foot ridges for more than 50 spectacular miles.

"By the 1900s you could count the sheep herds up here by the number of dust clouds," said Dr. Stan Welsh of Brigham Young University, my guide and longtime friend. We talked about how stockmen in the 1880s mistook an abnormally wet cycle for the norm, and greatly expanded herds: "Utah alone had nearly three million sheep."

The 1890s brought drier, more normal years, and starving herds ravaged native vegetation beyond recovery before stockmen reduced numbers. Much high range sprouted juniper and low range sprouted sagebrush, and where nothing would take root, gullies grew and hillsides slid away. In the 1900s Utahans sought and got national forest protection over much of their damaged high country, and the Forest Service began to curb grazing and restore the land.

Through the years range specialists have built a science of growing better grasses, to kudos and criticism. So more forage can thrive, herbicides kill aspen groves and advancing bulldozers linked by a chain uproot entire slopes of juniper or piñon pine.

In the Northwest's big-timber country, herbicides kill broadleaf maples, oaks, and alders that compete with commercially valuable Douglas firs. Some people living downwind of the sprayings have felt threatened. Sprayings in Siuslaw National Forest in 1975 alarmed Carol Van Strum: "The children got sick, my throat got sore, our garden died, and the fruit trees were blighted." Over the weeks, she said, there were other grim events around their home beside Five Rivers: "Ducklings died, and crayfish. Our poultry hatched with crossed bills and feet sideways." She and neighbors gradually tied it all to herbicide use: "First we went to the Forest Service, but they said the sprays they used were safe. We went to the county and the EPA [Environmental Protection Agency]. We organized Citizens Against Toxic Sprays. In 1976 we went to court."

They won a decision that the environmental impact statement on the spraying had not fully assessed effects on environment and failed to consider alternatives to herbicides. In 1978 the same judge approved a new impact statement, with "misgivings," for use of the herbicides. Only public outcries, Carol said, ultimately barred their use.

"We're using a lot of alternatives to herbicides where they will work," Chief Peterson told me. He listed fire, cutting by hand tools and machines, even an experiment with browsing goats in the Angeles. "But there are areas that require herbicides—the Pacific Northwest, for example, with its steep slopes, heavy rains, and fast regrowth."

Yes, there's a toll to bug and bird habitat in the spray zone, the Forest Service says, but there's plenty of unsprayed area to maintain nature's balance.

No, Forest Service sprays have never harmed humans, it says, despite citizen protests and lawsuits. "To my knowledge not one case has been proved," Max Peterson said. "The 2,4-D we're using in Oregon is an herbicide you can buy anywhere to kill dandelions. It's used on the White House lawn."

And there were hints that some herbicide foes had a concern for less than the total environment, for only one plant, in fact—marijuana. William A. Derr, a law-enforcement special agent for the Pacific Southwest Region, reported: "In northern California it has become big business." He said national forests there hide fields of many acres, watered by plastic pipes, watched by armed guards, an echo of moonshiner ways.

And even a rumor of spraying near a plot can demolish market value. Additives may help sell gasoline but not marijuana.

ANOTHER INVASION of some national forests that has caused controversy is by the off-road vehicle—the ORVs that can cause hell on wheels for wild creatures and places.

Largest in the nation, Tongass National Forest blankets 17 million

ORVs ran wild across public lands before restrictions caught up with them. Executive orders by Presidents Nixon and Carter made them legal users of the forest and called for the designation of ORV areas and rules to govern them. Ballinger Canyon, a near-desert crumple of ridges and canyons in California's Los Padres National Forest, quickly became an ORV battleground between the Sierra Club and two motorcycle clubs, the Dirt Diggers and Ridge-riders.

The Forest Service solution, district ranger Dave Alexander told me, would limit ORVs to designated roads and trails.

And would that satisfy the ORVers?

"No. They feel they're losing a right, that they've been pushed around quite a lot."

Would it satisfy the other side? "Not really. What they really want is an end to all off-road vehicles in the forests."

The Forest Service faced a different challenge in Indiana's Hoosier National Forest, a charge of failing to meet construction standards for a motorcycle trail.

The Los Padres and Hoosier cases carried added trauma of revolt within the Forest Service, long proud of its spirit of family. In Ballinger Canyon, wildlife management biologist Monty E. Montagne, in the Forest Service family a quarter century, reported a threat to the blunt-nosed leopard lizard, an endangered species and thus protected by law. Though many other biologists backed him, other Forest Service studies concluded the lizards were hybrids—and thus expendable. Montagne persisted in his view, finally filing a lawsuit. He was then offered the choice of a transfer to a regional office, early retirement, or separation. He retired.

The challenger in the Hoosier was my

acres on the mainland and coastal islands of southeast Alaska.

friend Claude Ferguson, in his fourth decade as Forest Service family. Claude said he found four-inch stumps along the motorcycle trail, where specifications required them to be flush with the ground. He reported that the grades of some slopes and the sharpness of turns exceeded standards imposed to limit erosion and wrecks.

When he failed to get corrective action, he said, he decided to make his concern public: "I felt I was following the first rule of the federal employees' code of ethics, putting the good of the people ahead of the agency."

When the Izaak Walton League sued the Forest Service, Claude filed a supporting action. The National Wildlife Federation and the Audubon Society also became plaintiffs. The American Motorcycle Association entered as a defendant along with the Forest Service. After two years came a mutual consent dismissal tied to an ORV ban in the forest while the standards were restudied.

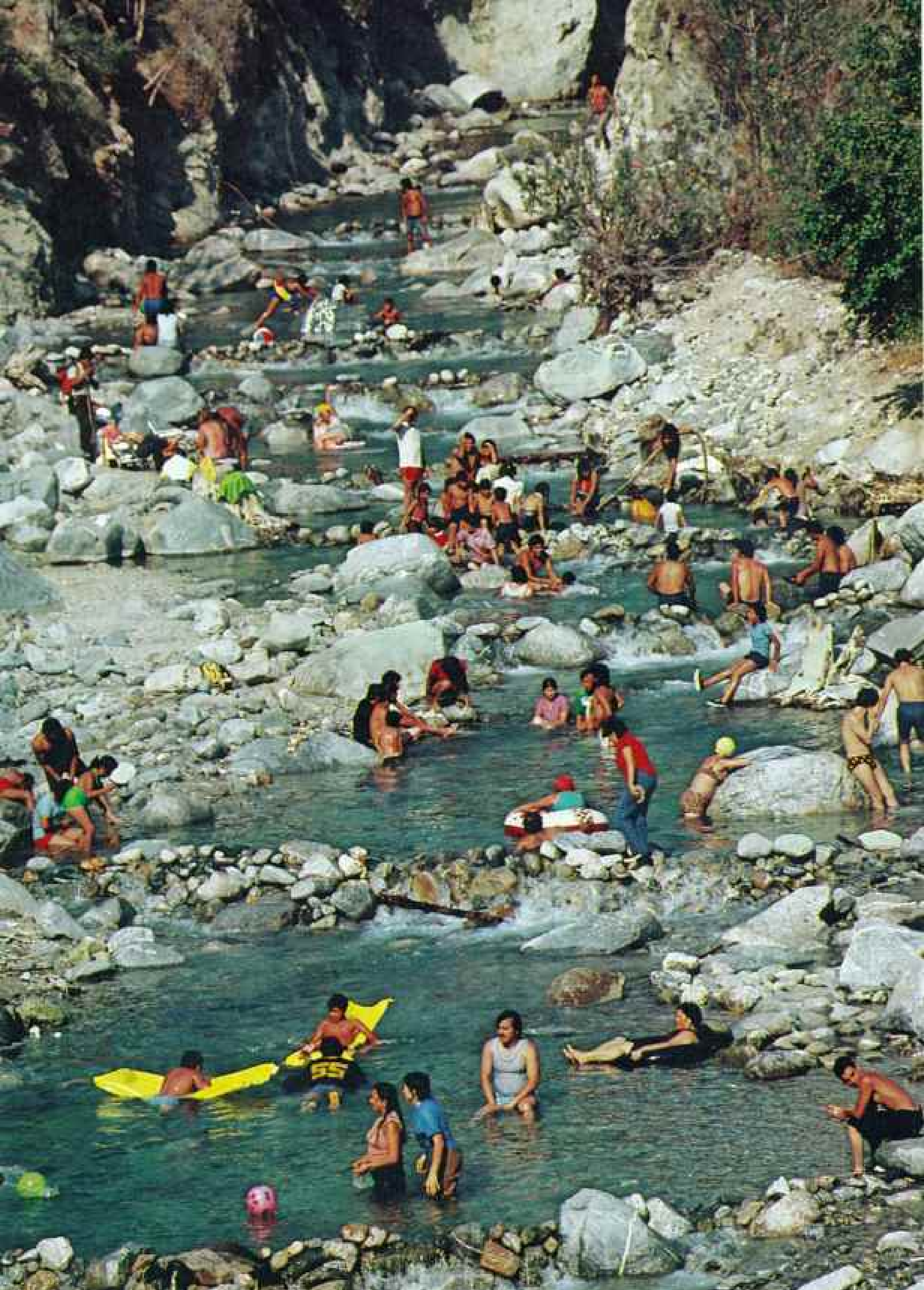
Like Montagne, Claude was offered transfer to a regional office desk, in this case Milwaukee. When he refused, he was fired, but an appeal won him early retirement. Any regrets? "Some—of course. But I'd do it again. It's a matter of conscience."

CONTROVERSY also abounds over the rich inventory of the Tongass National Forest in the sea-riven, mountain-framed Alaska Panhandle. Larger than all West Virginia, the nation's biggest forest grows straight-grained Sitka spruce, yellow cedar, and western hemlock—mostly for export to Japan, a fuse for debate. A wooded hill within Misty Fjords National Monument holds an estimated 20 billion dollars' worth of molybdenum, a tenth of the world's

Increasing demands *on public land often cast the Forest Service in the role of referee. The agency approved development of Beaver Creek Resort in the Meadow Mountain area of Colorado's White River National Forest (**below**) only after the developers agreed to several conditions. Maximum development of Meadow Mountain would have meant a total of 20,000 skiers a day.*

*Residents of three nearby small towns—Redcliff, Gilman, and Minturn—feared their communities would be swallowed up by the daily influx of skiers and resort employees. That concern brought together Redcliff resident Mike Salazar (**left,** center), district ranger Ernie Nunn, and Robert Gallegos of the Foundation for Urban and Neighborhood Development (FUND). A private consulting firm, FUND prepared a legally required study of Beaver Creek's social impact. Upon FUND's recommendation, the developers agreed to construct employee housing and assist in the development of a manpower training program aimed at giving priority in employment to area residents, hit with the loss of 400 jobs by the closing of a zinc mine in 1977.*

*Pleased that their town of Minturn has kept its identity, retired miners Nick Rivera (**below,** left) and Tony Joe Cordova, play at a family gathering.*



reserves, and U. S. Borax's plans to mine it have sparked a running fight with environmentalists. The Alaska Native Claims Settlement Act of 1971 in effect subtracts half a million acres of prime timberland. The excision of 20,000 of those acres on Admiralty Island has brought conservationists and exploiters together in opposition.

Anything less than a lifetime is too little to catalog the diverse abundance of all our national forests—or to plumb their problems. Last year some 25,000 youths and senior citizens found needed jobs working in the forests. On the day the budgetary ax was raised against the Young Adult Conservation Corps, now extinct, I was in a YACC camp in Florida's Ocala National Forest, taking testimonials: "This program cares more about me than my parents did."

Atop Colorado's 10,000-foot Grand Mesa, where winter piles snow to ten-foot depths, I celebrated spring in July as snowmelt streams glinted across flower-bright meadows and plummeted to thirsty lands below—a story repeated in a thousand national forest watersheds that supply most of the West and much of the East.

In New Hampshire's White Mountains I heard a ski-area manager defend his operation on national forest land: "The downhill skier is appreciating the same kinds of things that the backpacker thinks he alone is appreciating. Yes, we do some reshaping of slopes, but you won't see runoff problems."

In Puerto Rico's Caribbean National Forest, ornithologists are counting on breeding by captive birds to save the endangered Puerto Rican parrot: "But we'll never release the captive breeders because they've picked up words and sounds from people, dogs, and cats that would pollute the pure vocabulary of the wild birds." (Incidentally, *all* parrots, I'm told, walk like John Wayne—a sort of pigeon-toed swagger.)

In Los Padres National Forest I found controversy attending the start of a captive breeding effort to save the California condor: "With only about 30 birds left, some people think it's wrong to remove any condors from the wild, but the ones in the wild aren't breeding enough to save the species," a biologist told me.

Since species come and go in nature, why work so hard to save one? Forestry and fish and wildlife researchers gave me three reasons: In virtually all cases, the peril to the species has come from man; an act of Congress mandates efforts to save species; and each death of a species is a loss of genetic potential of unknown value to all life.

MAN HOLDS THE KEY to our forests' future, and pressure to accelerate harvests "is borrowing from our grandchildren," Dr. Arnold Bolle told me. "I see no calamity if we plan with intelligence. If we utilize new technology—which includes grinding up whole trees and using powerful glues to remold them to our needs—we'll have wood left over for export without ever having to touch marginal forests on the West's high slopes.

"The planning must include all woodlands, public and private, and for leadership we look to government, the only body stable enough to plan for decades and centuries."

My story about national forests ends where for me it began some 40 years ago—among the steep wooded hills and spring-fed streams of the Ozarks. With Claude Ferguson I once more drove the Mark Twain's forested miles to the North Fork to relive part of a float trip we'd taken in 1942.

Though the river ran a bit high and fast from two days of rain, it was still clear enough to see six feet down to where a bass toyed with a baited hook—the dividend of decades of controlling the watershed.

And as we drifted past snakes sunning on rocks and turtles on logs, some too relaxed or trusting to flee us, I felt a glow of being of a species kind enough and wise enough to foster nature's healing touch. May we learn to favor that touch in all our forests' many uses. Then we can truly lay claim to being made in our Creator's image. □

Escaping the city *but not its crowds, Fourth of July merrymakers from Los Angeles swamp San Gabriel Canyon in Angeles National Forest. Rangers closed the canyon to newcomers by 11 a.m., a sobering reminder that U. S. forests, which appeared boundless to earlier generations, can be pushed past their limits.*

ROOSEVELT COUNTRY

T.R.'s Wilderness Legacy

By JOHN L. ELIOT

NATIONAL GEOGRAPHIC SENIOR STAFF

Photographs by FARRELL GREHAN

A DEAD SEAL, of all things, had been fished out of New York Harbor and exhibited for the curious at a Broadway market one day in 1865. It was spied by a small boy, who tingled "with every possible feeling of romance and adventure." With a ruler he solemnly measured the creature. He finally begged its skull, and thus an ambitiously christened Roosevelt Museum of Natural History was born.

That seal ignited a long fuse. The explosion of action that followed transformed the nation. When the dust settled after Theodore Roosevelt left the White House in 1909, his zeal for natural history—and for a fledgling cause called conservation—had enriched the public domain by approximately 230 million acres, a patchwork of protection three-fifths the size of Alaska.

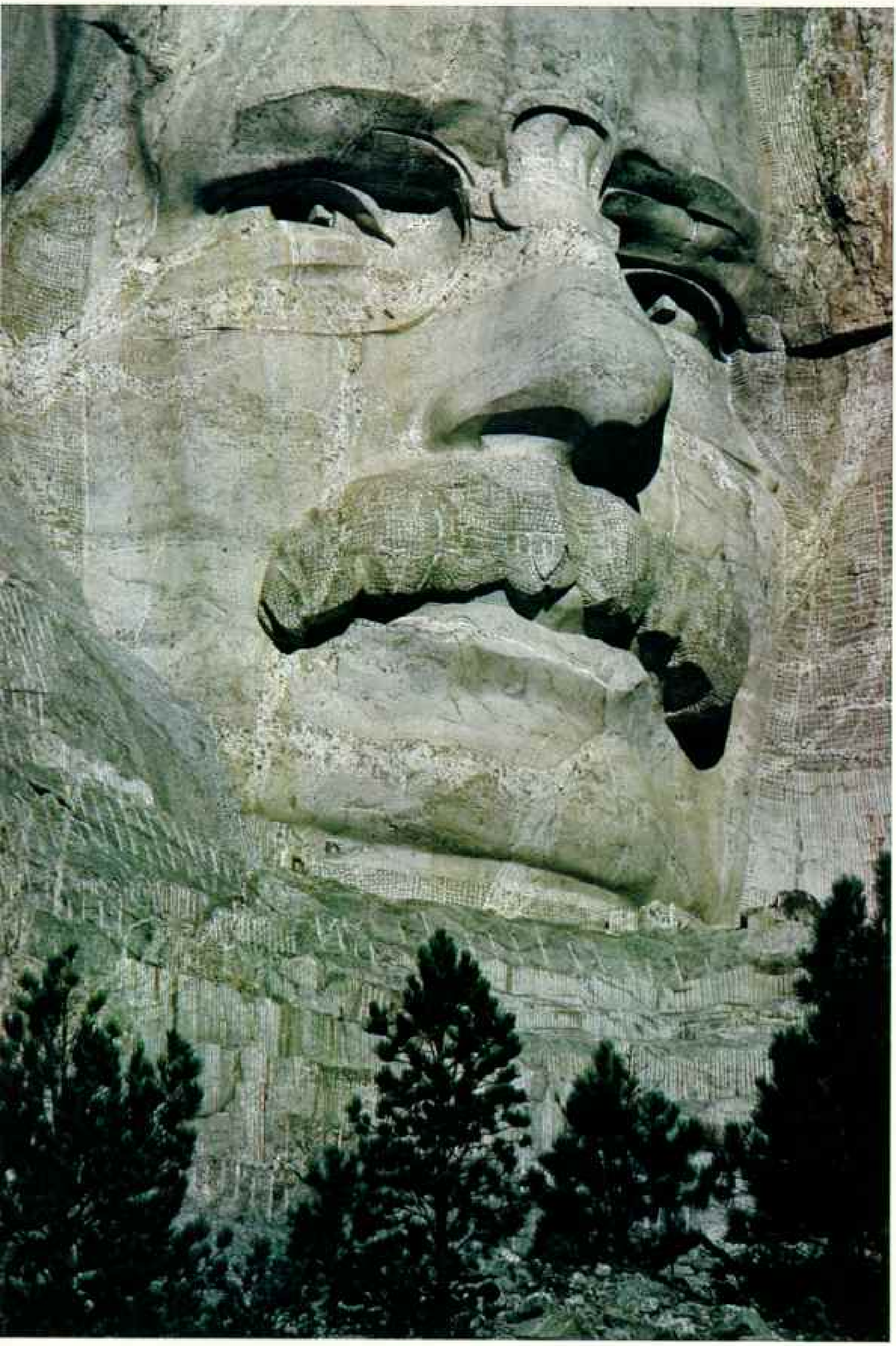
The ebullient slash of his pen quadrupled the existing forest reserves and proclaimed the first federal wildlife refuges, more than 50 of them. The number of national parks doubled; the first 18 national monuments came into being. The U. S. Reclamation Service was inaugurated to irrigate about three million acres in the arid West, and tens of millions of mineral-bearing acres also fell under Roosevelt's cloak (map, pages 346-7).

"I hate a man who would skin the land," he bristled. He railed against corporate "timber thieves," and argued that "a live deer in the woods will attract . . . ten times the money that could be obtained for the deer's dead carcass." Again and again he preached, "Conservation of our natural resources is the most weighty question now before the people of the United States."

The bombast may seem familiar, coming from an inexhaustible wellspring of energy whose better known accomplishments have become familiar political folklore. Rough Rider. Trust-busting wielder of the big stick. Ramrod of the Panama Canal. Bull Moose reformer. Militarist. Peacemaker. Author. Cowboy. Naturalist. Hunter. Conservationist.

Of those many facets, the last two may never be reconciled by many people with an undying image of "bloody Teddy" and his trophies. Nor is the vast gulf between hunter

A figure larger than life, *President Theodore Roosevelt secured a niche in South Dakota's Mount Rushmore partly for his little-known role as a conservationist. From 1901 to 1909 "T. R." set aside about 230 million acres of national forests, wildlife refuges, and other lands—an achievement that is still a worthy yardstick.*



Buffalo weathers winter *in Yellowstone. In the 1890s Roosevelt helped win a tough protection law for Yellowstone and its wildlife when the national park was suffering neglect and abuse. As President he aided in reestablishing buffalo in Oklahoma, Montana, and North Dakota. Of the slaughter by market hunters, he*

National Geographic, September 1982

lamented, "Never before . . . were so many large wild animals of one species slain in so short a space of time." In the West, T. R. hunted buffalo and many other animals—partly for meat, partly for the chase, and also to gain knowledge of their behavior, which made him one of the nation's foremost field naturalists.

and nonhunter ever likely to be bridged.

By John Burroughs, it was. "I have never been disturbed by the President's hunting trips . . . ," wrote the ardent naturalist, a longtime friend. "Such a hunter as Roosevelt is as far removed from the game-butcher as day is from night."

"T. R." (he detested "Teddy") did nothing without enthusiasm, and he studied animals and demanded their protection as vigorously as he hunted them. C. Hart Merriam, a famed biologist and one of the founders of the National Geographic Society, observed, "If his major interests had not been diverted into . . . politics, he would have been one of America's foremost naturalists."

Around him Roosevelt gathered a who's who of such early conservationists—eminent men like John Muir, forester Gifford Pinchot, and the best biologists and naturalists of the day. He hiked with them, sent them specimens, and argued with them. Together they made his boyhood museum come alive.

The landscapes of the Roosevelt legacy often reflect the man who bequeathed them. He cut his teeth on the country in the badlands of North Dakota, a tortured landscape of buttes and ravines honored after his death as Theodore Roosevelt National Park.

IN THE TOWN OF Little Missouri, rank cowhands taunted a bespectacled "Eastern punkin-lily" who stepped off the train in September 1883. He was a feisty young New York assemblyman, and he had buffalo on his mind. He was going to shoot buffalo while there were still buffalo left to shoot. He drove his cowboy guide crazy for a week, riding and slogging and sleeping in the muck of an endless rain, chirping, "By Godfrey, but this is fun!" When he finally got his bull, he did a war dance around its carcass.

Roosevelt had shot one of the very last buffalo in Dakota Territory, and a few years later surely realized it. "No sight is more common on the plains than that of a bleached buffalo skull," he wrote in 1885.

He labored on his book *Hunting Trips of a Ranchman* in the pine cabin of a cattle ranch known as Chimney Butte or Maltese Cross that he bought into on that first trip. Relocated eight miles north of its original site, the ranch house now stands near Park Service headquarters in Medora.

"That desk was Roosevelt's," said chief interpreter Micki Helickson, showing me through the cabin, "but it probably came from Elkhorn, his second ranch. The isolation of Elkhorn was more conducive to his writing." Over his lifetime T. R. wrote up a storm of more than 35 books, some 150,000 letters, and countless periodical pieces.

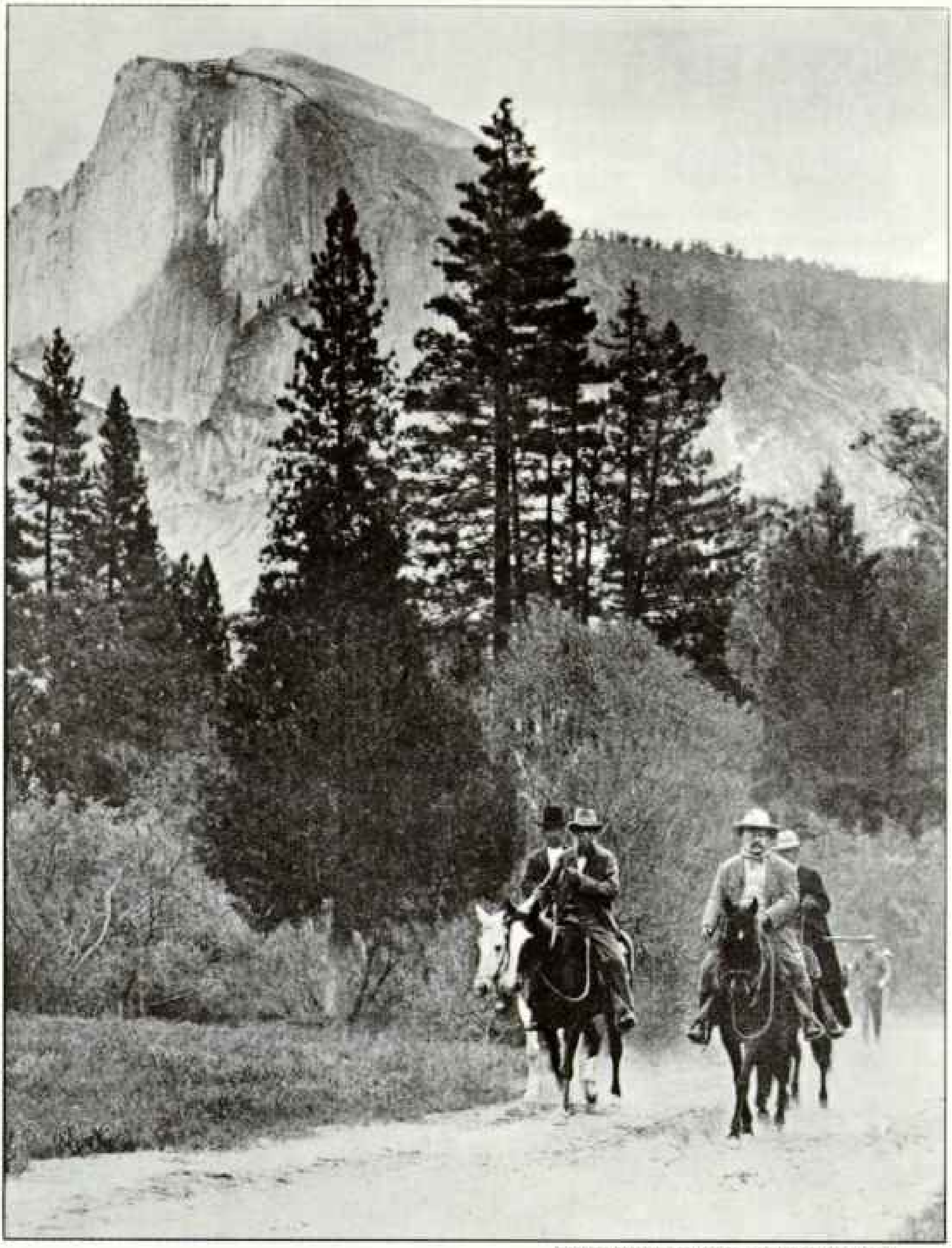
The rigors of life in the saddle rapidly knocked off the square corners of the dude from New York. "We knew toil and hardship and hunger and thirst . . . ," he wrote, "but we felt the beat of hardy life in our veins, and ours was the glory of work and the joy of living."

But the primeval richness of the plains was disappearing before his eyes, felled by the guns of the market hunters, trapped unchecked by fur traders, shorn by too many cattle. During the 1886 drought, Roosevelt told a reporter that "the cattlemen this season have paid the penalty. . . . there is not a green thing in all the region. . . . A stranger would think a donkey could not live there."

He learned many a hard lesson in the badlands and beyond on protracted hunting trips. "I owe more than I can ever express to the West," he wrote. With George Bird Grinnell, editor of *Forest and Stream* magazine, he organized the Boone and Crockett Club in 1888 to promote not only "manly sport with the rifle" but also the preservation of forest and game. The club threw its weight behind such causes as one that helped thwart destruction in Yellowstone National Park, at first only a paper preserve lacking the means for protection.

When an anarchist's bullets cut down William McKinley on September 6, 1901, and catapulted Vice President Roosevelt into the White House, Republican leader Mark Hanna growled, "Now look, that damned cowboy is President of the United States." The "cowboy" was still thinking about the buffalo. The vast herds that once numbered 60 million were gone forever, but there were still remnants. Could they be restored where others had been wiped out?

"Islands of rock in a prairie sea," the Wichita Mountains National Wildlife Refuge tumbles in heaps of boulders over the Oklahoma *(Continued on page 350)*



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"**How happy were the days** *in the Yosemite I owed to you," Roosevelt wrote John Muir, riding to his right beneath Half Dome. In 1903 the President and the great naturalist headed for Yosemite's tall timber to talk forests, birds, and conservation around the campfire. To the existing national park, Muir convinced T. R. to add Yosemite Valley and the Mariposa Grove of giant sequoias, then under California's control. Afterward, the President spoke at Sacramento: "We are not building this country of ours for a day. It is to last through the ages."*

ROOSEVELT COUNTRY 1901 to 1909

*SWEEPING MOSAIC shows the greening of the nation under Roosevelt, who halted unchecked exploitation of its natural resources and wilderness treasures with a framework of federal protection—for "the people unborn as well as the people now alive." His greatest crusader was Gifford Pinchot (**facing page**), who with T. R. founded the U. S. Forest Service and swelled its reserves from 43 million to 194 million acres. Urged on by naturalists like John Burroughs (**below**), Roosevelt set aside Florida's Pelican Island as the first federal wildlife refuge, then added 50 more. For scientific and historic preservation, he began the system of national monuments—an early designation for the Grand Canyon—and approved five new national parks. And he saw his pioneer reclamation projects as conservation because they irrigated the West for small homesteaders, rather than to benefit transient sheep and cattle barons.*

Roosevelt's unprecedented National Conservation Commission took the first inventory of the country's remaining riches. He later convened a North American Conservation Conference, and proposed another for the whole world. David Fairchild, an esteemed botanist, summed up Theodore Roosevelt as "the first and last President . . . to have a biological sense of proportions."

Tiny, far-flung islets set aside by Roosevelt today make up the Hawaiian Islands National Wildlife Refuge.

Camping with John Burroughs and guides in Yellowstone National Park, 1903.

T. R. established a foothold for conservation in Alaska with two huge national forests and seven wildlife refuges.

Medora

The lonesome badlands of North Dakota — later site of Theodore Roosevelt National Park — molded Roosevelt's love for the land after he bought two ranches there and punched cattle.

Mount Rushmore

Niobrara Bird Reservation

Niobrara Forest Reserve

From British Columbia south through the Rockies, from Arizona canyons to Louisiana bayous, T. R. tramped, camped, and hunted. His treks taught him the need to preserve the forests and their wildlife.

Roosevelt roamed the Adirondacks as a boy. As Vice President in 1901, he was hiking there when informed that President McKinley was dying from an assassin's bullets.

Mount Marcy

Sagamore Hill was T. R.'s rambling home and summer White House.

Oyster Bay

Washington

Charlottesville

Pine Knot, a rustic cottage near Charlottesville, Virginia, served as President Roosevelt's retreat for fresh air, solitude, and bird-watching.

Wichita National Forest and Game Preserve

Mosquito Inlet Bird Reservation

Pelican Island Bird Reservation

T. R. established a tropical forest reserve that became Caribbean National Forest and around Culebra Island a bird sanctuary, now part of Caribbean Islands National Wildlife Refuges.

Culebra Bird Reservation

PUERTO RICO

18°

66°

17°

COMING OF BUFFALO HERD INSURES A GAME PRESERVE

SO SAYS FORESTER MATTOON IN CHARGE OF WICHITA FOREST

ther and Various Kinds of Game Are to be Sent Here.

PREPARING TO RECEIVE THEM

Destructive Animals Will be Killed Off—Buffalo to Arrive This Evening or Tomorrow Morning—Sent By Express in Crates.

THE DAILY NEWS-REPUBLICAN OF LAWTON, OKLAHOMA OCTOBER 12, 1907

Gifford Pinchot Chief Forester

ORIGINAL SOURCE UNKNOWN

PRINTED BY WILLIAM H. BOND
RESEARCHED BY VICTORIA DUCHENEAUX
COMPILED BY ROBERT DULL AND DAVID MILLER
NATIONAL GEOGRAPHIC ART DIVISION

Soothing emptiness *of the North Dakota badlands* ***(right)*** *drew Roosevelt in 1883 to "a land of vast silent spaces . . . where the wild game stared at the passing horseman." There the young New York assemblyman invested in two ranches. One ranch house, known as Maltese Cross or Chimney Butte* ***(below)****, was later relocated in the badlands' Theodore Roosevelt National Park.*

Short, bespectacled, and a dandy, Roosevelt needed some time to earn respect. On a roundup, cowhands guffawed when he sang out, "Hasten forward quickly there!" But the dude proved able to ride for days through blizzards, shoot deer at an impossible range, and flatten a bully who taunted him in a bar. In furs and buckskins ***(far right)*** *T. R., center, stands with two of his partners, Wilmot Dow, left, and Bill Sewall. The trio traveled 100 miles to capture outlaws who had stolen their boat.*

For about ten years Roosevelt shuttled regularly between the East and the badlands, where his neighbors watched him evolve from ranchman to statesman. No one was surprised. One rancher had called him "the most remarkable man I ever met. Unless I am badly mistaken, the world is due to hear from him one of these days."

THEODORE ROOSEVELT COLLECTION, HARVARD COLLEGE LIBRARY

(Continued from page 344) flatlands near Lawton. The buffalo hunted by the Kiowas, Comanches, and other tribes had vanished when the area, championed early by the Boone and Crockett Club, was proclaimed a game preserve by Roosevelt in June 1905.

T. R. was intensely interested in bringing back the buffalo to the Wichita. So was Quanah Parker, the old chief of the Comanches, who said wistfully, "Tell the President that the buffalo is my old friend, and it would make my heart glad to see a herd once more roaming about Mount Scott."

In October 1907, 15 prime specimens chosen from the New York Zoo were specially crated and loaded on railroad cars at Fordham Station. As the train rolled 1,858 miles toward Cache, Oklahoma, newspapers touted the event and festive crowds lined the tracks.

At Cache, a group of Indians camped out for days near holding pens, awaiting the return of the "Great Spirit's cattle." Emotions ran high when the animals arrived. Onetime warriors pressed against a wire fence to view a few of the shaggy giants that once had blackened their plains.

Elk and wild turkey, by then exterminated from the region, were also successfully reintroduced, along with a herd of Texas longhorn cattle, carefully selected to preserve the best representatives of a dying breed. Today, within the fenced refuge's 59,000 acres, the U. S. Fish and Wildlife Service maintains about 300 longhorns and 600 buffalo, auctioning roughly 100 head from each group yearly to breeders.

Elmer Parker knows each animal by number, if not by name (one fetching cow became Belle Starr). Elmer is called a biological technician, which is like labeling corn whiskey as undenatured ethyl alcohol.

The fall buffalo roundups have branded him with more than a few scars. "I'm gettin' older and slower, I guess," he sighed, as three young bulls nosed around his truck one morning. "Few years ago a buffalo got me down on the ground. I just had to play dead while he worked me over. At least he never got a horn in me. He did bust up my kneecaps and tore up my clothes pretty bad."

While Elmer and others ride herd on the wildlife, refuge manager Bob Karges has fought a running feud with the Air Force and Fort Sill Military Reservation next door. The issue: noise. Since 1972 jet fighters circling practice targets at Fort Sill have also overflown parts of the refuge.

"To have wilderness, you have to have solitude," said Karges.

For Fort Sill, Lt. Col. A. T. Brainerd responded. "These are Air Force Reserve and Air National Guard pilots, and they try not to fly over densely populated areas. It's a trade-off."

Each year 12,000 people hike through Charon's Garden, a wilderness with a splendid little amphitheater of fractured rock where buffalo, elk, and deer wander amid blackjack and post oak. Bobwhites were calling around my camp one morning when an F-105 came screaming out of the sun, followed by three more a few seconds apart.

Well into the afternoon the roar of the jets filled Charon's Garden. Surely, on days like this, when grisly old Charon was ferrying the souls of the dead across the river Styx, the passengers awakened and bade him hasten the departure, as I did mine.

ON A THREE-ACRE ISLET of mangroves in the Indian River on Florida's east coast, the first seed of the National Wildlife Refuge System was planted on March 14, 1903. "Is there any law that will prevent me from declaring Pelican Island a Federal Bird Reservation?" Roosevelt queried. Told the island was federal property, he delivered a fiat: "Very well, then I so declare it."

It was to the bird-loving President that Frank M. Chapman of the Audubon Society and others had brought the island's case. To adorn fashionable ladies' hats, plume hunters were slaughtering the area's birdlife, chiefly the egrets. A one-man crusade on behalf of the birds had long been carried on by Paul Kroegel, a German boatbuilder who had settled nearby.

Paul Kroegel's modern counterpart, Lawrence Wineland, kept an eye on the birds for 17 years until his recent retirement. "Why would a pelican want to nest here? Only the pelican knows," he ruminated in an Arkansas drawl as his boat nudged the island, its mangroves bedraggled by decades of flapping wings and guano deposits.

Brown pelicans merit the endangered

species list at present because a buildup of DDT caused them to lay thin-shelled eggs elsewhere in their range. At Pelican Island that threat has not materialized, but another one has.

Here and there, adult pelicans flapped helplessly, ensnared in rats' nests of monofilament fishing line. "There's one that's got something stuck in his neck," Lawrence pointed out. "He probably got hold of a fish that still had a lure in it."

He set about cutting birds loose, chasing down one victim hamstrung by treble hooks snagged through its wing, shoulder, and bill pouch. With Lawrence holding, I performed crude pocketknife surgery. "One more pelican mended, I guess. He'll make it all right," he judged, as the patient waddled into the water.

ACROSS THE CONTINENT, on the California-Oregon border, another haven serves both bird and man. In the Klamath basin Roosevelt established first a reclamation project, and then, in 1908, the nation's first waterfowl refuge—the Klamath Lake Reservation.

McKinley was barely cold in the ground when Gifford Pinchot and Frederick H. Newell, champions respectively of forestry and reclamation, hastened to the Roosevelt White House. "We left, two very happy men . . . ," Pinchot later recalled. "It was a Heaven-sent chance."

Roosevelt used the Reclamation Service, established in 1902, as a tool for conservation—to benefit the common man, the actual settler, with the object of irrigation "not to make money, but to make homes." Today about 6.6 million acres are controlled by the Bureau of Reclamation, an agency that, ironically, often arouses the wrath of environmentalists, to whom "reclamation" has become synonymous with "dams."

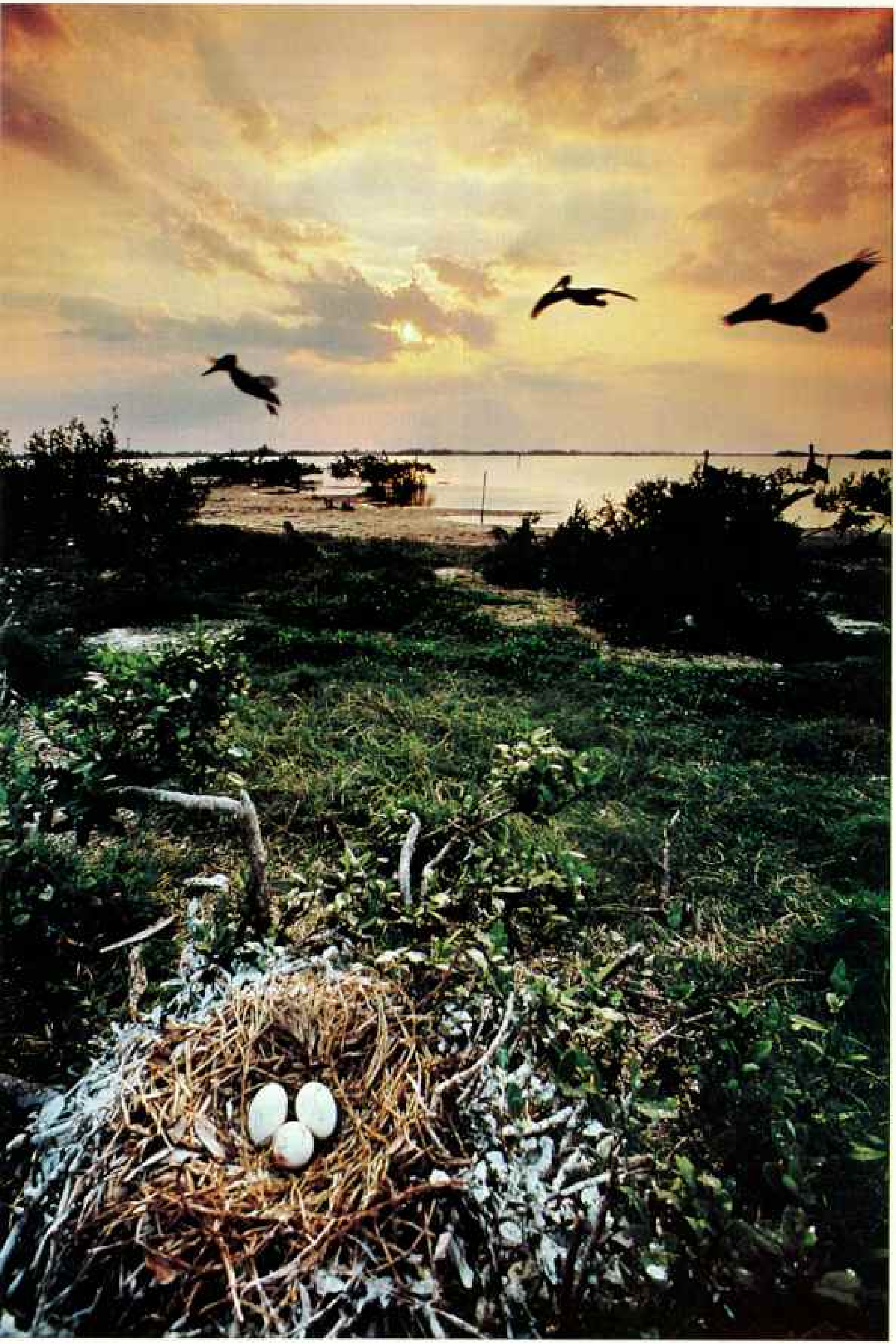
In the fertile tule marshes of the Klamath region, reclamation balances the demands of agriculture against those of a sky full of migratory ducks and geese. Three-quarters of the Pacific flyway population rests and feeds here during the spring and fall, sheltered now by five refuges.

The reclamation project grew into a complex system of dams, pumps, canals, and tunnels that now maintains the water level

THEODORE ROOSEVELT COLLECTION, HARVARD COLLEGE LIBRARY

***An indefatigable advocate** of "the strenuous life," T. R. clears the woods at his Long Island home. Years of hiking balanced his pursuit of big game with another passion—birds. He waxed rhapsodic at "the serene, ethereal beauty" of the song of the hermit thrush, "rising and falling through the still evening, under the archways of hoary mountain forests. . . ." At his Virginia retreat in 1907 he may have been the last person to observe wild passenger pigeons before their extinction, although his sighting was unconfirmed.*

To halt a bird slaughter *by plume hunters, Roosevelt in 1903 made Florida's Pelican Island* ***(right)*** *the first federal wildlife refuge. Brown pelicans, recently endangered by a buildup of DDT in their eggs, are staging a comeback. But Florida manatees* ***(above)*** *are still threatened by motorboats and possibly by red tides. T. R. protected the manatee in his Mosquito Inlet Bird Reservation, later abolished, though the system he started now numbers 410 refuges.*



on four of the five refuges. At Lower Klamath, farmers sharecrop 4,000 acres to grow barley, and must agree to leave a third of the crop unharvested for hungry birds in the fall and winter.

Many species live here through the summer, to test a birder's eye. Mount Shasta towered in the distance as black-necked stilts and American avocets sprang up in my path by Lower Klamath Lake. Eared grebes sailed along with their young nestled on their backs. Rarely, a wary western grebe poked out its long neck.*

Shyness did not save the western grebe from decimation by plume hunters here in the late 1800s. Each season, market hunters also shipped more than 120 tons of the region's ducks and geese to San Francisco.

Roosevelt heard of the carnage through William L. Finley and Herman T. Bohlman, a naturalist-photographer team who studied the area in 1905. Finley contributed their work on Klamath and Oregon's Malheur Lake—another Roosevelt refuge—to T. R.'s unprecedented National Conservation Commission of 1908, whose report was called "the most exhaustive inventory of our natural resources that has ever been made."

Finley and Roosevelt became old friends, and later reminisced about the wilderness of the West they had helped to save. "It will be one of the greatest memorials to your farsightedness when both you and I are gone," Finley told him.

"Bully," said T. R. "I had rather have it than a hundred stone monuments."

THEODORE ROOSEVELT COLLECTION, HARVARD COLLEGE LIBRARY

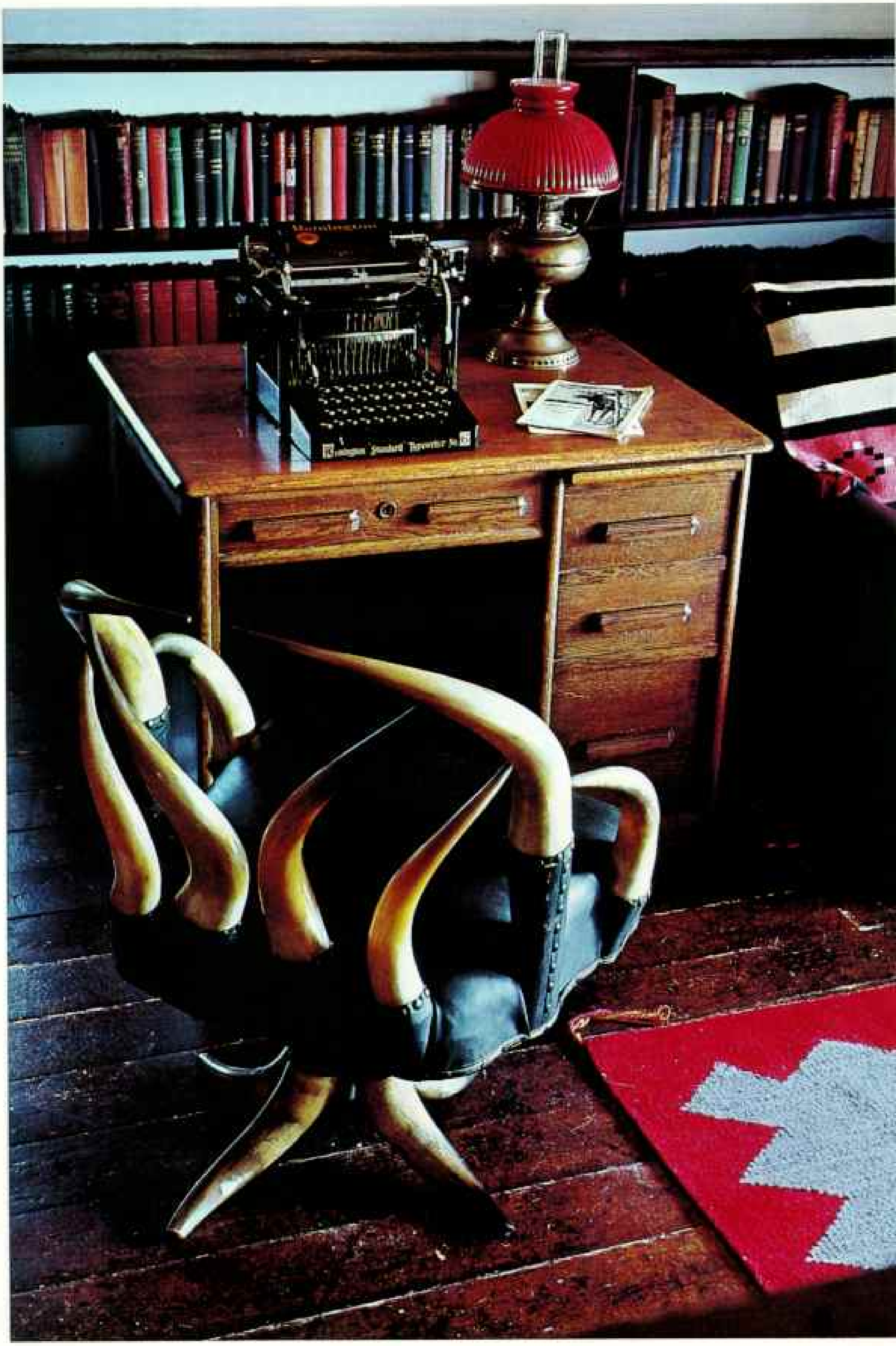
Trailside hoarfrost *adorns Mount Marcy in the Adirondacks* ***(facing page)****, where Vice President Roosevelt had taken a hike on Friday the thirteenth of September, 1901. A telegram reached him: President McKinley, wounded by an assassin, was sinking fast. He died as a buckboard relay sped T. R. from the mountains. The nation soon learned that its new Chief Executive* ***(above)*** *lived up to the Rough Riders' favorite tune, "A Hot Time in the Old Town Tonight."*

CONGRESS APPROVED five national parks during Roosevelt's tenure, including Oregon's Crater Lake and Mesa Verde in Colorado, but the park to which he drew the most attention was Yosemite. Two of its finest jewels, Yosemite Valley itself and the Mariposa Grove of giant sequoias, had been left under California's control when the national park was created in 1890. Those jewels, said critics, were being neglected by the state.

For six weeks during the spring of 1903 the President had been pressing the flesh campaigning in the West. A holiday was in order. "I want to drop politics absolutely for four days and just be out in the open with you," he had written to John Muir. On May 15 they arrived at Yosemite and headed for the trees, leaving the Secret Service behind and a bevy of officials with plans for banquets and fireworks holding the bag.

They were not entirely alone. It took three men and four mules to haul some 40 blankets that Roosevelt snuggled into at their first camp in Mariposa Grove. The next night

*See "The Birds That Walk on Water," by Gary L. Nuechterlein, NATIONAL GEOGRAPHIC, May 1982.



Peace and quiet were rare guests *at Sagamore Hill* ***(below)****, where six Roosevelt children and ten cousins "were encouraged to have all the fun possible." Completed in 1885 at Oyster Bay on Long Island, the home served as the summer White House and is now a national historic site. Mementos such as a cattle-horn desk chair* ***(left)*** *recall T. R.'s authorship of some 35 books and a staggering 150,000 letters. Other keepsakes echo his years as civil service commissioner, assistant secretary of the Navy, Rough Rider, and New York governor.*

they slept near Sentinel Dome and woke up covered with four inches of snow. "This is bullier yet!" crowed T. R.

The sage of the mountains wrote of Roosevelt, "I fairly fell in love with him." Around the campfire he seized the chance to proselytize the President: "I stuffed him pretty well regarding the timber thieves . . . and other spoilers of the forest," Muir recalled. Three years after their trip Roosevelt's pen incorporated the valley and Mariposa Grove into the national park.

What would he think of the valley now, where as many as 18,000 people and 6,000 cars have crammed the one-by-seven-mile area in a single day? For more than ten years the National Park Service has struggled to devise a plan to make Yosemite Valley something more than a drive-in rat race and remove some of the bureaucratic scenery.

"I love it, but I don't have to be here just so I can look at Half Dome out the window while I shuffle these papers," said assistant superintendent John Byrne at park headquarters. Under a plan that may take at least a decade to complete, most of the Park Service's 1,500 employees and their buildings will be relocated outside the valley. The plan will also remove some concession facilities, such as the tennis courts, and will reduce—but not ban—automobile traffic.

"But don't forget," said Byrne, "this is only three square miles of development. There are 1,186 more square miles out there, and most of that is virgin wilderness."

Outside the valley the crowds trickle away into the vast Sierra forests. Not far from Mariposa Grove, the sun flamed over my tent as it dropped behind the Chowchilla Mountains. I didn't at all mind sharing the sunset with a couple who happened by, especially since they had driven straight through from Kansas to see it. Anyway, they left before they could smell my steak frying.

In Mariposa Grove the next morning, shafts of sunlight played over the Grizzly Giant, the Telescope Tree, the Faithful Couple, names that bespeak the awe felt by millions at the sight of the famous sequoias. Roosevelt and Muir had camped near the Sunset Tree, a battered veteran 17 feet across. When he first entered the grove, T. R. lay on his back for half an hour, staring up at the behemoths that had stood,

some of them, for well beyond a millennium.

"The majestic trunks, beautiful in color and in symmetry, rose round us like the pillars of a mightier cathedral than ever was conceived even by the fervor of the Middle Ages," he wrote. To the residents of Sacramento, he said, "It would be a shame to our civilization to let them disappear."

A SPECIES OF ELK was disappearing from the Olympic Peninsula of northwestern Washington in the early 1900s. Roosevelt's personal interest in it stemmed from a friendly debate he had carried on with Hart Merriam of the Biological Survey.

Merriam, a scientific "splitter," used subtle differences among similar animals to describe many new species and subspecies. T. R., a "lumper," rebelled "when an old familiar friend is suddenly cut up into eleven brand new acquaintances."

If T. R. therefore sensed praise with a faint damn when Merriam named the Olympic elk *Cervus roosevelti* in 1897, he smothered it. "I am more pleased than I can say . . . ," he wrote Merriam. "I am only sorry that it will never be in my power to do anything except to just merely appreciate it."

He later amended such modesty by proclaiming Mount Olympus National Monument, another of his administration's innovations created by the Antiquities Act of 1906, which authorized the President to set aside "objects of historic and scientific interest." T. R.'s other national monuments included the Grand Canyon (11 years before it became a national park), the Indian ruins of New Mexico's Chaco Canyon, and Muir Woods near San Francisco.

Around Mount Olympus, hunters were gunning down the elk for their meat and canine teeth, which brought a handsome price as watch-fob ornaments. Today Olympic National Park protects about 5,000 of the majestic animals named for T. R., but a future generation of even finer splitters had the last word, classifying *Cervus elaphus roosevelti* as but another subspecies.

Roosevelt elk also bugle through part of Alaska's Chugach National Forest, among the 150 million acres of forest reserves that T. R. and Gifford Pinchot carved out. When Roosevelt took office, more than half the nation's forests had been leveled. The pioneer spirit—when, as T. R. said, "The American had but one thought about a tree, and that was to cut it down"—was still very much alive.

T. R. and Pinchot, his fiery chief forester who had been labeled "tree mad" at Yale, promoted a utilitarian philosophy. Far from locking up the forests, as many western legislators loudly alleged, they aimed at perpetuation through intelligent use. (A report on the national forests begins on page 306.) But in 1907, Congress forced a showdown.

It came on February 24, when an amendment was tacked onto the agricultural appropriations bill that would thenceforth permit only Congress to create or expand forest reserves in Oregon, Washington, Idaho, Montana, Colorado, and Wyoming. Roosevelt had eight days to sign the bill.

Little did Congress know what it had unleashed. In those six states Pinchot recalled, "We knew precisely what we wanted." He and his men worked around the clock. "At one point when they ran out of paper, Roosevelt and Pinchot were on their hands and knees in the White House drawing forest-reserve maps on the floor," said Horace M. Albright, who later became director of the National Park Service.

When T. R.'s "midnight" proclamations rang down on March 4, they created 21 new reserves totaling some 16 million acres. "The opponents of the Forest Service turned handsprings in their wrath, and dire were the threats against the Executive . . . ," he gleefully recalled.

Roosevelt took in more than 700 miles of Alaska's southern coasts with the vast Tongass and Chugach forest reserves. To Chugach, he added 700-square-mile Afognak Island, set aside in 1892 by President Benjamin Harrison as a "Forest and Fish Culture Reserve" at the urging of the Boone and Crockett Club. On Afognak, eight Roosevelt elk introduced in 1929 have multiplied to about 1,500 today.

WEST BY NORTH of Afognak, on the sweeping treeless tundra where the Yukon and Kuskokwim Rivers carry their silt toward the Bering Sea, Roosevelt created a remote bird reservation in 1909. It was so remote that in 1922 it was

abolished amid the smoke-filled rooms of Warren G. Harding's administration.

In 1980 it was reborn as part of the 20-million-acre Yukon Delta National Wildlife Refuge. In the fall more than a hundred million waterfowl and other birds stage a great migration from the delta that darkens skies in the Americas and across the Pacific.

Down the Pacific flyway streams a honking, quacking multitude, past a gantlet of hunters' shotguns that harvest a certain regulated number of ducks and geese. When the rest return to the delta for spring nesting, native hunters await them, posing a delicate balancing act for the U. S. Fish and Wildlife Service. To explain the situation, service biologists led me on a wild-goose chase.

The compact-size geese, called black brant, were in their summer flightless stage as a floatplane slowly drove 400 of them squawking along a slough. Upstream eight of us lay strung out along the mud flats. One by one we stood up on signal as the birds swam past our positions and fled in alarm—neatly into a funnel of nets ending in a pen.

In no time at all we were sitting on the tundra playing brant poker, dealing the birds back and forth to record their sex and age. Each brant got a leg band for hunters to return. Some were given large yellow collars with coded letters and numbers.

"Spring hunting by the natives is a red-hot issue up here," said refuge manager Chuck Strickland as he worked. "There are 12,000 to 15,000 Yupik Eskimos living on the delta. After sitting at home all winter eating dried salmon, some of them have a real need to go out and get fresh meat. If we're going to let that continue, we've got to know how many birds are killed in the spring."

He hopes the banding program will show how the brant and other game species are divided between lower forty-eight hunters and delta Eskimos. The latter resent being branded by the Migratory Bird Treaty Act as outlaws for their out-of-season subsistence hunting.

Earlier, at a camp called Old Chevak, biologist Vernon Byrd was mulling over the question when a young Eskimo named Peter Boyscout dropped by in search of milk for his young child. Peter, a Vietnam veteran and mechanic, told us that he was teaching a nine-year-old friend to repair outboard

Once upon a time, *this stuffed bear in the Sagamore Hill nursery adopted a Roosevelt nickname—and subsequently became a nighttime pacifier for millions of children.*

In 1902 Roosevelt made a political swing through Mississippi that included a bear hunt. A guide tracked down an old, lame, half-blind bear, tied it to a tree, and invited the President to shoot it. In disgust, T. R. refused. The incident was celebrated in a "Washington Post" cartoon, but artist Clifford K. Berryman chose to depict a bear cub as the victim. The cartoon inspired toy maker Morris Michtom to design a bear and secure permission from T. R. to use his name.

Thus, the "teddy bear" was born, despite the fact that Roosevelt hated the nickname "Teddy." The bear's success enabled Michtom to form an industry giant—the Ideal Toy Corporation.

"**The gradual extermination** *of this, the most stately and beautiful animal . . . can be looked upon only with unmixed regret . . . ,*" *wrote Roosevelt of the elk, here grazing on Fort Niobrara National Wildlife Refuge in Nebraska* (**above**). *T. R. and Pinchot set aside the Niobrara Forest Reserve for a successful tree-planting experiment that served as a forerunner for the great "shelter belt" later begun by T. R.'s fifth cousin, Franklin Delano Roosevelt.*

T. R. wrote authoritative life histories of many animals, including waterfowl, buffalo, bear, mountain sheep, and cougar. He was the first President to have a book published while in office—entitled, appropriately, "The Deer Family." C. Hart Merriam, a renowned biologist, rewarded T. R.'s devotion to natural history by naming what he believed to be a new species the "Roosevelt elk."

In Theodore Roosevelt National Park, a black-tailed prairie dog scouts his surroundings for danger (**right**). *Of Roosevelt, John Burroughs wrote, "Nothing escaped him, from bears to mice, from wild geese to chickadees, from elk to red squirrels."*

motors. He mentioned that the wife of an older villager was making her husband a traditional raincoat from seal gut.

"By the way, Vernon, I've got two of those brant collars and leg bands for you. Got 'em a while ago," he said.

After he left, Vernon didn't bat an eye. "Yeah, it's illegal. What am I going to do about it? Nothing. In Alaska, the bird act is one thing. Our policy is another."

SOME PIONEER BIOLOGIST must somehow have passed word to Roosevelt of those fabulous bird cities, so unthinkably distant from the Washington of 1909. The same year, about 5,400 miles southeast of Yukon Delta, another unknown lover of birds was rewarded when T. R. created the Culebra reservation of about 22 islets east of Puerto Rico.

There the sky is filled with terns, brown pelicans, brown boobies, and other seabirds that are today part of the Caribbean Islands National Wildlife Refuges. One of the keys also supports four endangered or threatened marine turtles—hawksbills, leatherbacks, loggerheads, and green turtles.

Roosevelt had a penchant for these outposts of life, echoed by other island refuges he created in Hawaii, California, and Louisiana. In his travels he had known those rare moments when only the sounds of wings and waves break the silence.

"To lose the chance to see frigate-birds soaring in circles above the storm," he wrote, "or a file of pelicans winging their way homeward across the crimson afterglow of the sunset, or myriad terns flashing in the bright light of midday as they hover in a shifting maze above the beach—why, the loss is like the loss of a gallery of the masterpieces of the artists of old time."

Even in Washington the White House itself became something of a wildlife refuge, stocked by six rambunctious offspring. Algonquin the pony rode the elevator. Dignitaries were introduced to Josiah the badger and Jonathan Edwards the bear. A congressman once helped number four son Quentin off with his coat to carefully evict a king snake that had slithered up a sleeve.

In a sense, there were seven Roosevelt children. "You must always remember," said an English friend, "that the President is about six." In Washington's Rock Creek Park—a splendid obstacle course for puffing members of the "Tennis Cabinet"—Senator Henry Cabot Lodge was once heard to shout, "Theodore! Theodore! If you knew how ridiculous you look on the top of that tree, you would come down at once."

WASHINGTON must have suffered mortal tedium after T. R. left office. He promptly embarked on his celebrated African hunting trip, which was sponsored by the Smithsonian Institution. Biologists brought back more than 14,000 specimens, from rhinos to rodents, many new to science.

In 1914, on his "last chance to be a boy," he joined another expedition that broke new naturalistic ground exploring Brazil's River of Doubt. Its dangers proved fatal to more than one member of the party. An accident aggravated an old leg injury, causing chronic abscesses that may well have triggered the pulmonary embolism that killed Theodore Roosevelt on January 6, 1919.

Today, around his grave overlooking Oyster Bay on Long Island, the nation's oldest Audubon sanctuary cares for injured wildlife. Down the road and around the bay, National Park Service guides show visitors through a rambling, 23-room Queen Anne-style home that saw a lot of living in the days of the Roosevelt clan.

"At Sagamore Hill," T. R. wrote, "we love a great many things—birds and trees and books, and all things beautiful, and horses and rifles and children and hard work and the joy of life."

At the main entrance a comfortable porch looks to the west. Carved over one door is the family motto, *Qui Plantavit Curabit*—"He who has planted will preserve." □

Winter sun spangles *a hot spring pool in Yellowstone. Roosevelt emphasized the "essential democracy" of such sanctuaries and issued a farsighted warning: "It is clear beyond peradventure that our natural resources . . . are still being abused . . . and that we have at last reached the forks of the road."*

Boom Times and Buccaneering

THE BAHAMAS

Radiant waters draw sunseekers and sportsmen as gleaming islands attract investors and freebooters. Bahamians welcome many visitors while striving to keep the nation their own.

By
PETER BENCHLEY

Photographs by
BRUCE DALE
NATIONAL GEOGRAPHIC PHOTOGRAPHER

Hues of coral, ocean, sky, and cloud color the Bahamian cosmos in a street mural by Nassau schoolchildren. For generations across the archipelago, farming, fishing, and sailing have supported close-knit island settlements, bonded by the

community of church. Migration toward jobs has shrunk such villages, and Nassau and its environs have absorbed more than half of the islanders. Most share an African heritage, celebrated by all in the lively Junkanoo festival.

Scrawls of sand and limestone on turquoise parchment, the Exuma Cays rim the reef-studded, bar-ridden Great

Bahama Bank for a hundred miles. This vast, barely submerged plateau dwarfs the nation's dry-land area.

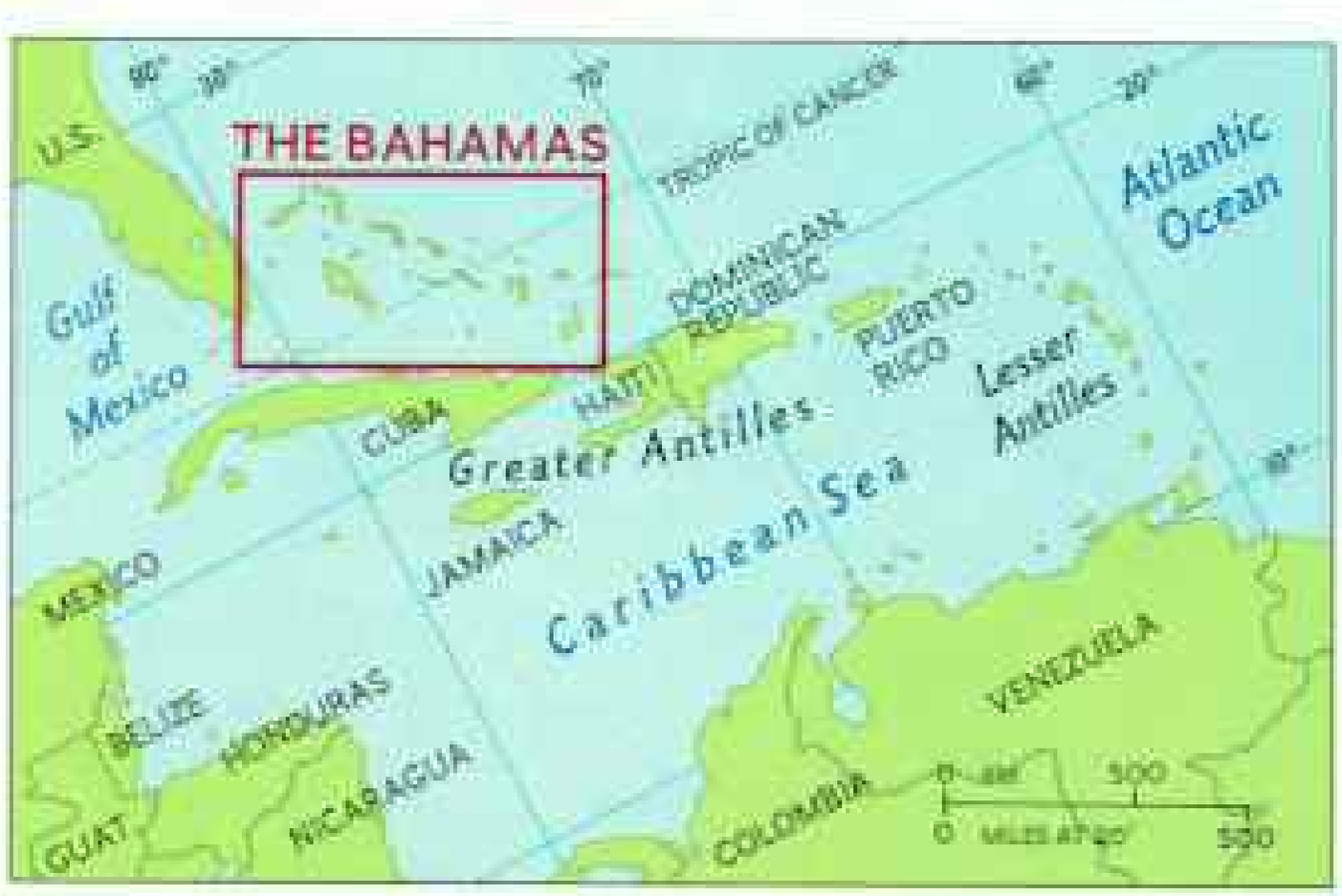
Constellation of islands spangles a shallow sea—

SEAGIRT island nation, the Bahamas sprawl over 100,000 square miles of waters, called *bajamar*—shallow sea—by Spanish explorers. After the Spanish abducted the native Arawak Indians for slave labor in the early 1500s, the islands were uninhabited for more than a century. The British began settling in the mid-1600s, but owing to the scourge of pirates and raids by the Spanish and French, it was the late 18th century before the crown's sovereignty was established. The colony gained full independence from Britain in 1973. With some 700 islands and islets favored by fair winds and postcard beaches, the Bahamas have built a 600-million-dollar-a-year tourist industry, attracting 1.8 million visitors in 1981.

AREA: 13,942 sq km (5,383 sq mi). **POPULATION:** 210,000. **CAPITAL:** Nassau, New Providence. **GEOGRAPHY:**

the Bahamas

Archipelago of flat, low-lying islands fringed by coral reefs. **CLIMATE:** Subtropical to tropical; temperatures average 70°F in winter, 85°F in summer. **GOVERNMENT:** Parliamentary democracy. **ECONOMY:** Tourism, banking, petroleum processing, pharmaceuticals, alcoholic beverages, salt, aragonite.



THE AIRPLANE was still burning when I arrived. It was a DC-6, and it sprawled nose down, charred and eviscerated, off the end of an unfinished airstrip on the island of Great Abaco. A tiny finger of flame, like a pilot light, cast an eerie purple glow inside the cockpit as night crept in off the ocean.

"I wouldn't get close," said Lewis Pinder, the retired hog hunter who had guided me here through back roads and swamps. "That be a fuel line burnin', and if she get a bubble in there, she gonna blow."

I asked Mr. Pinder if anyone had been hurt in the crash.

"Who knows? They fade away in the bush, and far's anyone know, they never happened. They not stupid, them druggers. They buy a plane ticket for where they come from, then they try again. This baby probably had five to eight million dollar' worth of marijuana on her." He smiled. "At them prices, you only have to succeed once."

I wondered aloud why the plane crashed.

"Why do any of them crash? Came in here with a payload of about 35,000 pounds, at night, with no lights. Probably landed long and overshot the runway, and *bang!*"

"Exploded?"

"Nope. Didn't even burn. They took a lot of the grass off her—nobody knows how much—before the police came. Left about a hundred bales on the ground here, then took off. People're saying it was the police shot out the tires and set her afire."

"The police? What for?"

"Who know 'bout these things?" He shrugged. "This the Bahamas, man."

And in the Bahamas, Mr. Pinder's reply seemed to say, a prudent person does not pry into affairs that don't concern him. After all, crashed airplanes and midnight skulduggery are but contemporary chapters in the Bahamas' long and picaresque history.

DISCOVERED by a Genoese sailor in 1492, depopulated by the Spanish, resettled by Bermudian adventurers, held hostage by rapscallion bands of buccaneers, cultivated by Loyalist refugees from the American Revolution and African slaves, bloated by profits from Civil War blockade-running and Prohibition-era rum-running, devastated by everything from insects to hurricanes, and, finally, resurrected by tourism, the Bahamas have such a roller-coaster tradition of booms and busts, of rogueries and heroics, that the depredations of the current crop of outlaws seem almost trivial by comparison.

And certainly they have not damaged the fortunes of the islands. At a time when shaky financial conditions worldwide have worked havoc with economies that depend on free-spending foreigners, the Bahamas are doing remarkably well.

The first tangible evidence I saw of a boom was from the deck of *Miss Wendy*, a converted Louisiana shrimp trawler. I was one of a crew of five cruising into Marsh Harbour on Great Abaco. Four years earlier I had visited Marsh Harbour at the height of the winter season. There had been three boats anchored in the harbor and six tied to the docks at the Conch Inn Marina. Now we were arriving off-season, in early June, and

Shadowy business *came to light when a DC-6 crashed and later burned (**left**) while making a midnight delivery of marijuana to Great Abaco. Lonely airstrips, uninhabited cays, and countless miles of coastline make the Bahamas an ideal spot to transfer drugs destined for the United States. Huge profits enable smugglers to buy advanced equipment, but thefts do occur. Some pilots chain their propellers (**above**) as protection. Concerned over lawlessness, the Bahamians have stepped up surveillance and cooperation with the U. S., and reports of violence have declined. Although the Royal Bahamas Defence Force intercepted 10,000 bales of marijuana last year, its commodore, British Navy Capt. Christopher Belton, points out, "It is not possible to police 100,000 square miles. I would suggest, with all respect, that the entire U. S. Atlantic Fleet couldn't do it."*

we expected to be able to nose the boat right up to the dock.

There were 56 boats anchored in the harbor and dozens more crammed into slips at the dock. We called to a man pumping fuel and asked how long the wait would be for a space at the dock. "Five days," he called back. "Maybe a week."

We anchored well out in the harbor, and when we finally got ashore in our dinghy, we were greeted by a slim young man named Cay Russell, a boat fancier fascinated to know all the details about the conversion of the shrimper. Now a porter for Bahamasair, Cay told us, "I've got a master's ticket for boats less than 41 feet, and I'm going for a charter captain's ticket working right out of here. After that I'll be a pilot on the new airline coming here.

"Abaco is a going place. It is booming. This is a fine place to be a man."

LATER, I REPEATED Cay's remark to Wally Smith, the genial, silver-haired owner of the Conch Inn. "He's right," Wally said. "There's Treasure Cay [a major resort] with a new jet strip. And look at all the boats here. People sense it if you welcome them."

And if you don't. Flanking Marsh Harbour is a string of cays—Green Turtle, Whale, Great Guana, Man O' War, Elbow, and so on—and though they are right beside one another, they are different worlds. "Some are only a mile or so apart," Wally said, "and they're as different as New York and Kansas City." Some are hospitable; others are less so—and not shy about letting you know it.

I took the dinghy over to Man O' War Cay, where some of the finest Bahamas working sailboats have been built, and strolled through the quiet, immaculate town. I found Marcell Albury sitting in the shade of his porch and asked him idly whether there was a hotel or an inn anywhere on Man O' War. He shook his head.

"We feel just like our forefathers did," he said. "That is, keep 'em over there on the mainland [Great Abaco], and we'll stay over here. And maybe once in a while we'll have a few of 'em over here so we can get a few of their dollars. But—always make sure you send 'em home by dark."

Among the forefathers of the Man O' War people were Loyalists who fled to the Bahamas after the American Revolution to raise crops and to fish.

"The way things used to be," Mr. Albury said, "the master and his family lived over here, on the cays, the field hands over there, on the mainland. The families were always feuding. One family would steal another's field hands, and the fight was on.

"Each cay started with only one or two families. On Man O' War it's the Alburys; on Green Turtle it's the Sawyers and the Lowes; on Elbow, the Malones and the Bethels. We may all have come from the same tree, but we're different buds. Here, we're Gospel Church, which is less verbal than the Church of God on Green Turtle. Over there, when the preacher says something good, they all shout, 'Hallelujah, brother!' Here, all we do is go, 'Mmmmmmm.'"

The population of Man O' War is, to this day, 100 percent white, which Mr. Albury acknowledged as an anomaly in a nation that is 85 percent black, is governed by a black majority, and prides itself on maintaining racial harmony among its citizens.

"Yes, the people who live here are all white, but the important word is 'live,'" Mr. Albury explained. "By 'live' here, we mean people who own property or have a permanent residence. Most of the blacks here are Haitians. We hire them as domestics, and we either give them to-and-fro transportation every day or a place to live here during the week and transportation home to Great Abaco on the weekend."

I MENTIONED that I had seen a lot of controversy in the local press about Haitians inundating the Bahamas. The Bahamian government had made a move to repatriate some of the migrants, to which the Haitian government had responded by refusing to accept any returnees.

"The Haitians are a real problem," Mr. Albury said, "but only in one sense—that the government has no consistent policy toward them. The fact is, for all the Bahamians who may shout about the Haitian 'invasion,' Haitians will do the menial work that many Bahamians won't."

No one knows for sure just how many

Haitians are in the Bahamas, for, in addition to the 1,500 contract workers allowed in each year, untold hundreds slip in under cover of darkness and melt away into the population. Immigrant spokesmen, eager to allay Bahamian fears of a flood of homeless, hungry people, estimate 7,000 to 10,000. Some Bahamians put the number at 40,000.

Paul L. Adderley, the Bahamas' crisp and debonair attorney general and minister of external affairs, estimates 10,000 to 15,000. Though admitting the difficulty of stemming the flow of illegal entries, he denied that government policy is inconsistent.

"All immigration in the Bahamas is related to employment necessity," he said, "and the Haitians provide a very necessary function in the Bahamian economy. They are gardeners, domestics, and farm laborers."

In short, the Haitians fill vital vacancies at the bottom of the Bahamian economy. Though their pay is low, they dare not complain, for anything is better than being sent home. "They gotta make ten to twenty times more here than they do at home," Lewis Pinder told me.

THE BAHAMAS are both victim and beneficiary of geography. The westernmost islands, only 50 miles across the Gulf Stream from the east coast of Florida, are an easy weekend jaunt for yachtsmen, a pleasant overnight sojourn for the gambler eager to try his luck. They are also a splendidly convenient relay point for smugglers running drugs up from the Caribbean and South America to the hundreds of miles of scalloped shoreline along Florida's "gold coast."

But proximity to the U. S. mainland, Minister Adderley said, is only one of the conveniences the islands' geography offers the smugglers: "We have more miles of coastline than anyone could conceivably count; so they can be undetectable here. It is impossible to police this whole area. Absolutely impossible."

The accepted figure for the number of Bahama islands is 700, stretching from Walker's Cay in the northwest corner of the Abaco group to Great Inagua, some 500 miles away to the southeast. The figure is accepted only because no one can come up with a more precise one.

In 1864, an official report listed just 29 islands, but it mentioned 661 cays and 2,387 rocks. According to Paul Albury, president of the Bahamas Historical Society, the confusion is largely one of definition: "The word 'cay' was adopted from the Arawak *cairi*, which meant 'island,' but in English form, pronounced 'key,' it means 'small island.' Each individual engaged in naming decided for himself whether he was dealing with an island or a cay. Inevitably, this produced interesting anomalies. For example, Rum Cay has an area of 30 square miles and Harbour Island only one square mile."

Most marine charts of the Bahamas counsel mariners not to rely solely on marine charts, for islets that once existed may now be shoals that lurk just below the surface, and whilom sandbars may now be shrubby cays. Coastlines are changing constantly; lighthouses may or may not be functioning; buoys may have blown away. Navigation is perilous and best attempted in full daylight.

Consequently, the government, despite its increased efforts, has no hope of keeping track of all the boats and planes that thread through the reefs and islands; there is no way for anyone to know, reliably, what is going on.

Drug-related acts of violence and piracy, rare though they may be, attract attention in the archipelago described by that first tourist, Christopher Columbus, as being "very green and fertile and the air very balmy."

Articles in Florida newspapers and boating magazines have warned about cruising in the Bahamas and cautioned mariners to carry guns. They have recounted horror stories about yachts attacked and boarded by drug runners seeking "clean" boats on which to sneak into the United States.

Understandably, the young Bahamian government has grown apoplectic about the tarnish on the islands' reputation and has, with U. S. aid, launched a crackdown on smuggling. Since the country gained independence from Great Britain in 1973 (though it is still a member of the Commonwealth under Queen Elizabeth II), it has taken pains to build an image as a safe and carefree tropical paradise. And the work has paid off: More and more tourists come from more and more countries. In 1981 almost 1.8 million tourists flocked to this little nation,

Rollicking ride *on the pry—a plank for counterbalance—drenches crewmen in Nassau's Marlboro Championship of Racers (**right**). The contest pits Bahamian skippers against internationally known ocean-racing captains, all sailing native racing sloops. Spectators take joyous pride (**above**) in contenders who hail from across the Bahamas, where regattas mark high points in the lives of Family Islanders. Highly skilled, the Bahamian sailor reads his multihued reefs and shallows as a Yankee skipper reads his charts.*

which covers only 5,383 square miles (about the size of Connecticut), and they pumped more than 600 million dollars into a permanent population of only 210,000.

The government is quick to point out that the average tourist is unlikely ever to encounter the drug problem. At worst, he might be walking down a crowded street in Nassau and be accosted, as I was one day, by a bebopping young man with a tape deck blaring into his ear, who tugged at my sleeve and showed me a handful of white powder and murmured, "Hey, man, you want to wake up your nose?"

There will be no drug problem evident to the gambler in the busy casinos of Paradise Island or Cable Beach or to the shopper in the cosmopolitan arcades on Grand Bahama. There will be no whispered overtures in the elegant drawing rooms of Lyford Cay Club on New Providence. And in the lovely, bucolic resorts of the Family Islands—once the Out Islands ("out" from Nassau) but renamed by the government to impart a sense of community to this necklace of far-flung settlements—one's brain need be assaulted by nothing more hallucinogenic than a dazzling sunset.

THE GOVERNMENT'S posture contains an undertone of justified resentment: It is not the Bahamas' fault that the U. S. has become the world's biggest market for illicit drugs; if the market were to dry up, so would piracy. The government claims, besides, that the problem has been exaggerated. "Anything can happen in a drug situation," Livingstone Coakley, then minister of tourism, told me, "but the incidents that have occurred have been blown out of all proportion."

Sadly, though, the handful of genuinely serious incidents has by now grown into a basketful, and if one crisscrosses the Bahamas by boat, as we did, few days go by without some reminder that the buccaneering tradition is very much alive in the islands of the Spanish mariners' *bajamar:* shallow sea.

It is a minor irony that such violence, which has held an almost honored place in the past 500 years of Bahamian history, was an imported commodity entirely. It was foreign to the aborigines, a placid and pacifist branch of the Arawak Indians who had fled

north to these islands to escape the barbarity of the Caribs—who were not only fearsome to see but also cannibalistic.

COLUMBUS FIRST LANDED on the island the Indians called Guanahani on October 12, 1492. His first order of business was to change the name to San Salvador. His second was to get to know the locals.

"They are so . . . free with all they possess, that no one would believe it without having seen it," he reported to the Spanish sovereigns. "Of anything they have, if you ask them for it, they . . . invite the person to share it, and show as much love as if they were giving their hearts." So fine a people were they that Columbus deemed them worthy of serving as slaves to the Spaniards. Within 30 years he and his successors had managed to extinguish the islands' Arawaks.

For the next century or so no one lived on the islands, and there were few visitors. One, briefly, was Ponce de Leon, who sailed uncertainly among the islands in search of the Fountain of Youth before turning his quest to Florida.

Then, in the 1640s, a band of Bermudians, dissatisfied with religious conditions in their adopted home, sailed south to the Bahamas and established a colony. They dubbed themselves Eleutherian Adventurers ("eleutheria" has its root in the Greek word for "freedom"), and their island came to be called Eleuthera.

Other Bermudians, with interests other than religious, settled New Providence island, for it offered three commodities prized by seagoing folk: shipwrecks to salvage (it was beside major shipping lanes), ambergris to sell, and salt. As the years went by, New Providence became attractive to still another group—pirates—for it had a superb harbor and a marked absence of government.

Governor after governor had failed to suppress the pirates and inspire the population to gainful labor. Finally, in 1718, the English sent Capt. Woodes Rogers to Nassau to try his hand as governor. A man of discipline, tenacity, and impeccable integrity, he offered amnesty to those pirates who would go straight, chased away those who refused, and hanged those who accepted and then reneged. Rogers' feats inspired a motto for the Bahamas: *Expulsis Piratis Restituta Commercia* (Pirates Expelled, Commerce Restored).

No sooner had the excitement of piracy died down than tourism began. The first tourists, in the 1720s, were sickly gentry following their doctors' advice to repair to a more salubrious climate. Tourism hardly exploded into a major industry: 150 years later, in 1873, there was jubilation when the number of tourists soared to 500. But tourism has endured in the face of considerable adversity, and it now provides two-thirds of the country's gross national product.

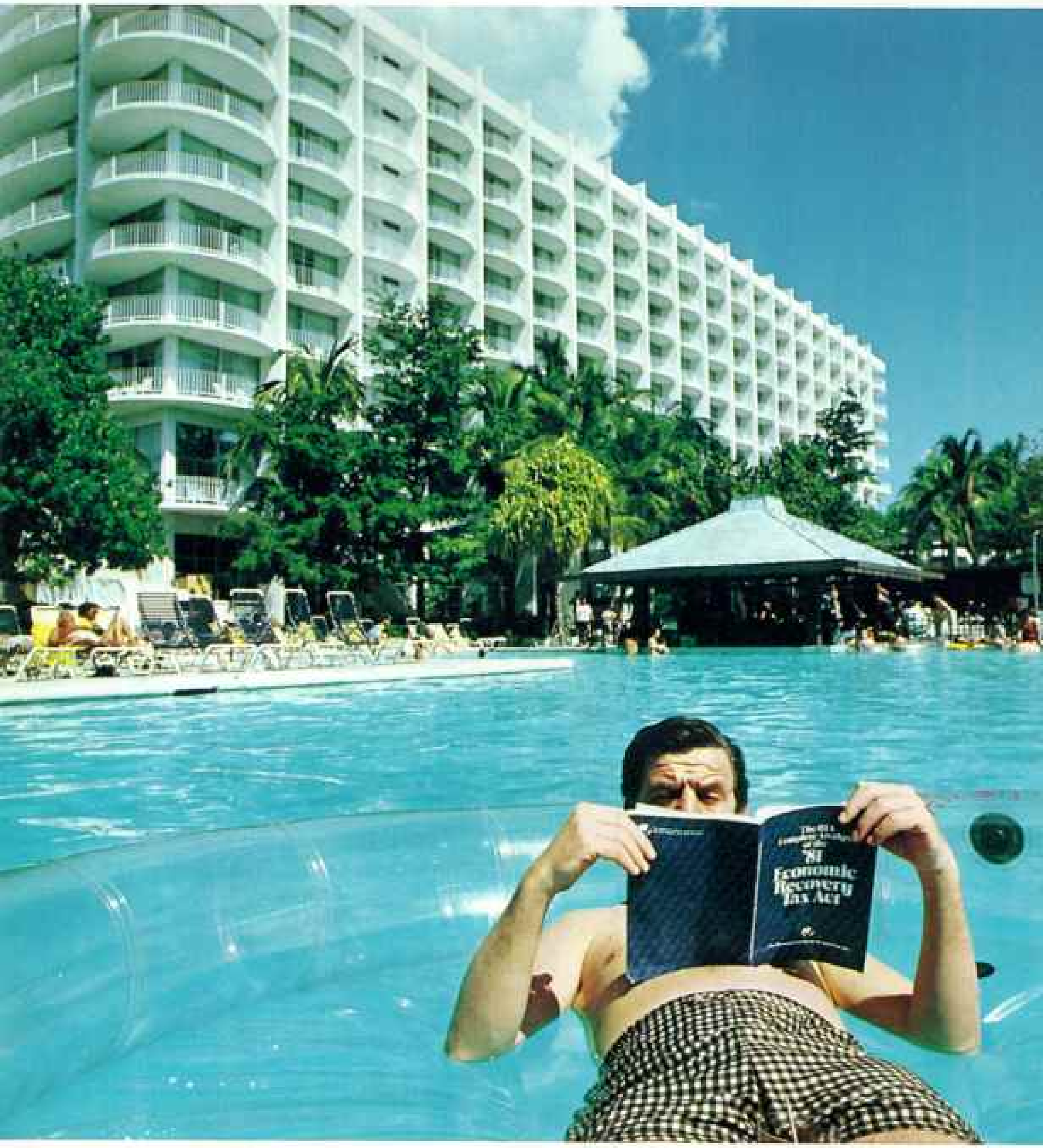
ANOTHER INDUSTRY critical to the Bahamas is fishing. Thousands of Bahamians are nourished or supported by what they harvest from the sea, but in some areas the islands' stocks of grouper, spiny lobster, and conch are being fished out—because of inadequate resource management, by fishermen who ignore the regulations that do exist, and by poachers from other countries, largely Cuban Americans from Florida.

Off Eleuthera's northern tip, in Spanish Wells, I was told that the price of conch had recently risen to two dollars apiece, a manifold increase in only a few years. I heard a bitter dispute between a man who believed the price reflected scarcity of conch and a man who blamed inflation, which he placed directly at government's door: "Dem damn gummints dey take it all for dey selves to spend on vimmin."

Other communities, anxious to prevent overfishing, are establishing their own unofficial game preserves, independent of the government, at times enforced with vigilante fervor. Not all private preserves are for fishermen, however; at least some are dedicated to divers and snorkelers.

On Harbour Island, to the east of Eleuthera, a small resort hotel called the Romora Bay Club has been hacked out of the tropical undergrowth and constructed with care and taste over many years by an American named Roy Schmidt. Romora Bay offers most of the standard Bahamian fare—sun, serenity, beauty, and beaches—plus some of the best scuba diving in the Bahamas.

What makes the diving off Harbour Island particularly *(Continued on page 383)*

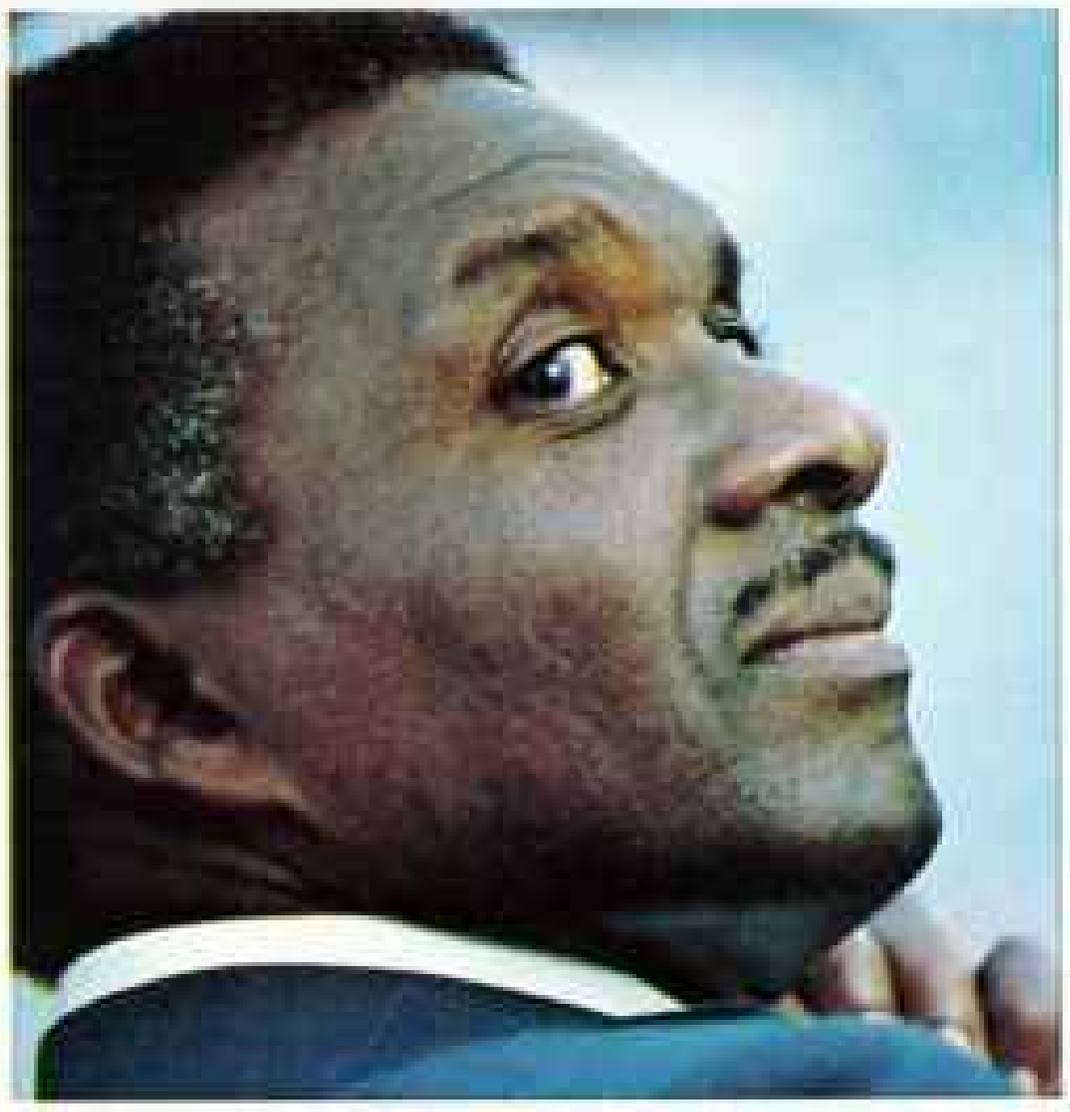


Vacation can pay at *Paradise Island Resort and Casino—for gamblers who get lucky at the gaming tables or for the more canny bettors who bone up on tax law in the hotel pool before crossing the bridge to Nassau and its money houses. Some 330 banks and trust companies cater to intercontinental clients in a haven free of taxes on personal and corporate income, inheritance, gifts, royalties, and a wide variety of other dealings.*

A Switzerland of the Americas in finance, the Bahamas, by law, guarantee strict secrecy of customers' identities and accounts. Moreover, hotels and industries pay no duty on imports for capital investment.

Round-the-compass shelter *and open Atlantic beaches lie within strolling distance in Hope Town, one of a string of Abaco cays communities founded by Loyalist refugees from the American Revolution. Each maintains a distinctive character,*

some little touched by outsiders, others hosting small resorts. Harbors fill with pleasure boats drawn by the discovery that the Abaco cays, stretching 110 miles, enclose a virtual inland sea—among the world's finest cruising grounds.



Architect of independence, *Prime Minister Lynden O. Pindling* ***(left)*** *came to power in a burst of Bahamian pride in 1967. He early shook foreigners' confidence in real estate investment in Freeport when he took steps to reassert control over immigration and labor, formerly granted to the huge foreign-owned development under a charter that had made it almost a state within a state. Construction such as that along the Grand Lucayan Waterway* ***(below)****—with 90 miles of bulkhead and roads, water, and electricity installed—came to a standstill. Residential real estate sales elsewhere in the Bahamas rose in the '70s, but in 1979 proposed new policy threatened a foreigner's right to purchase land. Residential land sales*

plummeted, and home building by foreigners was stymied as purchase and construction approvals were delayed or denied without appeal.

But, the government contends, it has acted only to end land speculation. As Central Bank governor William Allen explains, "We are trying to marry the need for economic development with attempts to control our land—the only real resource our country has." Director-General of Tourism Baltron Bethel adds: "Foreign ownership is welcome but only where it is going to produce." Since recent elections, clearer, more lenient regulations concerning property sales to non-Bahamians have emerged as a government goal.

good is that the location of the best dive sites is kept secret. The fish have been not only protected but also tamed to a point where large groupers will swim up to a diver and nuzzle him in search of food.

Young Bill Ellis, who worked at Romora Bay, took us to his prime site, at a place called the Plateau, along Eleuthera's rocky eastern shore. Eighty feet down we were swarmed over by Nassau groupers—bumped, nibbled at, gently assaulted, until we surrendered the frankfurters Bill had given us.

"If people follow us out here," Bill said, "we just keep going. If someone started fishing the Plateau, in about 15 minutes the groupers would be fished out."

SUPPOSEDLY, the Eleutherian Adventurers landed in 1648 at a spot very near here, on north Eleuthera between Harbour Island and Spanish Wells, and they camped and prayed in what they called Preacher's Cave. But the honor of being the first permanent community established in the Bahamas, by the Eleutherians, is claimed by a tiny settlement called Cupid's Cay, halfway down Eleuthera.

We anchored in Governor's Harbour, in the lee of Cupid's Cay, mesmerized by hillsides of bright red royal poinciana that, in the afternoon sun, made the town of Governor's Harbour seem to be afire. But before we could set out for town, we spotted ruins on Cupid's Cay, and we aimed the dinghy for that shore first.

We were hailed there by Donald Farington, as he filled his water jug from the town spigot. "I'm the oldest man on Cupid's Cay," he volunteered proudly, shifting a plug of tobacco back and forth in his mouth. "I'm 73, and I still work a full day, thanks to God."

Mr. Farington is a part-time pineapple farmer, living relic of an industry that, in its heyday year, 1900, exported seven million dozen pineapples. Nowadays he is mostly the unofficial historian of Cupid's Cay, and as he led us on a wander among the ruins, he described each crumbling building.

"That was the lieutenant governor's house, a couple of centuries back; that was customhouse; that was government house. This was port of entry for the whole area then. They have all burned now. But there

are fine things about this place still: the peace, the quiet, no crime. Not like Nassau. It is bad in Nassau." (Among Family Islanders, Nassau is synonymous with Sodom.)

Across the harbor the town of Governor's Harbour looked as if it had been transported intact from New Hampshire. Many houses were sparkling white clapboard, some with ornate Victorian gables. A few were being tended by shy and silent Haitians, who were cutting the lawns with machetes.

Most of the houses were closed—the vacation homes of foreigners: Canadians, Americans, Britons, and Germans. And these fine, well-cared-for houses were symptoms of still another complicated problem that has become a bur under the seat of government. Much of the choice land on several of the Bahamian islands has been bought by foreigners, for homesites, rental or condominium

complexes, or simply to "land bank"—that is, to own as a speculative investment.

Minister of Tourism Coakley told me, "On Great Exuma there is no place to expand because all the land surrounding the existing communities is already owned by foreign interests. Of the 30 percent of all Bahamian land owned by foreigners, a lot has been bought for speculation, and much lies fallow."

***To tan means all** in the number one tourist sport, here played at Great Abaco's Treasure Cay resort. For the nation's leading industry—tourism—planners predict an upswing and are adding by 1983 some 3,000 new hotel rooms, apartments, and time-sharing units in Nassau and Grand Bahama. The emphasis is shifting as well to the Family Islands and small resorts attuned to local customs and architecture.*

The result of the government's concern has been the formulation of a new land policy. New legislation, though still unsigned by the governor general, has thrown the Bahamian real estate market into a muddle. And according to some frustrated landowners (and would-be landowners) the laws could wreck the real estate industry.

The controversial legislation would establish that though no land would be confiscated, a non-Bahamian who wanted to buy a house or land must get a government permit. An effect has been to cloud the inheritance of property by foreigners.

At the north end of Long Island is the Stella Maris Estate, a development of individual lots designed to sell to people (Europeans, mostly) who have grown fond of Long Island during visits to the Stella Maris Inn. When the new land policy was revealed, home buyers vanished. Now, the inn, which has an interest in the estate property, has had to guarantee repurchase for several homes so that people can feel safe buying property in the estate.

"Everybody was scared to invest," said Jörg Friese, an owner of the complex. "You're not going to rush out to buy land if you believe some bureaucrat six months from now will tell you you don't own it."

Because of the nose-diving real estate market, there is now a countermovement to ease requirements for foreign ownership.

Minister Coakley said legislation is needed to assure Bahamians that they will be able to own land in their own country. "We must develop properly," he said. "Proper development will encourage our young people to return to the Family Islands."

Nassau is like a leech to the Family Islands, sucking out their lifeblood, their youth. At last count, 135,000 of the Bahamas' 210,000 people lived in and around Nassau. Evidence of the loss is everywhere in the islands.

Walking down a road on Long Island one day, I passed empty house after empty house. I stopped to talk with Braggy Knowles, his face more weathered than many houses, who, with his wife, runs a thriving straw-weaving business. "Sometimes I work growin' pineapple," he said, "sometimes cotton, yeah man. No more cotton now, though."

There has not been a Bahamian cotton industry since before the American Civil War. It succumbed to insects and depleted soil. "No one want to work no more, yeah man." Braggy waved an arm at the row of deserted houses. "They all want the high life, the high life in Nassau, so they move away." He shook his head sadly. "Yeah man, they move away."

BUT HOPEFUL SIGNS exist. The dive master at the Stella Maris Inn, a robust and amiable young man named Jason Burrows, is a reverse migrant: Born and raised in Nassau, he moved to Long Island because "I like things better here. You don't have to worry 'bout how fast things go."

Jason is a local authority on sharks, and has conditioned more than a dozen local bull sharks to accept divers in their midst.

"Some people think it's a gimmick," Jason said, "but it isn't. It teaches that sharks aren't all out to eat you. They're an animal you have to respect. People have to get to know about the sea, or else they're going to destroy it out of ignorance."

Or greed. Or both. It is a combination of greed and ignorance that is threatening to destroy one of the Bahamas' most vital organs, their coral reefs.

In George Town, Great Exuma, I met an old Bahamian friend, 65-year-old Gloria Patience, celebrated as the "Shark Lady" for her career of catching sharks singlehandedly from a 13-foot Boston Whaler. The jaws she sold to visitors, the carcasses she used for fertilizer. Retired now, Gloria fishes for fun, and she has seen reef after reef killed by, of all things, chlorine bleach.

"It's the spiny lobster fishermen," she said angrily. "They found that if you squirt

In the swing of things, *a young schoolgirl comes to bat during a sandlot ball game on Great Inagua. Unemployment among under-25-year-olds—62 percent of the Bahamas' population—poses a challenge that the government hopes to meet with expanded tourism, agriculture, fishing, and light industry.*

bleach into the reef, you drive the lobsters out into the open where they're easier to grab." Gloria slammed a ham-size fist onto the table and shouted, "Stupid idiots! To get a few bloody lobsters, they kill everything: the fish, the coral, the reef, everything. And it won't come back, y'know."

A few days later I saw a bleached reef, and it was sickening: snow white, brittle as glass, completely barren, dead.

"And there's nothing anyone can do," Gloria told me. "If a man's dynamiting the reefs, you can catch him with dynamite in his boat and put him away. But there's no law against carrying bleach. Lord! Enough things die around here as it is. We don't have to give 'em a push."

THE GREATEST natural killer in the Bahamas has always been hurricanes. Though a truly bad hurricane hasn't struck the islands in more than a decade, in the old days a hurricane often caused more devastation than a war. One of the worst hurricanes hit in 1866. In Nassau alone, 601 houses were demolished and more than 600 were badly damaged. Of 200 ships at anchor in Nassau Harbour, 199 were sunk or smashed to splinters.

The hurricane best remembered by Long Islanders struck in 1926. "I was in the house here," weaver Braggy Knowles recalled, "and the water come up into the house. A dead man, he float right up to the door. Then my father, he float by and they pull him by his suspenders right *in* the door, good as new. Now that *good* luck, yeah man."

Hurricanes in the 1920s damaged farming and the sponge industry on the Bahamas' largest island, Andros, which, with 2,300 square miles, constitutes 43 percent of all the land in the country. Many people moved away, and the island's economy has never fully recovered.

Today Andros has no big industry and only two significant employers. The largest is the U. S. government, which employs 150 Bahamians among 900 workers at AUTEC (Atlantic Undersea Test and Evaluation Center) on the east coast. Basically, AUTEC is a testing ground for submarines.

The key to the location of AUTEC on Andros is a natural phenomenon that some government men insist on reducing to the acronym TOTO, but which most other human beings refer to by its name: the Tongue of the Ocean. It is a strip of extremely deep

Time passes slowly *but not idly on Mary Johnson's front porch on Harbour Island. Strands of silver palm that she plaits may go into handbags, hats, and place mats for Nassau's straw market, a major outlet for handicrafts.*

water—a thousand fathoms—right offshore, making it possible for AUTEC to operate hydrophones and other scientific gear from shore, while, virtually in its front yard, a simulated deepwater battle is conducted between submarines, revealing whatever deficiencies there may be in the submarines and their personnel.

The other sizable business on Andros is a cottage industry with international distribution. A batik-manufacturing enterprise, Androsia, employs 45 people on the grounds of a derelict luxury hotel—overgrown by vines and riddled by termites.

Androsia was started by Dick and Rosi Birch. He was from Canada, she from Wisconsin. They met on Andros, married, and became Bahamian citizens. Just Dick showed me around because Rosi had departed for Florida to show her spring line. (We learned later it was stolen from the trunk of her car in Miami.)

At the Androsia works the chief batik designer, young Merton Thompson, said proudly, "We can turn out about a yard a minute, 420 to 480 yards a day. But there are so many steps in the dyeing and the drying that it's a six-week process before the fabric is ready to be sold as a garment."

Dick is keeping his fingers crossed about the present success of the batik enterprise, for, he says, one never knows whether success will be condoned by Andros's most celebrated figure, the infamous, though legendary, "chickcharney." To the logical mentality of an outsider, the chickcharney is a poltergeist: a nonexistent, three-toed, three-fingered, human-faced elf invented by the Androsian imagination to explain the inexplicable. To the people of Andros the chickcharney is as real as the nose on your face, and has a great talent for mischief.

For consultation about the chickcharney, Dick Birch referred me to Papa Gay, who owns a restaurant across Fresh Creek in Coakley Town. A large, round man with short-cut gray hair and thick-lensed glasses, Papa Gay eyed me suspiciously when I inquired as to the whereabouts of the chickcharneys.

"Man, you don' wan' find them," he said. "They cause you grief, all kinds of grief." He must have taken my silence for disbelief, for he added ominously, "You don' believe the chickcharney bad, you just go aks Neville

Lured by a speared fish, *a requiem shark goes before an ABC Sports camera* ***(below)****. During a lull in action, a crew member blows air rings; one frames his body* ***(below right)****. Filming took place at Shark Reef, where professionals from*

Chamberlain. He go cut down de trees where de chickcharney make de nest—and *man!* they ruin his plantation, ruin his family, ruin everything. Yeah, you aks Neville Chamberlain. You know him . . . he de one start World War II."

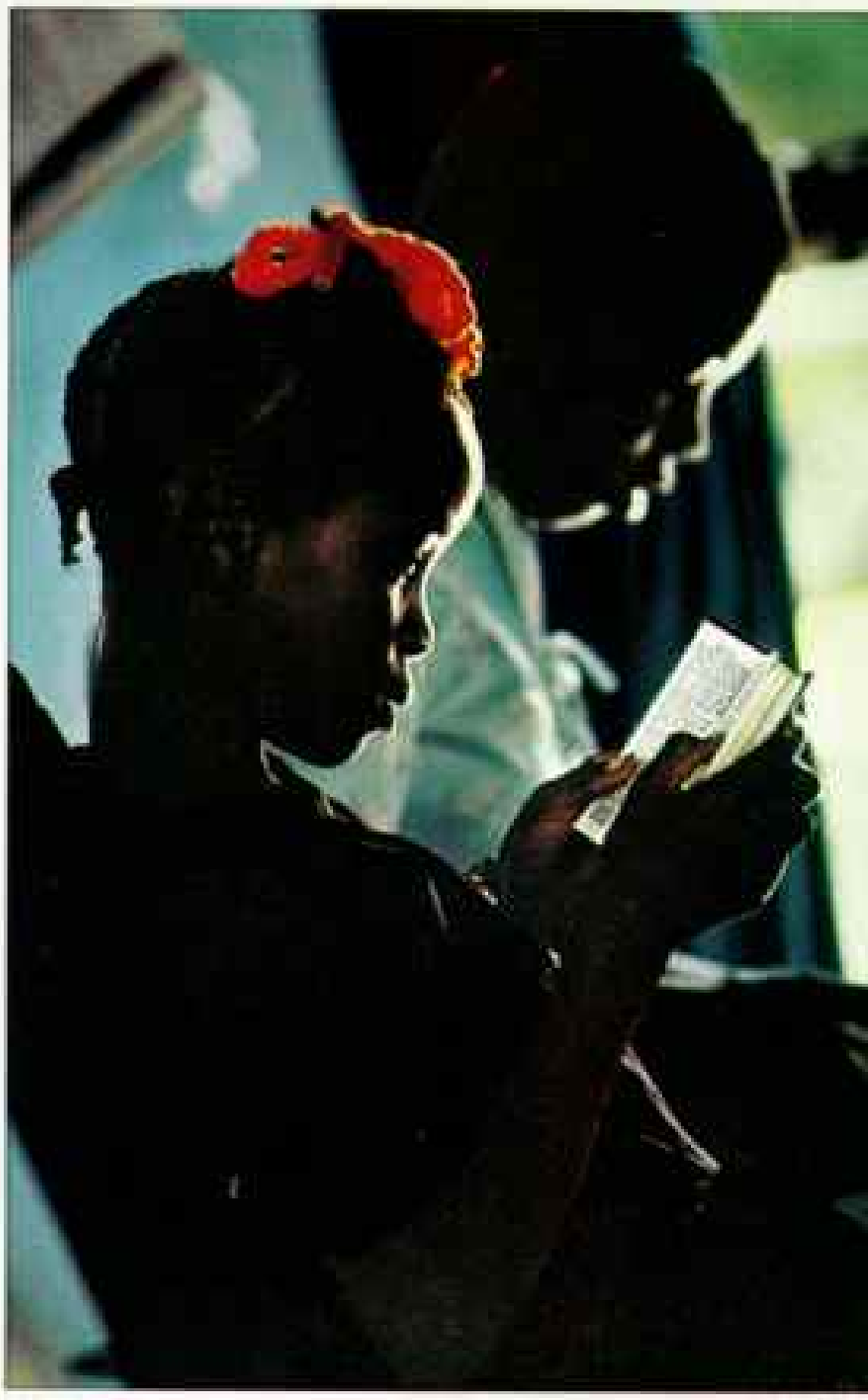
Fantasy? I looked through Paul Albury's respected history, *The Story of the Bahamas,* and found that Neville Chamberlain and his father had, indeed, had a sisal plantation on Andros at the end of the last century. Sisal growers thrived for a while, but not the Chamberlains. In 1896 a despondent Neville wrote to his father, "I no longer see any chance of making the investment pay."

If only the chickcharneys had let Neville Chamberlain be, he might have stayed on Andros, growing sisal for making rope, and avoided the whips and scorns of time.

FROM ANDROS, we put into Nassau to make repairs to a couple of ornery pumps. From all the dour warnings we had heard about Nassau, I expected immediately on arrival to be set upon by footpads, cutpurses, brigands, hoydens, and amphetamine-addled teenyboppers.

Of course what I found instead was that nightmare for all small-town folk: a city. Relative to the peaceful and pristine Family Islands, Nassau is noisy and crowded and dirty. There is crime—housebreaking and burglary predominate, Paul Adderley told me, though homicides are not unheard of,

Long Island's Stella Maris resort have safely introduced hundreds of scuba-diving enthusiasts to a local population of bull sharks. Crystal waters make the Bahamas a favorite destination for divers and underwater filmmakers.



Rock of the islands *forms the massive and cooling walls of the Anglican church in Glenton, Long Island, where parishioners emerge into noonday glare after morning service* ***(left)****. An Anglican priest visits once a month. Other Sundays, catechist Jerome Adderley conducts lay services. Asked about his calling to the role, he says simply, "We little children were all raised going to Sunday school and reading the Bible"—an upbringing still a way of life for the latest generation of youngsters* ***(above)****.*

In most Family Island hamlets a variety of churches and denominations serve the spiritual needs of a people who live close to the elements, mindful of the vagaries of nature. Intimate with the sea and eating from its bounty, they also acknowledge, "The sea, she'll eat you up."

muggings not uncommon. The people are brusquer, less easygoing, more interested in what money can buy and thus more eager to separate tourists from their money. But for every wisecracking tough guy in Nassau, there is at least one charmer like Olive Rolle.

We met Olive at the outdoor market on Potter's Cay, beneath the bridge that connects Paradise Island to New Providence. Here every day come the boats from the islands, carrying fruits, vegetables, conchs, jacks, mackerels, groupers, crabs, and spiny lobsters—alive, dead, dried, filleted.

A plump and jolly woman, Olive sat at her stand selling vegetables and preparing a conch salad, crushing peppers, dicing vegetables, sprinkling spices. Beside her was a wire cage full of live crabs. I asked how long they could live out of water.

Olive looked at me as if I were ineffably stupid. "They be land crabs," she said. "From Andros."

"Oh." To change the subject, I pointed to something among her vegetables I had never seen—a huge, lumpy, brown, pea-podlike critter. "What's this?"

"Tamarind," she said. "You make an ade of it, or you can do like this." She peeled one end of a pod and offered it to me, smiling.

Sophisticated gourmand that I am, I knew what to expect—a native delicacy, one of those secret wonders of island cuisine, like conch fritters. So I popped it into my mouth—and wanted to die. It was ghastly!

Where pirate ships anchored, *cruise liners unloose hordes of bargain-bent visitors on downtown Nassau* ***(left)****. Those who yearn to sample the life of the people may turn up at Potter's Cay produce market, where they find some of the best buys in the Bahamas: fresh mangoes and other tropical fruits, vegetables, conchs, and fish. And in vendors like Olive Rolle* ***(below)*** *they discover a friendliness that never goes stale. . . . "No charge."*

Bitter, sour, acid, altogether nasty. I clutched my throat and tottered, and Olive, reveling in the sight of the lurching grotesque, roared with laughter and peeled a banana and forced it into my mouth to quench the taste of tamarind.

Even away from the Nassau hustle, not every welcome is a warm one. A Royal Bahamas Defence Force spokesman advises: "There are areas where boating is not wise—just as there are areas in Washington, D. C., where a tourist shouldn't walk." But stories of piracy have grown fewer, due perhaps in part to an American yachtsman who shot and killed three Andros islanders after they boarded his boat and demanded money at knife point. He was not charged.

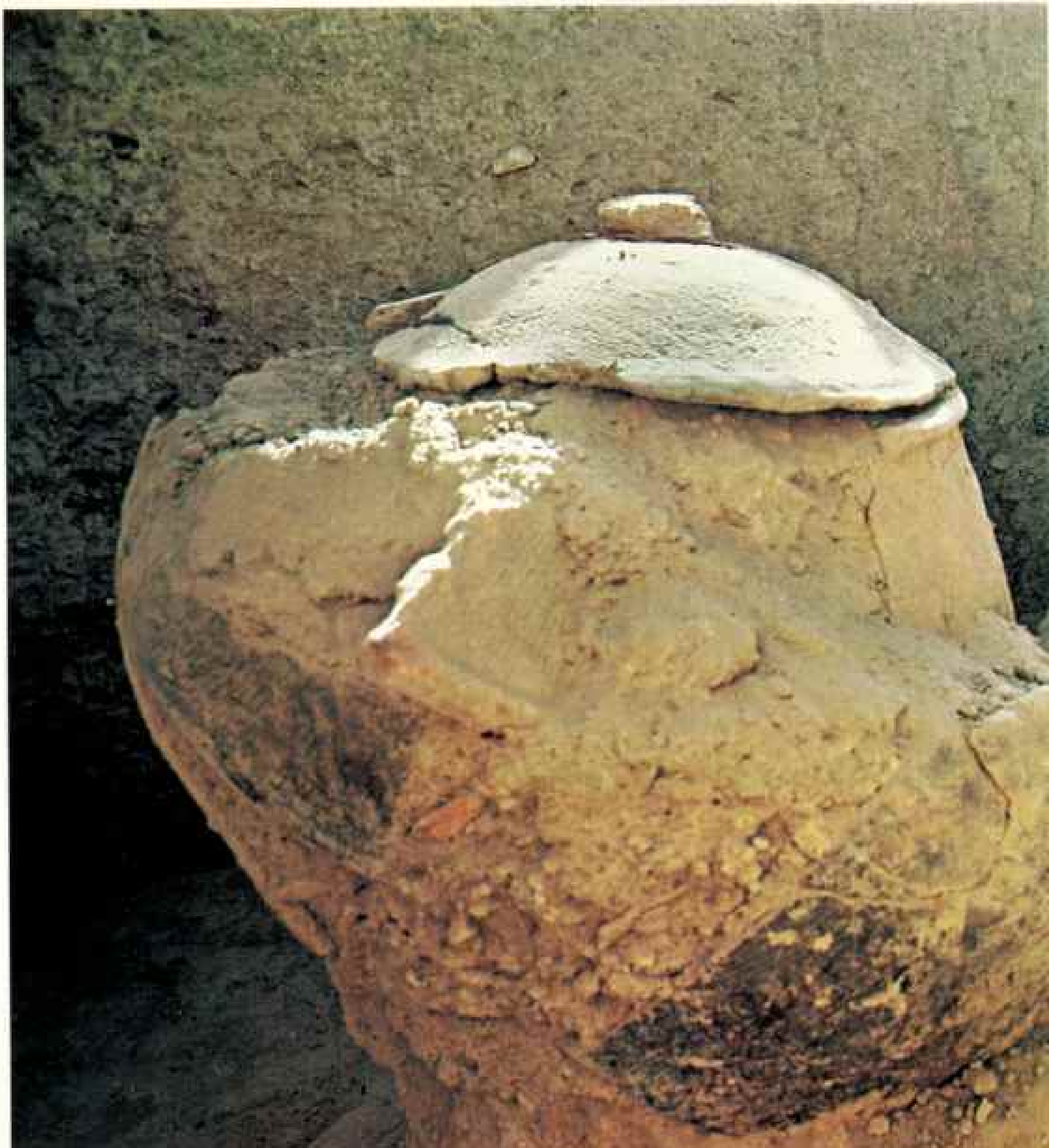
I recalled the Bahamas motto from the 18th century: *Expulsis Piratis Restituta Commercia.* And I wondered whether a new motto might be appropriate for the modern-day Bahamas: *Restitutis Piratis Maxima Commercia,* which translates loosely, "The pirates are back but business is booming."

For still the dominant image is one of prosperity. Though the bloom is off the boom in some areas, banking, pharmaceuticals, and other industries thrive.

Cruise ships pack Nassau Harbour. Tourists flock to casinos and shops. I thought there might well be truth to Minister Coakley's prediction that "the Bahamas will be the top tourist destination in the world for years to come." □

Finding West Africa's

By SUSAN and RODERICK McINTOSH Photographs by



Oldest City

MICHAEL and AUBINE KIRTLEY

***Bones of the past** lie in funerary urns unearthed at Mali's Jenne-jeno, a city recently revealed as a capital of commerce in West Africa more than a thousand years ago.*

TWO CITIES lie as neighbors on a stark river plain of West Africa. One stirs with the vigor of 10,000 inhabitants. The other, now lifeless, a thousand years ago held as many people, perhaps more.

Three kilometers separate modern Jenne, busy with marketing and trade, from the ghost town Jenne-jeno—"ancient Jenne." Both sprawl across flats where the Bani and Niger Rivers weave braided courses in the Inland Delta region of the Republic of Mali (map, page 400).

In the scorched bleakness of the Sahel belt of West Africa, Jenne-jeno is a great wonder—and a paradox. From a start in the third century B.C., the city by A.D. 800 had grown to support many thousands. Mysteriously abandoned 600 years ago, Jenne-jeno lay forgotten for centuries.

Today a few acacia trees and a clump or two of mangoes dot the barren ancient site, a vast teardrop-shaped mound that rises to a height of seven meters (23 feet)—beyond reach of annual floods—and measures two kilometers (1.2 miles) around its perimeter. Composed entirely of the debris of human occupation, this tell is a maze of eroded house walls, the surface littered with potsherds, glass beads, fragments of stone bracelets, and bits of corroded metal.

During two field seasons, in 1977 and 1981, my husband and I probed at the skeleton of Jenne-jeno. Its old bones, in the outcome, yielded evidence that here 10,000 or more inhabitants fashioned an advanced society vibrant with elegant craftsmanship, productive agriculture, and far-reaching trade. It is the oldest known city, and perhaps the most important Iron Age site, in Africa south of the Sahara.

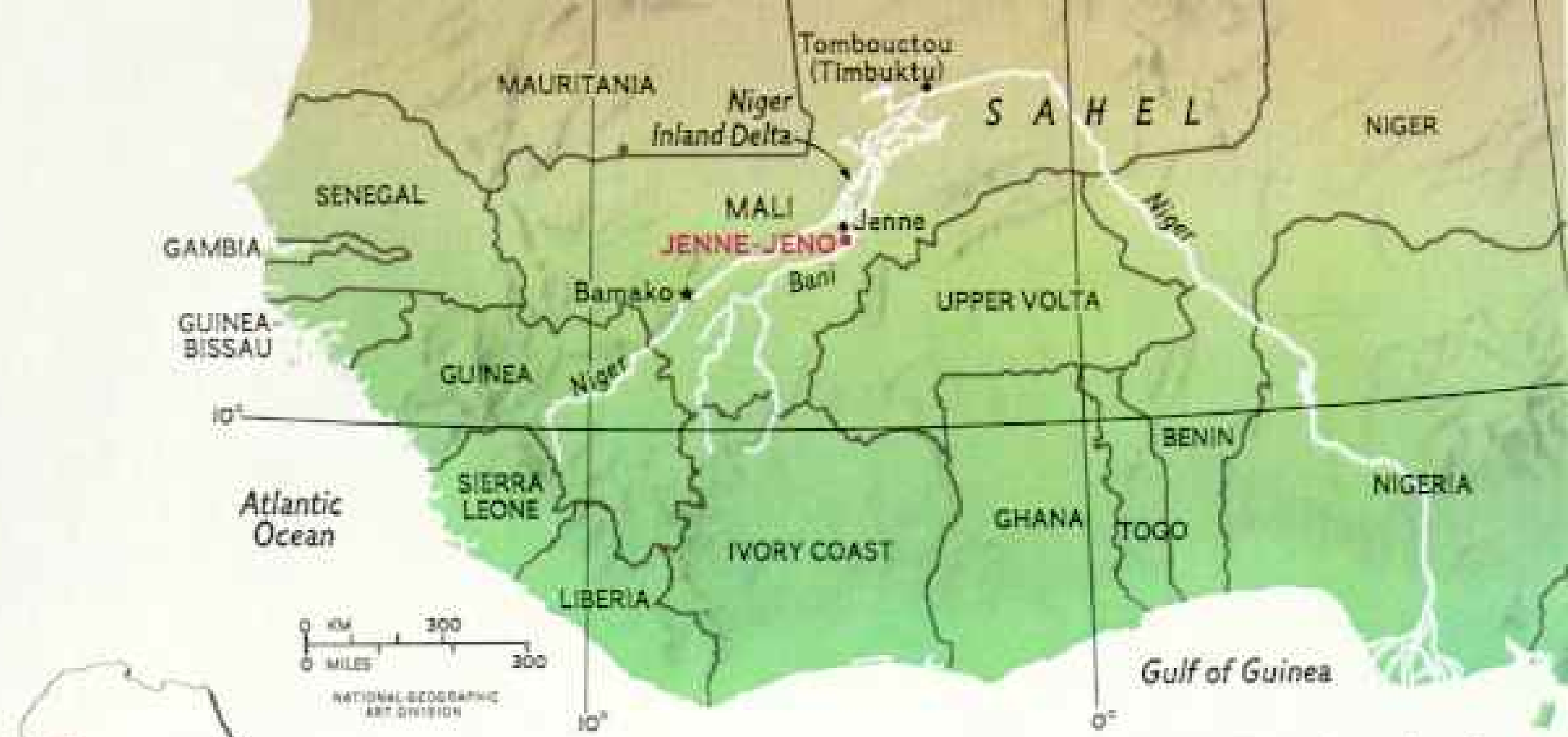
We came upon Jenne-jeno almost accidentally. In 1975 Rod and I, then graduate students in archaeology, had driven across West Africa from Senegal to Ghana to check out locations for future research. After days of travel over Mali's dry savannas, we entered a floodplain alive with cattle, carpeted with grasses, and studded with man-made earth mounds that ignited our curiosity.

ALL ARTIFACTS PHOTOGRAPHED COURTESY OF THE NATIONAL MUSEUM OF MALI AND THE INSTITUTE OF HUMAN SCIENCES

We stopped in the busy city of Jenne, intending to explore nearby sites the next day. Unfortunately, Rod was struck by virulent bacillary dysentery. We fled Jenne seeking a doctor, unaware that we had passed almost within sight of Jenne-jeno.

Our actual "discovery" of Jenne-jeno came months later as we pored over aerial photographs bought from the Mali government. A huge tell three kilometers southeast of Jenne, in area almost as large as the modern

***Kneeling statuettes** (**above**) may have represented protective ancestral spirits for the inhabitants of Jenne-jeno—"ancient Jenne." Reverence for forebears persisted as late as 1900 in modern Jenne (**right**), where workmen clean pottery sherds near its impressive mosque.*



Like a fingerprint, *modern Jenne patterns the floodplain of the Bani River* (**below**), *just three kilometers from ancient Jenne at upper right. In a closer airview* (**above right**), *Jenne-jeno gives little hint of its riches. On the ground, however, the authors found its surface littered with potsherds, artifacts, beads, and scores of house foundations—tantalizing evidence of a major lost city.*

In 1977 and 1981 the McIntoshes' excavations established that Jenne-jeno flourished hundreds of years before cities were thought to exist in West

*Africa. From a small group of round mud huts around 250 B.C., Jenne-jeno grew into a cosmopolitan center of perhaps 10,000 people by A.D. 800. Sited in the Niger's Inland Delta (**above left**), the city profited from an extensive riverine trade that linked it first with the Timbuktu region and later, by caravan, with North Africa.*

Ancient Jenne was mysteriously abandoned about A.D. 1400, perhaps because the Islamic elite considered the city contaminated by pagan practices. As ancient Jenne declined, modern Jenne arose.

town, riveted our attention. We counted 65 smaller mounds in a four-kilometer radius.

Rod and I succumbed to the challenge of Jenne-jeno, and on January 30, 1977, we walked for the first time across the site. Flanked by friends from the Ministry of Culture of Mali, we gazed awestruck at what we saw. The dense brown clay was strewn with artifacts. We counted scores of mud-brick house foundations and spotted the truncated remains of a massive city wall. Clearly, thousands of people once lived here, but how long ago?

"It's a bewildering site, and we're starting from scratch," Rod said to me and our crew of local helpers. "We've got four months before the rains to learn as much as we can."

Our luck far exceeded expectations. Each of the four pits we dug yielded abundant evidence of how the inhabitants had lived and of the chronology of the community. Animal bones, rice chaff, and carbonized grains documented a mixed diet. Pottery fragments, spindle whorls, terra-cotta statuary, and crucibles for smelting copper or gold gave insight into local arts and crafts. Walls defined sturdy homes; hearths located cooking areas.

But most important of all was the radiocarbon dating from hearth charcoal proving that Jenne-jeno already had been occupied for 1,600 years when, about 1400, it was finally abandoned—not much after the time most scholars believe Jenne was founded.

Our discovery excited archaeologists and historians. It contradicted earlier assumptions that urbanism was introduced into West Africa only after North African Arabs penetrated the Sahara in the ninth century to control long-distance trade. Catalyzed by expanded trade, cities grew, first in the southern Sahara, centuries later farther south. By this reasoning, Jenne-jeno should have developed in the 13th century.

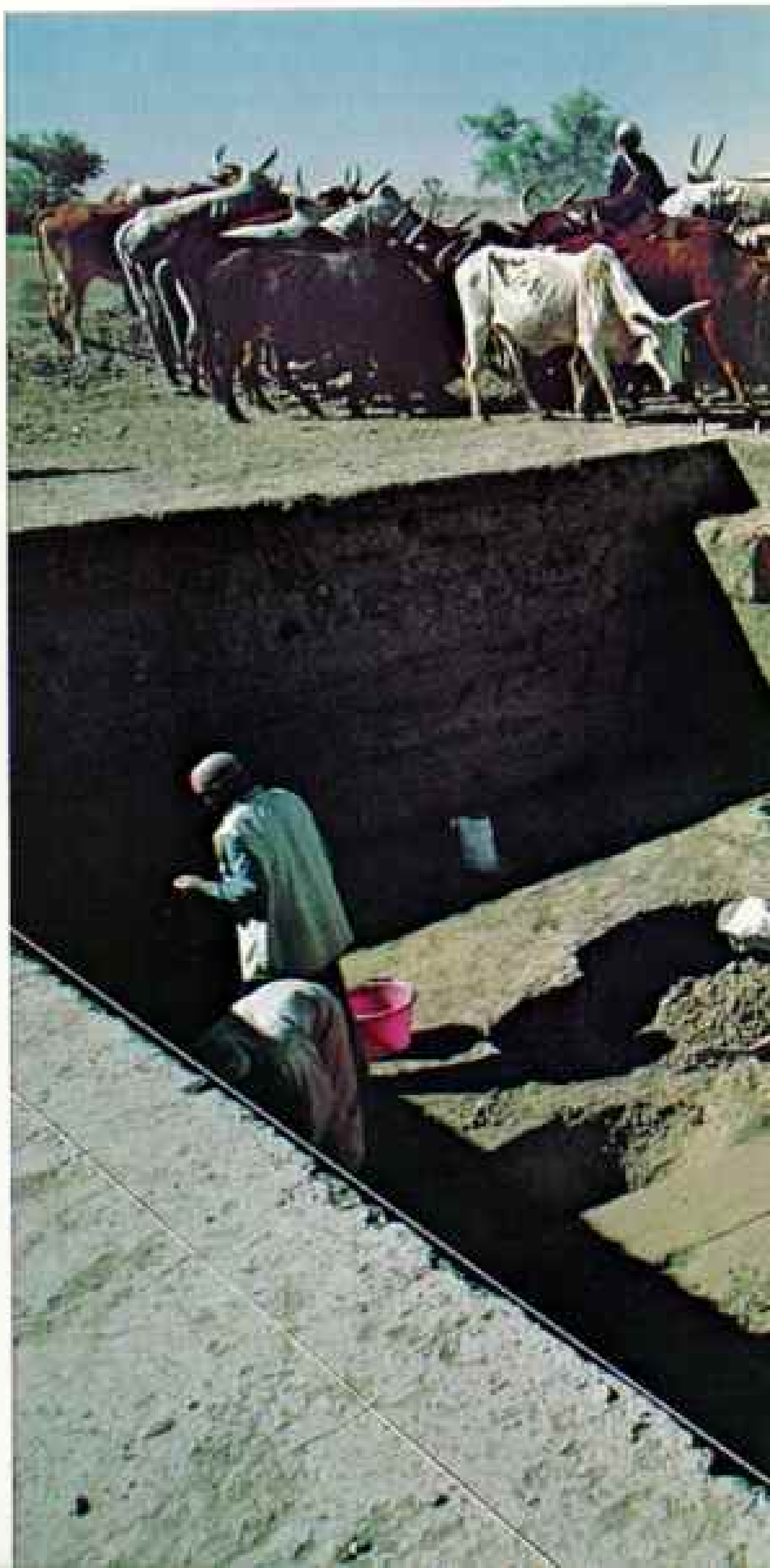
What then were *(Continued on page 408)*

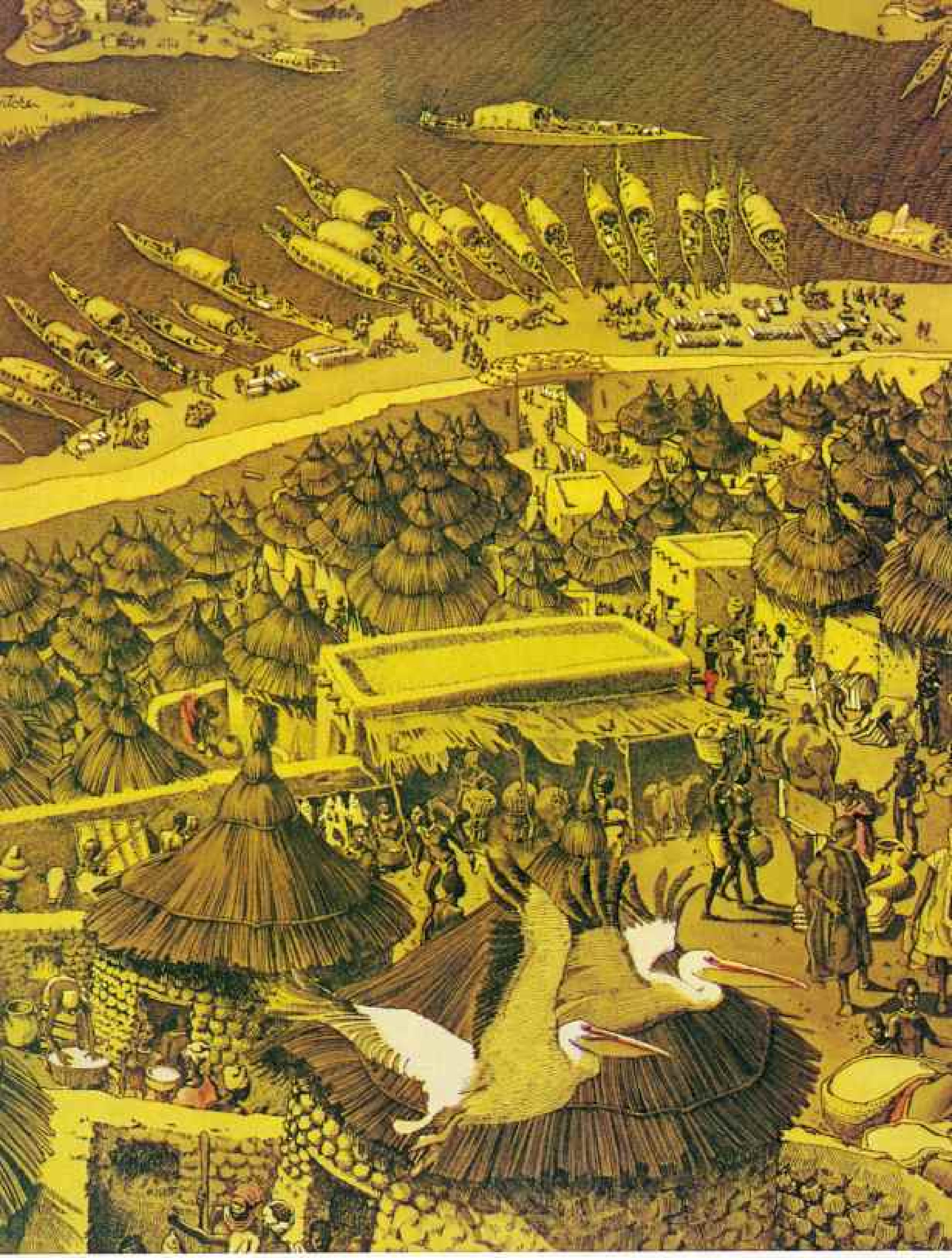
Susan Keech McIntosh and **Roderick J. McIntosh**, professors of anthropology at Rice University in Texas with 18 seasons of combined field experience, have directed the Jenne-jeno excavations since 1977. **Michael** and **Aubine Kirtley** are free-lance photojournalists based in Paris (see On Assignment, July 1982). This is their third assignment for the GEOGRAPHIC.

***Eroded mud bricks** are all that remain of a wall that girded the city (**right**). Rod McIntosh, at left, and assistant Karol Stoker measure its width at three meters and estimate its height at four meters or more.*

What was its purpose? "Perhaps for defense," say the McIntoshes, "or perhaps for flood protection." Pottery found in and below the wall dates its construction from A.D. 400 to 800.

*As errant cattle are herded from the dig (**below**), workers remove soil bit by bit to reveal the circular foundation of a mud-brick and thatch house. The diggers went down five and a half meters—16 centuries of occupation—before encountering sterile ground.*

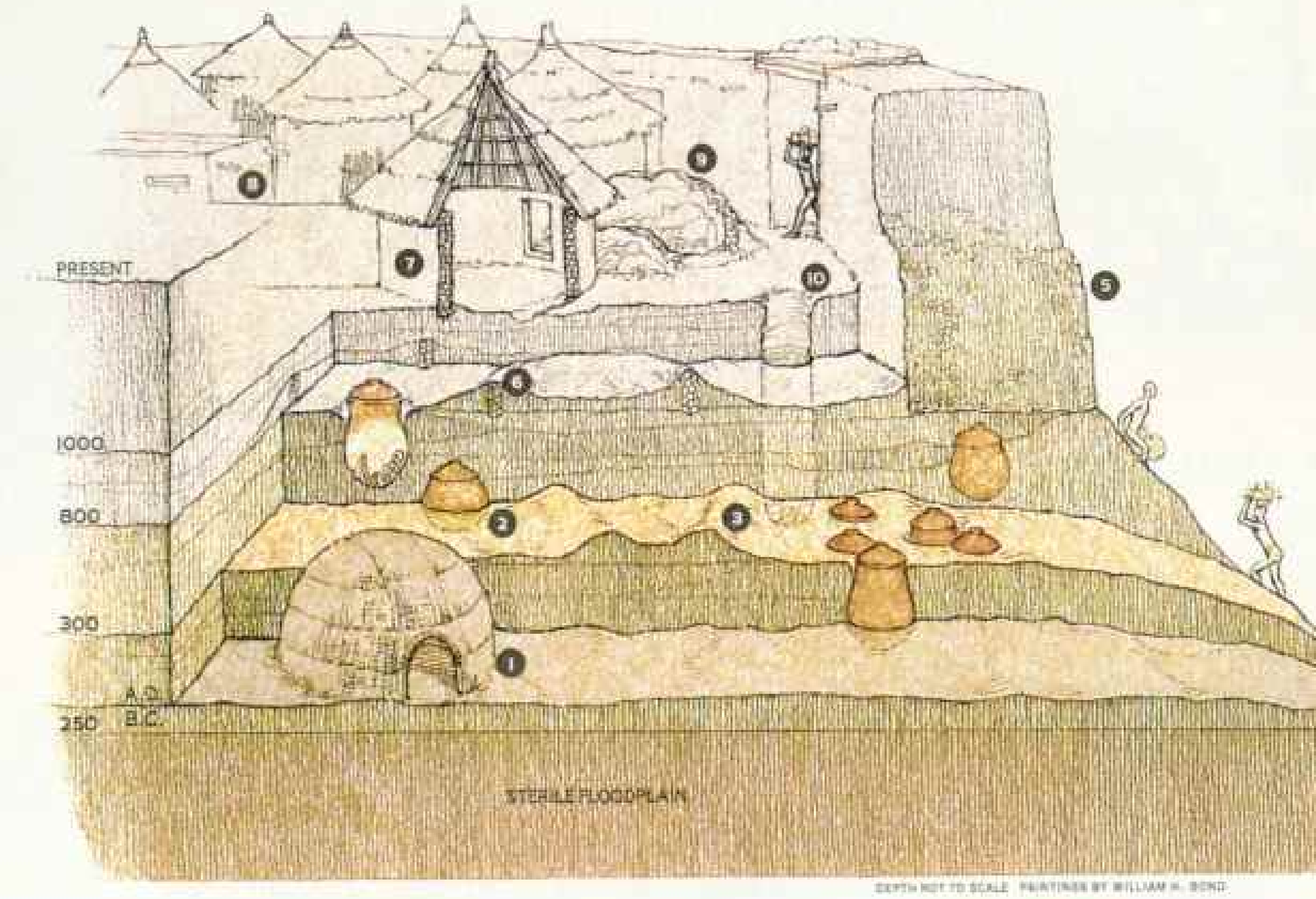




The hum of life *echoes from Jenne-jeno's markets circa A.D. 1000, as inhabitants gather to barter rice and millet, baskets and pottery, and fish. By this time ancient Jenne and its satellite communities had penetrated the marketplace of*

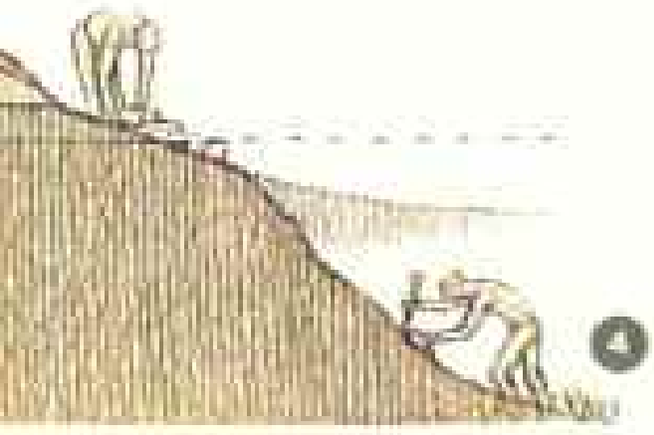
PAINTING BY CHARLES SANDORE

North Africa. As goods, produce, and gold flowed north from Jenne-jeno via river and caravan, Saharan salt and Mediterranean glass beads came south, probably along with new ideas in architecture such as rectangular houses.


PRESENT
1000
800
300
A.D.
250 B.C.
STERILE FLOODPLAIN
DEPTH NOT TO SCALE PAINTINGS BY WILLIAM H. BOND

The city that grew on top of itself

*STAIRCASE into the past reaches to the earliest time of human occupation at Jenne-jeno (**left**). Artifacts found by the authors (**right**) chronicle the city's rise as a center of trade and commerce in West Africa.*



*The first inhabitants of ancient Jenne, perhaps herders and fishermen from the north, lived in circular houses (**1**) built of bent poles and woven reed mats waterproofed with mud.*

*From 250 B.C. to A.D. 300 (**panel at right**), the inhabitants used everyday bowls of a design common several centuries earlier in the southern Sahara, indicating that the original population may have migrated from there. The inhabitants wore necklaces of stone beads and employed sandstone cylinders for grinding grain. Children's clay toys of domestic and wild animals — this one is a bull — were made in great numbers.*

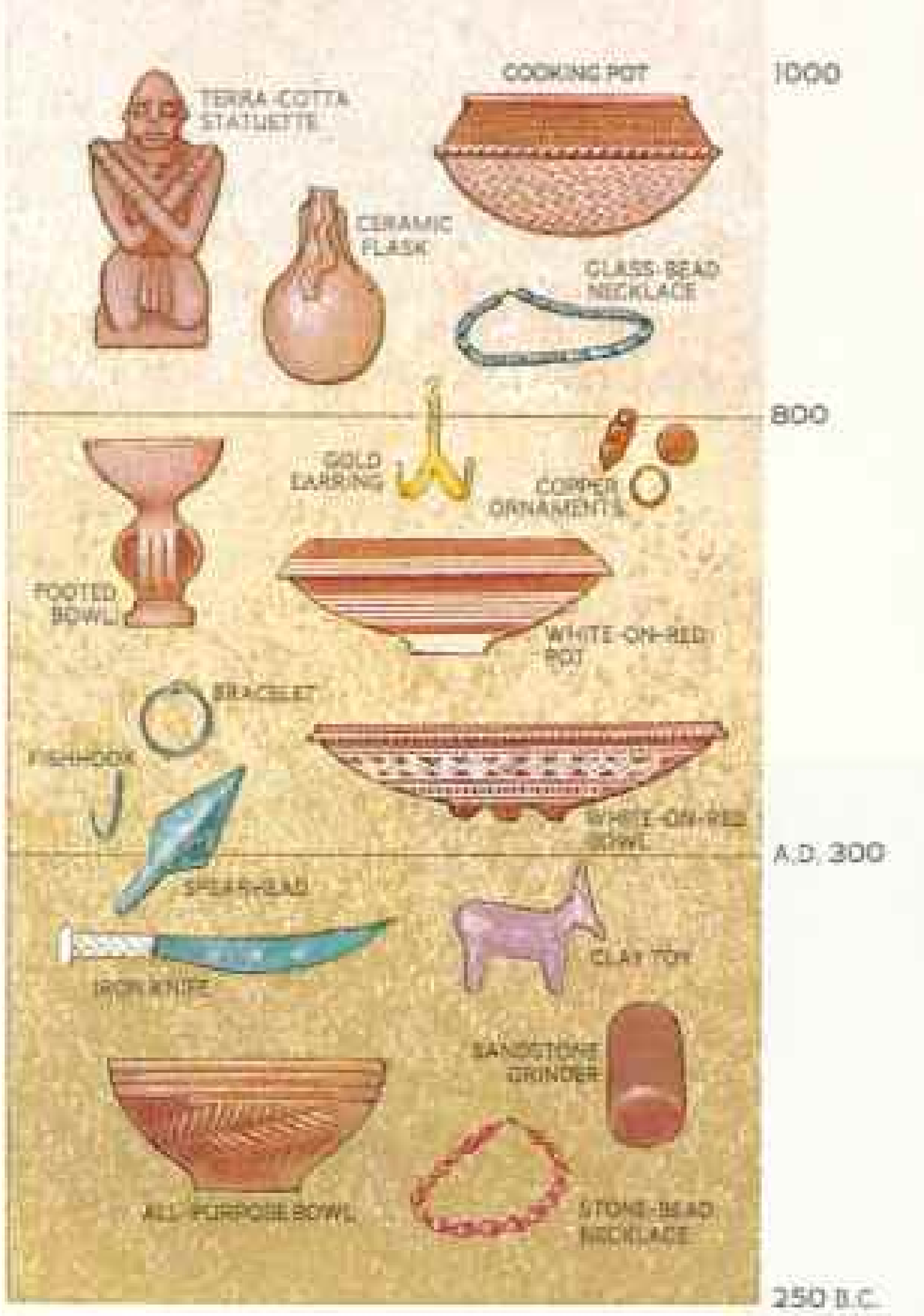
*The second phase of occupation, from A.D. 300 to 800, shows the use of urns for burial (**2**) and the eroded foundation of a house (**3**). For building material residents employed mud from the floodplain (**4**), carried to the site and stacked layer upon layer. Thus the city literally grew on top of itself — to a depth of 5.5 meters over 16 centuries. By 800 the wall (**5**) that girded the city was complete.*

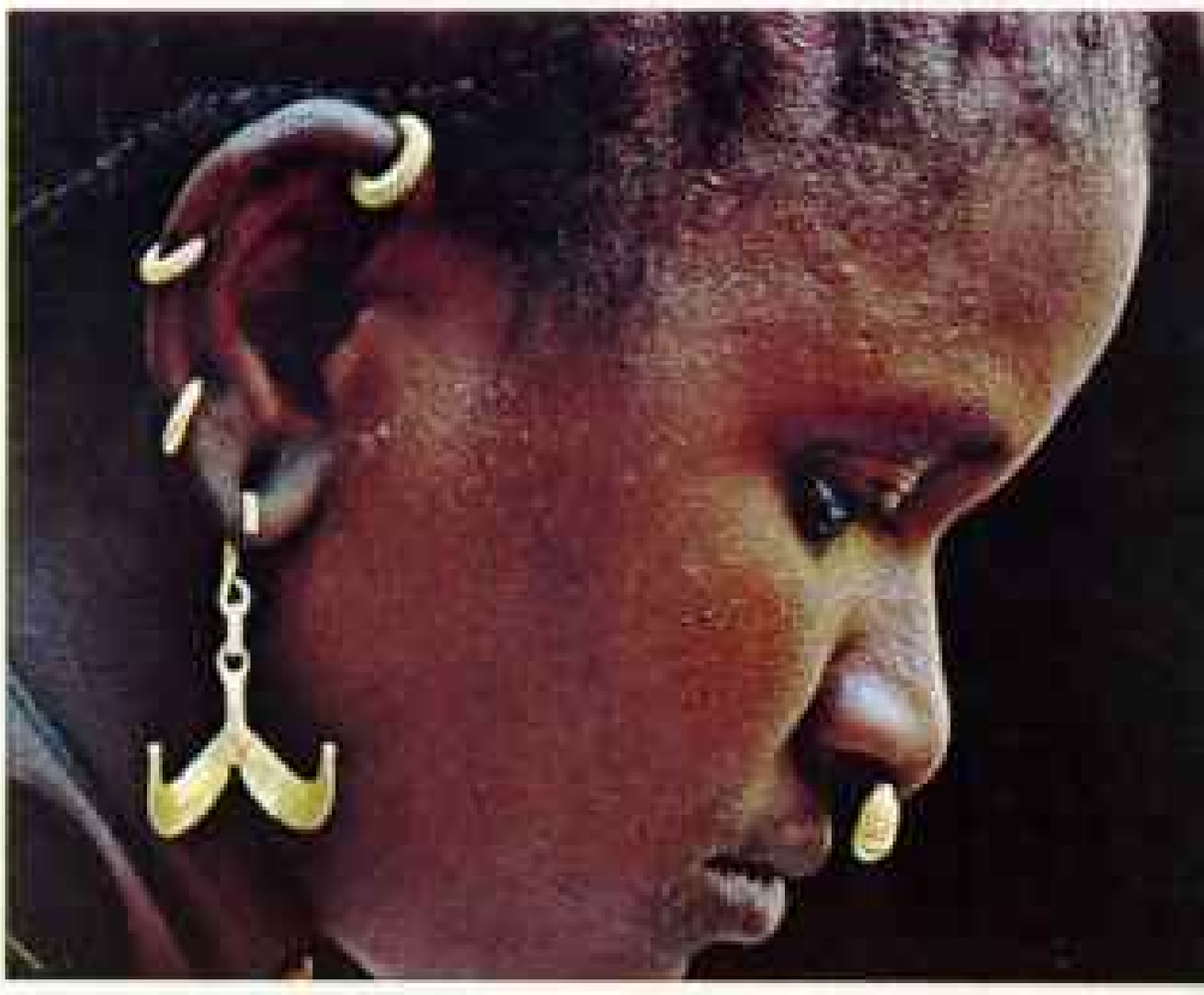
*In addition to iron fishhooks and bracelets (**panel**), pots and bowls painted with white designs appear during this phase. Because the paint washes off readily, the authors conclude that the pottery served only decorative purposes. This use of luxury ware indicates a level of affluence and sophistication based on success of the city's trade system. A footed bowl is similar to others found as many as 750 kilometers upstream along the Niger. Saharan sources likely supplied the copper for hair ornaments. City goldsmiths fashioned an earring — the oldest yet found in West Africa — probably from gold mined far to the south.*

*From 800 onward, mud bricks, uncovered in foundations (**6**), were employed in house construction. Terra-cotta statuettes (**panel**) and ceramic flasks may have had a ritual purpose. Glass beads for a necklace came from North Africa. The top of a cooking pot is decorated by fingernail indentations in the wet clay, the bottom by impressing braided twine.*

*Jenne-jeno reached its heyday — defined by city size, diversity of artifacts, range of imported goods and luxury wares — between 700 and 1000, with round houses (**7**) and rectangular ones (**8**) seeming to vie with one another for space. When one house crumbled (**9**), another was built on top of it. Garbage pits (**10**) reached down to earlier levels of occupation.*

After 1000, despite new commerce with North Africa, the city's fortunes began to wane, shown by a population decrease. Jenne-jeno was abandoned around 1400.





***Ties of gold** bind nomadic Fulani women with the women of ancient Jenne. Wearing a nose ornament and rings that rim her ear, a Fulani (**above**) models an earring found during the 1981 excavation (**panel above**). Two other Fulanis (**facing page**) wear modern gold earrings; the one at left adds silver coins and chunks of polished amber.*

(Continued from page 402) we to make of our radiocarbon dates testifying that Jenne-jeno existed 1,500 years earlier?

The evidence suggested an impressive buildup of population in and around the ancient city throughout the first millennium. When and why did Jenne-jeno begin to grow? What occupied all those people? What was so attractive about the location that the city held in orbit so many satellite communities?

Only further excavation could provide the answers. By 1980 we both were members of the anthropology faculty at Rice University in Houston, an institution with strong resources to back us. Then, too, our 1977 findings won interested attention from scholars in Europe, Africa, and the United States. As a result, for our second field season we gained additional support from the National Science Foundation and also benefited from cooperation and logistic backing by Mali's Institute of Human Sciences.

With three graduate students as assistants, we arrived at modern Jenne on New Year's Day 1981, exhausted from the dusty two-day road trip from the capital, Bamako, which we had reached by air. Dozens of children surrounded the taxi, demanding candy, ball-point pens, and Malian ten-franc coins (worth about two U. S. cents).

Nothing had changed. Jenne was still without electricity and running water. Bleating sheep and goats still scuttled through the narrow alleys. Street vendors dozed under grass-mat shelters in the noonday sun. Very much a traditional African town, Jenne displays handsome, geometric mud-brick architecture that—fortunately, in our view—overshadows the few colonial-style concrete buildings with metal roofs.

To work at Jenne-jeno, we would have to commute daily from Jenne, where we rented the second floor in a mud-brick house owned by a local merchant, Baba Traoré. His neighbors called him "Little Baba." Baba's brother, Dani, and his family occupied the ground floor. Stairs ascending in tight angles led from our apartment to the roof, where we spread out artifacts for study and where we slept in the summer heat.

Diggers were easy to find; many men were in town seeking work during the dry season, slack for agriculture, from January through April. There were the usual rumors, of course, that we would be digging up treasure from old tombs. But most applicants were earnest men with no thought of booty.

On January 4 we jounced out to the site in a springless donkey cart. As we creaked over the lumpy floodplain, we clung white-knuckled to the sideboards and gave up trying to talk through rattling teeth.

We began in the central part of the mound, the men digging with short-handled agricultural hoes made in Jenne. Many

The bridge of time *connects the pottery of ancient and modern Jenne. A bowl that dates from around 200 B.C. may have been used for washing* (**above**). *Similar bowls serve the same purpose in modern Jenne, where a potter* (**facing page**) *uses wooden stamps for decoration, a technique first popularized in Jenne-jeno eight centuries ago.*

mud-brick house foundations were visible. Domestic structures were a priority: They told us how people lived—what they ate, the tools they used, the jewelry they wore.

As we peeled back a meter of deposits in the first pit, seven wall footings appeared. In this well-to-do section of town, families lived in roomy, rectangular houses built of round mud bricks like residences in Jenne today. Ladies of the house wore jewelry and hair ornaments fashioned by craftsmen from materials, such as copper and semiprecious stones, that could only have come from distant sources. Iron and stone bracelets came to light, and iron and copper rings.

Bones, grain remnants, even the kind of utensils showed that everyone in this part of town dined nutritiously on catfish, perch, rice, beef, and presumably milk.

Using pottery styles as dating benchmarks, cross-checked by radiocarbon analysis, we determined that all this was going on at Jenne-jeno from A.D. 1000 to 1200.

A month of hard labor—and we had only reached a depth of one meter in the large central pit, which we called LX for large exposure. Other pits bore designations such as WFL, waterfront location; NWS, north wall section; and ALS, Adria's last stand, where student Adria LaViolette did excellent work. Potsherds showed we were now digging in the horizon of A.D. 800-1000.

Soil Deposits Pose a Riddle

Puzzlingly, the soil began to change character. In the southern half of the LX pit we traced several large holes filled with broken pottery and bones. Were these originally storage pits, or graves, or rubbish dumps?

Just north of the holes we uncovered three basin-shaped areas of fire-reddened clay filled with ash. Adria, supervising work in the pit, shared with us her uncertainty.

"I can't figure out how all these things fit

Toys made from river mud, *miniature clay camels and cattle are a common sight in modern Jenne (**above**). Broken pieces of clay—still recognizable as cows, sheep, and a Niger-dwelling manatee—found at ancient Jenne by the McIntoshes were immediately identified by their workmen as toys.*

together," she said. "There are those odd burned-clay concavities; in the rest of the pit the deposits are very hard in some spots and soft in others. It just doesn't make sense."

Trowel in hand, I began probing the troubling deposits. Finding a spot where hard, compact earth had soft material beside it, I inched along on hands and knees, tracing the interface. The line of compact deposits lengthened into an arc. Suddenly the picture snapped into focus. We had delineated the foundation of a round house—an entire round house! The three enigmatic baked-clay structures at once made sense as cooking hearths outside the house. The pits to the south were garbage dumps.

At least some were. Two turned out to be graves containing deeply buried urns. These shapely orange-red vessels, some a meter high, came to light all over the mound in cemetery areas and within or beside houses. We excavated about two dozen of them, many still intact (pages 396-7). Many, many more were (and still are) visible, eroding out of the surface of the site.

We found bones in all the urns; the dead had been interred doubled up in the fetal position. Put in place over a span of more than a thousand years, A.D. 300-1400, the big pots often were crushed by later burials superimposed at the same spots.

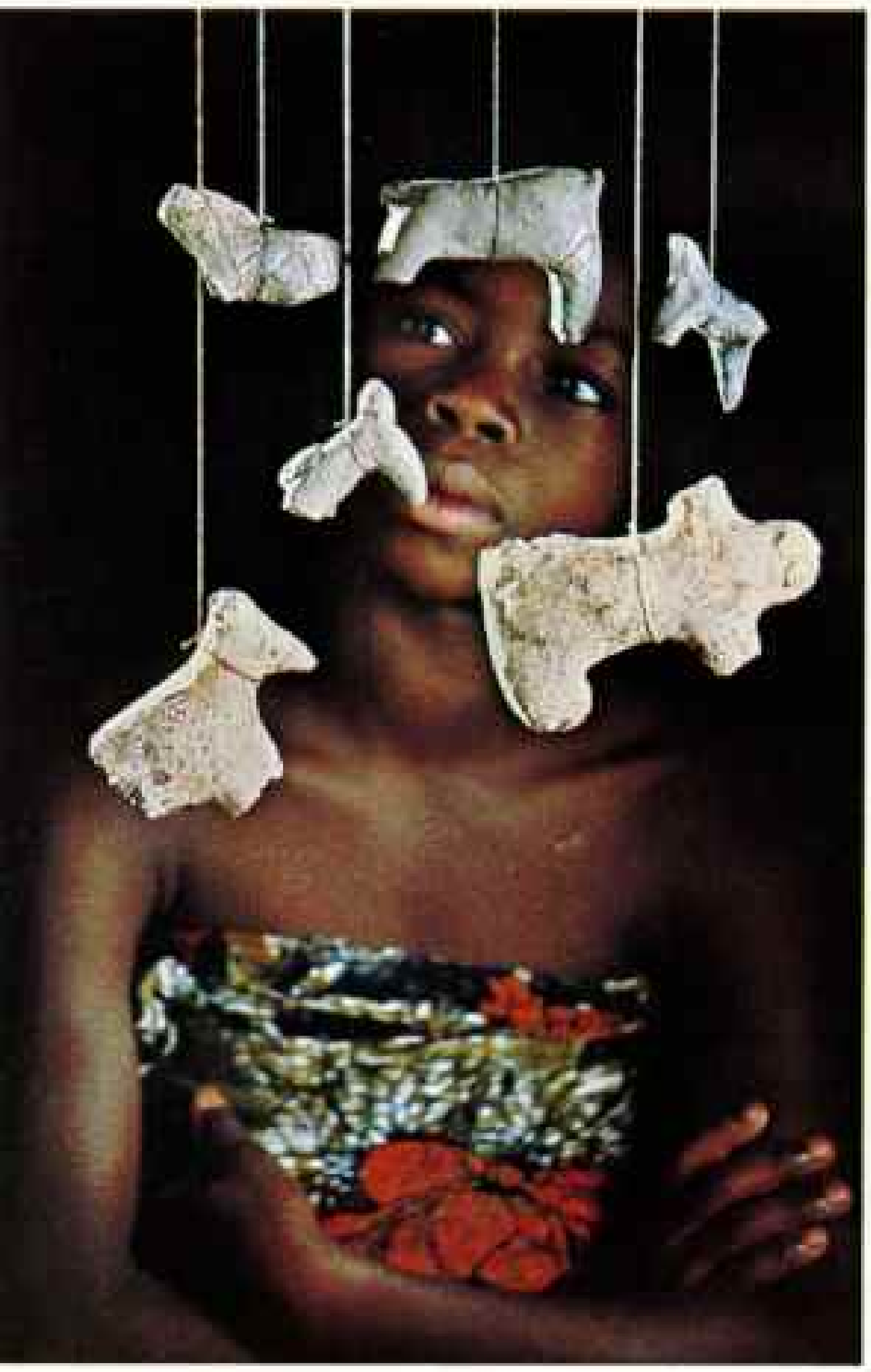
Here again, continuity linked the old and new Jennes: The custom of urn burial is practiced today among the Bobos and other Malian tribes not converted to Islam.

Painstaking work revealed, brick by brick, the entire round-house foundation. Then a shout rose from the workmen. A patch of deep orange terra-cotta shone against the light gray bricks. In minutes we uncovered the headless torsos of a pair of terra-cotta statuettes. Male and female, side by side, they had been set into a niche within the house wall. The heads had been broken off and lost, doubtless sometime when the figures had been exposed at ground level.

Their shrinelike positioning cast light on three similar statuettes we had discovered in 1977. All were in a kneeling posture, with short skirts or loincloths; all had been set into a wall or placed under the floor. Why had the people thought it important to incorporate them in their house structures?

Again, modern Jenne provided a parallel. In the early 1900s a colonial administrator noted that many entryways in Jenne houses had a small altar, a platform supporting a statuette in the likeness of a revered ancestor. At the shrine, sacrifices could be made to the deceased. We think it is possible to trace this custom of ancestor worship back a thousand years to Jenne-jeno. The kneeling statuettes from the ancient city may well represent protective ancestral spirits once invoked by its inhabitants.

Word spread rapidly of the round-house discovery. Mr. Be Sao, chief mason of Jenne, bicycled out to the site. He pronounced the structure a female residence; the attached cooking ovens left no doubt. Mr. Sao pointed out that such houses still can be found in rural Mali. Mud walls that we found reaching out from opposite sides of the round house, he confidently informed us, would have joined the house with others arranged roughly in a circle to form a family



Foundation of family life, *a round mud-brick house, excavated to its floor, probably once sheltered a wife and her children. The husband's other families lived in connecting*

dwellings. In this reenactment, braziers flame in ancient hearths.

compound, sheltering separately two or more wives and the man who was husband of all. Other compounds crowded close.

Mr. Sao's analysis was persuasive. As he talked and gestured, Jenne-jeno of A.D. 800 came alive for us. His words evoked narrow alleys, barely wide enough for a donkey or a woman bearing on her head a day's wood supply, twisting among the compounds.

By late February, Jenne-jeno heated up at noonday to 43°C (110°F). The harmattan, a desiccating wind from the Sahara, swept across the floodplain daily. The relentless pummeling frayed everyone's nerves. Gusts swirled into the pits, flinging loose dirt in our faces. At the suggestion of our Fulani friend Hama Bocoum, we quickly adopted the headgear of the local herders of his tribe—three meters of cotton cloth wrapped several times around the head, nose, and mouth. Unavoidably, the eyes still suffered.

Jenne-jeno kept on yielding quantities of artifacts and data. Rich finds included iron spears and harpoons, and ceramic cows and sheep that were children's toys. It took Rod and me and our three assistants more than four hours every afternoon to number and catalog everything found earlier in the day. Most tedious was describing and analyzing the more than 100,000 pottery sherds. Properly studied, pottery can elucidate the advancement and social organization of its makers, as well as furnish chronology.

Pottery Dates Advance New Idea

One March afternoon I studied some pottery brought in the day before. On a table I laid out several large pieces of exquisitely made pottery with geometric designs painted in white over a glowing deep red slip.

"We just got these out of the LX pit," I said to Rod. "Our 1977 pottery data, you remember, and the radiocarbon dates told us that white-on-red pottery like this was made only between A.D. 400 and 800. Well, I've been examining the pottery from our other five pits. They all produced this pottery."

Rod's interest sharpened. "But those pits are scattered all over Jenne-jeno," he said, "two of them at the edge of the mound. We have to walk nearly a kilometer just to get from one pit to another. Are you saying that the mound, all 80 acres of it, was already in existence as early as 1,500 years ago?"

"The dating of the pottery shows there's no doubt," I responded.

Both of us exulted over this solid evidence that Jenne-jeno had expanded much farther at an earlier date than had seemed possible. It was, perhaps, our biggest discovery there.

The evidence was unequivocal: Jenne-jeno was a major settlement several centuries before the Arabs first established trading posts in the Sahara. But could we really call the site, no matter how large it was, a true city at that time?

Various lines of evidence suggest that we can. Within days after we discovered the pottery tie-in, a new trench dug through the mud-brick foundation of the massive city wall began producing early white-on-red pottery. Although centuries of erosion have leveled this once formidable wall, three-meter-wide sections of it can be traced over almost the whole two-kilometer perimeter of the site. Erecting it was a major public-works project, the kind that we expect urban populations to undertake. And it was built at Jenne-jeno sometime between A.D. 400 and 800.

City Prospers on Trade

At the height of development Jenne-jeno and its nearby satellites may have had close to 20,000 people. This large population was served by specialists, including well-trained potters to judge from ceramic quality. And we found the remains of copper- and iron-working ateliers, even though neither copper nor iron is native to this area. The closest iron ore is found more than 50 kilometers away. All accessible sources of copper are in the Sahara, 1,000 kilometers distant. Sandstone slabs and cylinders, used as grinding stones, came 100 kilometers from the north.

Who organized the trade that brought these materials to Jenne-jeno in the fifth century? Certainly not the Arabs, since they didn't appear on the scene for at least another 400 years.

No evidence has turned up of a foreign hand directing the early Saharan commerce that nourished Jenne-jeno. No Roman or Byzantine or Egyptian imports have been unearthed on the site. The trade in the mid-first millennium seems to have been indigenous—initiated and developed by Africans.

Seemingly, the inhabitants of Jenne-jeno were always traders, even when they settled the site around 250 B.C. They had to barter for two vital materials that the floodplain lacked—iron and stone. From such humble origins, we believe, commerce gradually expanded to tap Saharan copper and salt.

What did Jenne-jeno offer in exchange to tempt desert nomads to mine for copper and to quarry salt? Archaeological evidence gives no clear answer. But the trading activities of present-day Jenne provide clues to Jenne-jeno's economic past.

For 600 years Jenne's major export has been food. This land owes its richness to the annual silt-bearing flood of the Niger. Huge surpluses of rice and other crops can be grown. The nearby river offers endless fish—Nile perch and several kinds of catfish. What could be more appealing to a desert dweller than a reliable supply of food?

For six centuries Jenne has traded downriver with Timbuktu, providing the fabled desert city with food in exchange for salt, copper, and many other goods from the north. In 1830, René Caillié, one of the first Europeans to reach Timbuktu, wrote that it "possesses no other resources but its trade in salt. . . . The inhabitants procure from Jenné every thing requisite for the supply of their wants."

The Monday market in Jenne still packs people into a public square as big as a football field. Many spend a whole day getting there: Some come by foot or donkey cart, others by river in flat-bottomed canoes—pirogues—the same kind that have long traded between Jenne and Timbuktu.

Many of the items bought and sold, we saw, have not changed in that time. In one corner a merchant hammers at gray-white slabs of salt from Saharan quarries. An old man in a flowing jellaba offers dates from Algerian oases. Throngs of people buy and sell local produce—bushels of red African rice, baskets of blackened smoked fish, small mountains of chili peppers and onions.

Islamic Jenne prospered from its luxury trade in salt and gold. In 1655, Al-Sadi, a native of Timbuktu and an imam of Jenne's mosque, described Jenne as "one of the great markets of the Muslim world. There the salt merchants of Taghaza [in the Sahara] meet merchants carrying gold from the mines of Bitou [to the south]. Because of this blessed

In majestic repose, *a unique statuette of androgynous character likely had religious significance, indicated by serpents coiled around the neck and arm and an amulet of magical power. Found touching one another, head and torso fit together, but minor stylistic differences raise a slight question of whether they match.*

city, caravans flock to Timbuktu from all points of the horizon." Even in the 19th century, Jenne was known as the Land of Gold, because so much of the long-distance gold trade passed through it. This raised the question in our minds whether gold had been traded at Jenne-jeno a thousand years or more earlier. Pre-Arab participation in the gold trade would help account for the city's rapid growth.

Would any gold come to light at Jenne-jeno? The days passed and the excavation entered its fourth and last month. Then. . . .

Rod was working near the southern edge of the mound when one of our Malian crew handed him a note. Charlie McNutt, the supervisor of the city-wall excavation, had written one electrifying word: "Gold." Rod grabbed his camera and sped across the site.

"What have you got, Charlie?" Rod asked, peering into the excavation.

"Sidi here was straightening up the trench

Houseboating nomads, *the Bozo people (**left**) ply the Bani and the Niger. "They are most likely the descendants of the riverfolk who forged the link with the Timbuktu region," the authors claim.*

beneath the city wall, from which the treasure had been wrested.

"Then it came from these deposits *under* the city wall," Rod mused aloud. "That's perfect, absolutely perfect! It means that gold was reaching Jenne-jeno even before the city wall was built."

The discovery of gold perked us all up. The earring and its implications were discussed endlessly at mealtimes.

"If the gold trade was important enough to link Jenne-jeno with mines 800 kilometers south," asked site supervisor Karol Stoker one evening, "why isn't there more of it?"

"There probably is more gold," I said, "a lot of it. But look how huge this site is and how small and scattered our six pits are."

I compared Jenne-jeno to a big jar filled with hundreds of mixed cookies. If someone reached in for a favorite kind—say chocolate chip—and there were only a few of them in the jar, he might have to pull out a lot of cookies before getting a chocolate chip.

Rains End Excavation Season

In mid-April, clouds gathered over Jenne-jeno. Within three weeks the rains would drive blinding sheets across the site, carving jagged gullies. Before then we had to complete our excavations and backfill the pits.

Almost five meters down in the LX pit, we at last turned up pottery made by the first settlers at Jenne-jeno (page 408). It was beautiful, thin walled and light. Potters had decorated it by rolling braided twine across the wet clay surface. In today's Jenne we saw artisans beautifying their pots the same way.

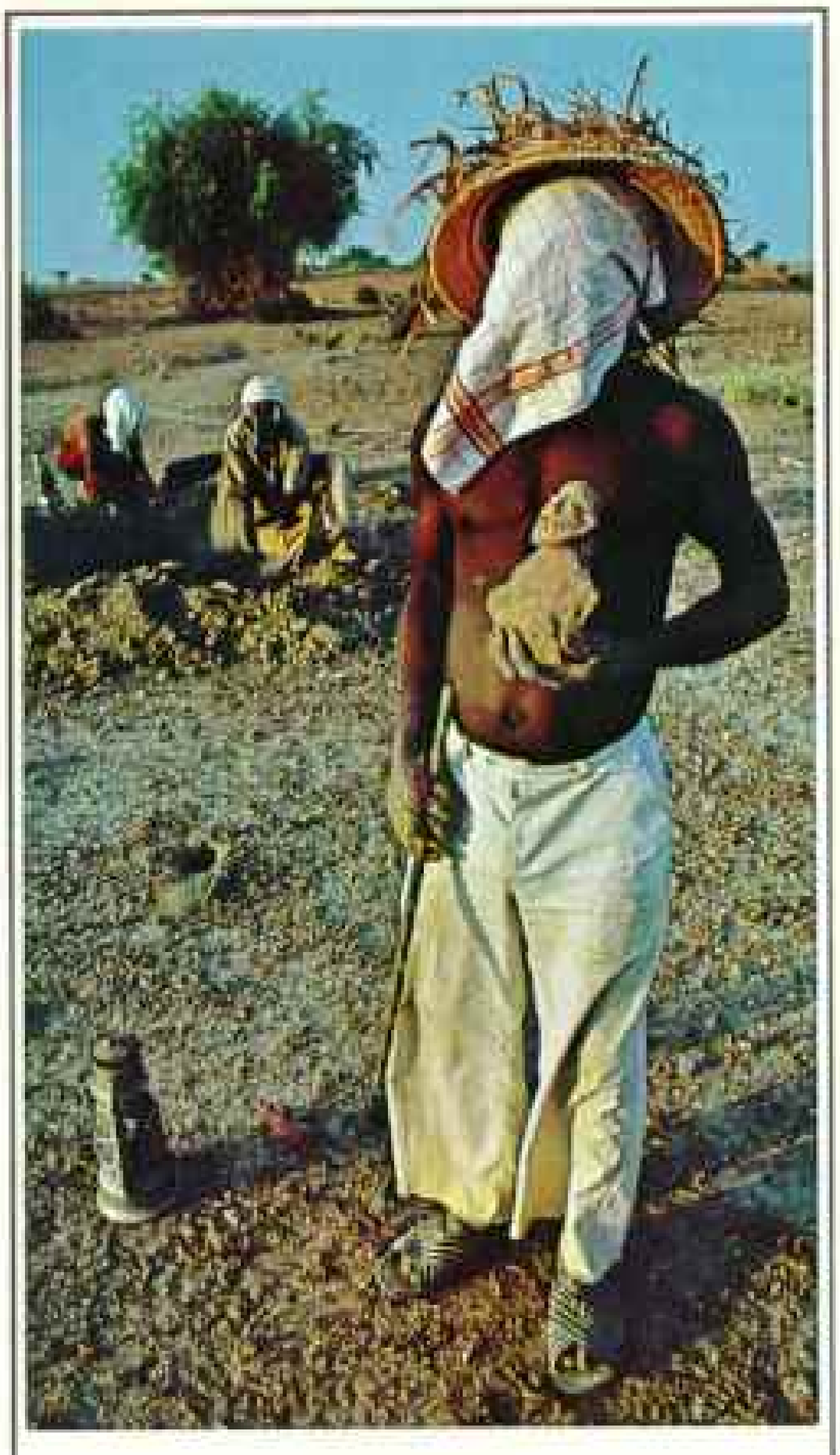
Both in shape and in decoration, this fine ware strongly resembled pottery made between 2000 and 500 B.C. that has been found all over the southern Sahara. Thus we could identify the broad area from which Jenne-jeno attracted its first colonists.

By 250 B.C., when Jenne-jeno was founded, the Sahara had dried out. Geology and archaeology tell us, however, that before 3000 B.C. the Sahara was well watered, populated by cattle herders who also hunted and

walls when his hoe blade caught something. Turned out to be this piece of gold jewelry. The workers say it's an earring." Charlie held out the prize with elaborate casualness.

It was a stunning piece of craftsmanship (page 407). Two delicately curved arms ended in tiny spirals of gold wire. The surface glowed. We discovered later that not even the best goldsmiths in Bamako could precisely duplicate its gleaming mat finish.

Charlie pointed to a little hollow, directly



Peasant turned scavenger *agreed to display his treasure—a statuette he and his fellows dug from Jenne-jeno—but not his face at the site where he had found the statuette. It will be sold to a local art dealer and, escalating in price, pass finally to a collector.*

Such trafficking, commonplace at sites throughout the world and supported by the high prices paid by collectors, outrages archaeologists. "The past is being destroyed," say the McIntoshes, "and we can never put those pieces together again." The authors saw some pits four meters deep and others several meters wide dug by nocturnal scavengers.

The Malian government, deeply concerned, has passed laws banning the practice, but enforcement is difficult. All artifacts legitimately recovered from Jenne-jeno have been transported to Bamako, the capital, for safekeeping. On an international level, a UNESCO convention seeks to prevent illegal traffic in cultural property.

fished in lakes and streams. As the Sahara grew arid, many herders were forced elsewhere to find water for their cattle, and the desert was almost emptied of its population. At some point, herders who had moved south became agriculturists and began using iron. Jenne-jeno was settled late in the course of this slow migration.

Initially, the settlement must have been no more than a tiny cluster of round pole-and-mud huts. Luckily for us, some of these burned to the ground. This fired the smooth mud plastering, preserving impressions of the underlying pole-and-woven-reed structures. Hundreds of these imprinted fragments of burned clay came to light in the lowest levels of our pits.

The newcomers to Jenne-jeno tended their cattle, planted rice, and fished. Their Iron Age hamlet resembled thousands throughout West Africa.

But as prospering Jenne-jeno grew into a city, a new, more cosmopolitan way of life evolved. Other communities sprang up within walking distance, producing a kind of urban sprawl. Within several centuries of the city's founding, the power of its wealth and commerce had completely transformed the scope and quality of human life on the Inland Delta floodplain.

Thriving Jenne-jeno Abandoned

A complex urban life-style flourished at Jenne-jeno for almost a thousand years. The reasons for the gradual population shift after A.D. 1200 to Jenne are unclear. They may relate to the transfer, documented in the city's oral traditions, of commercial power from pagan merchants' hands to those of an elite converted to Islam. This new aristocracy perhaps insisted that the new Jenne dissociate itself from the older city's polytheistic practices.

In the centuries since Jenne-jeno's abandonment, the dominance of Islam all but erased oral histories relating to the ancient pagan city. Only a few sentences have been handed down that suggest the true relationship of the two great urban centers that have dominated Mali's Inland Delta floodplain.

The ancestral site lay mute and forgotten—that is, until under our direction 20 men of modern Jenne sank hoes into the earth and uncovered their own past. □

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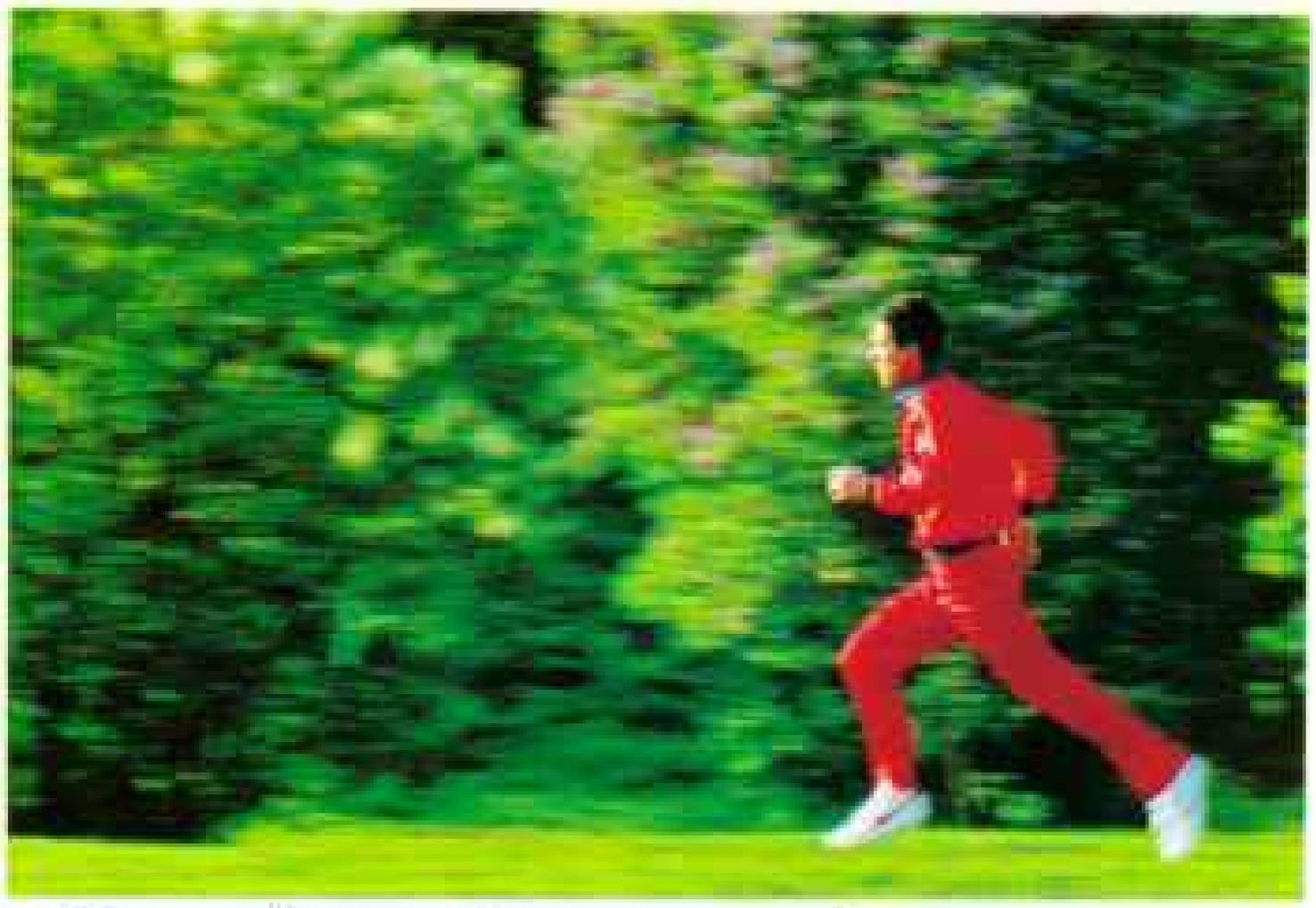

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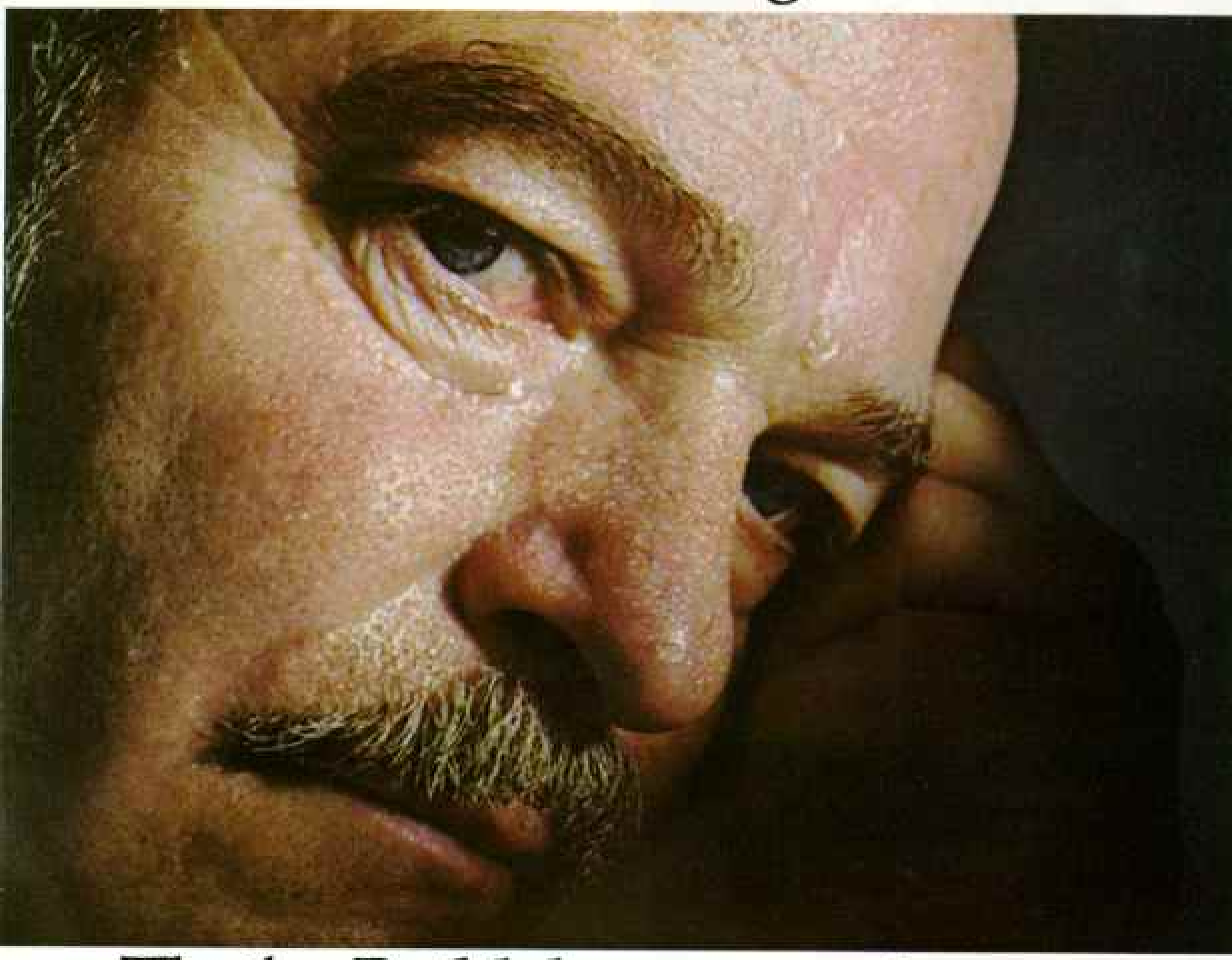

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Members Forum

NAMIBIA

In the jungle of reporting on foreign countries, where the average American does not have the faintest clue what is going on, your article on Namibia (June 1982) was particularly welcome. Having spent some time in South Africa, and having consciously tried to understand the problems, I am very happy to see that your reporters tried to show all 11 sides.

Paul A. Elias
Greenwich, Connecticut

Your story on Namibia's inching toward nationhood was a highly informative mix of politico-technical and human matters. As an agricultural specialist, I was particularly intrigued by game management's being made a paying proposition. The technique seems to make lots of sense.

Frank Meissner
Bethesda, Maryland

EL GRECO

The very sensitively written story "The Genius of El Greco" (June 1982) notes that the young page in "Burial of the Count of Orgaz" is El Greco's son. May I point out that the mourner immediately above St. Stephen is El Greco himself!

Waldo Ruess
Santa Barbara, California

Most art historians say there is no conclusive evidence that the man seventh from left is El Greco. The boy, however, can be positively identified, since the date of Jorge Manuel's birth, 1578, can be seen on the handkerchief in his pocket.

PALOUSE

In my 50 years' acquaintance with the Palouse (June 1982), as a geologist I know of no evidence to support the idea that the loess ever formed dunes. Dune areas the world over are characterized by sand and a disrupted drainage pattern. The Palouse has neither. Not a single natural lake or pond exists anywhere in the vast extent of Palouse wheatlands.

John P. Thomson
Spokane, Washington

The term "standing dunes" is used by many geologists to refer to the loess hills of the Palouse, even though, strictly speaking, dunes are formed by wind-driven sand bouncing along the surface, loess hills by windblown silt suspended in air.

THE INCREDIBLE POTATO

In your May 1982 article, nothing was said about the green that shows up on a potato exposed to too much sun or light. I have always heard that it is poisonous—is that true or an old wives' tale?

Mrs. G. E. Jones
Oxford, Pennsylvania

Since the potato tuber is actually part of the plant's stem, it contains chlorophyll, which will turn green when exposed to light. Some varieties do build up a little solanine, a poisonous alkaloid, but one would have to eat a lot of potatoes before there would be any effect at all.

"Nutritionists rate the quality of potato protein higher than that of the soybean." Please, what nutritionists? The Department of Agriculture compares the potato, 2.0 percent protein, with soybeans, 34.9 percent protein.

Roger Williamson
Deerfield, New Hampshire

USDA experts say that although soybeans do contain far more protein per portion than potatoes, the potato protein is more easily assimilated and therefore has greater nutritive value.

One paragraph stated that John Dillinger reportedly carved a pistol from a potato, dyed it with iodine, and used it to escape from prison. I recently learned that the gun that Dillinger carved was made of wood and is on display at the John Dillinger Historical Museum in Nashville, Indiana.

Gary M. Womack
Lebanon, Oregon

The owner of the Dillinger museum shot holes in the potato-pistol legend when he tracked down the wooden gun and placed it on exhibit in May.

ANGKOR

I visited Angkor Wat, Angkor Thom, and the Bayon in the early sixties, then in 1979-1980 worked as a volunteer helping the Khmer refugees in Thailand near the Khmer border. I saw dozens of young armed Khmer soldiers 14 to 17 years of age with several four-faced heads from Angkor; they had brought them to the border on a bullock cart, they said, to sell to Bangkok antique dealers.

Les Allan
Williamstown, Victoria, Australia

On page 571 of the May 1982 issue the author states that "the Khmer obtained two and even three harvests a year." I was much involved in bringing the new IR-8 (so-called miracle rice) to Vietnam from the Philippines. It had been my understanding that varieties common to Southeast Asia yielded one crop. The new rice would

Members Forum

yield three crops per year. I was led to believe this was a first and, naturally, wondered how the multiple Khmer crops were documented.

George W. Salkeld
St. Petersburg, Florida

The Chinese traveler Chou Ta-kuan visited Angkor in 1296. His journal says: "Generally they have three or four crops a year in this country." Archaeological evidence has not yet confirmed that report, but Bernard Philippe Groslier's investigations demonstrate that Angkor's irrigation system would have made feasible a year-round growing season with multiple crops.

KAMPUCHEA

In the past 12 years we have gone from the traditional Cambodia to Khmer Republic and now Kampuchea. If we are to follow this rationale, then I feel we should also use Suomi, Österreich, and Bharat for Finland, Austria, and India respectively. If the Cambodian people wish to call their country Kampuchea, that is entirely their affair. But it is ridiculous to have to completely readjust our geographic vocabulary according to who is in power this week.

Charles M. Robinson III
San Benito, Texas

The United Nations recognized the new government's name change to Kampuchea in 1976. The U. S. Board on Geographic Names accepted it in 1978, and NATIONAL GEOGRAPHIC followed suit.

On pages 616-17 of the May 1982 issue you show a heart-wrenching picture of a young amputee whose family will sit with him until he gets better—or dies. I would love to send this boy a small donation, so that he could have some little bit of comfort in his illness.

M. Luffman
Willowdale, Ontario

Author Peter White says: "When I saw the injured boy, the doctor said he would probably die in a few days. Maybe he did pull through; such miracles happen. Unfortunately I have no way of finding out, or any idea where he might be.

"I know your feeling on seeing this boy. I felt a bit like that when I stood next to his bed. I reached into my pocket and felt my comb there, and gave him my comb. I wish I could have done more than that."

POLAND

With great interest and genuine sympathy I read "The Face and Faith of Poland" (April 1982). However, to my dismay there was not a word about East Prussia, the land where I was born. The way I remember the "displacement" as a ten-year-old in January of 1945 was a flight with my mother, my grandmother, my seven-year-old sister, my mother's friend, and her three children, partially on foot between two military lines from Rastenburg to the shores of the Frisches Haff, which took us almost four weeks and which we miraculously survived. The other type of "displacement" of ethnic Germans was ratified in the West German Parliament "Money for People" deal in 1976 with Poland, which finally in August of that year allowed 115,000 people to leave.

Rosemarie Podehl Pilaud
Elmendorf Air Force Base, Alaska

After World War II Poland's borders were shifted to the west, and it gained 39,600 square miles of German territory. Roughly four million Germans had fled advancing Soviet armies, and under the Potsdam Agreement about 3.3 million more Germans were transferred to zones of Allied occupation. In 1976 Poland agreed to repatriate or grant exit visas to those remaining, and less than one percent of Poland's population is now German.

PERU

Your article in the March 1982 issue, "The Two Souls of Peru," was very interesting. I noticed that credit was given to Hiram Bingham for discovering the Inca ruins of Machu Picchu in 1911. I believe they were discovered by a Scottish Presbyterian missionary named Thomas Paine before 1911. He befriended the Quechua Indians, and they took him to the site. A book entitled *Eternity in Their Hearts*, by Don Richardson, tells the true story of the discovery.

Frank L. Zeoli
Pine Ridge, Kentucky

Mr. Richardson's source for Paine's claim was a conversation Paine had with another man some years later. Both this gentleman and Paine's family recall his telling of finding the ruins in the early 1900s, and of writing to the Royal Geographical Society in London about them. The Royal Geographical Society has searched its records and finds only correspondence from Bingham. There is no doubt that the young Yale University explorer first drew world attention to the Inca site following his expedition in 1911.

Letters should be addressed to **Members Forum,** *National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.*

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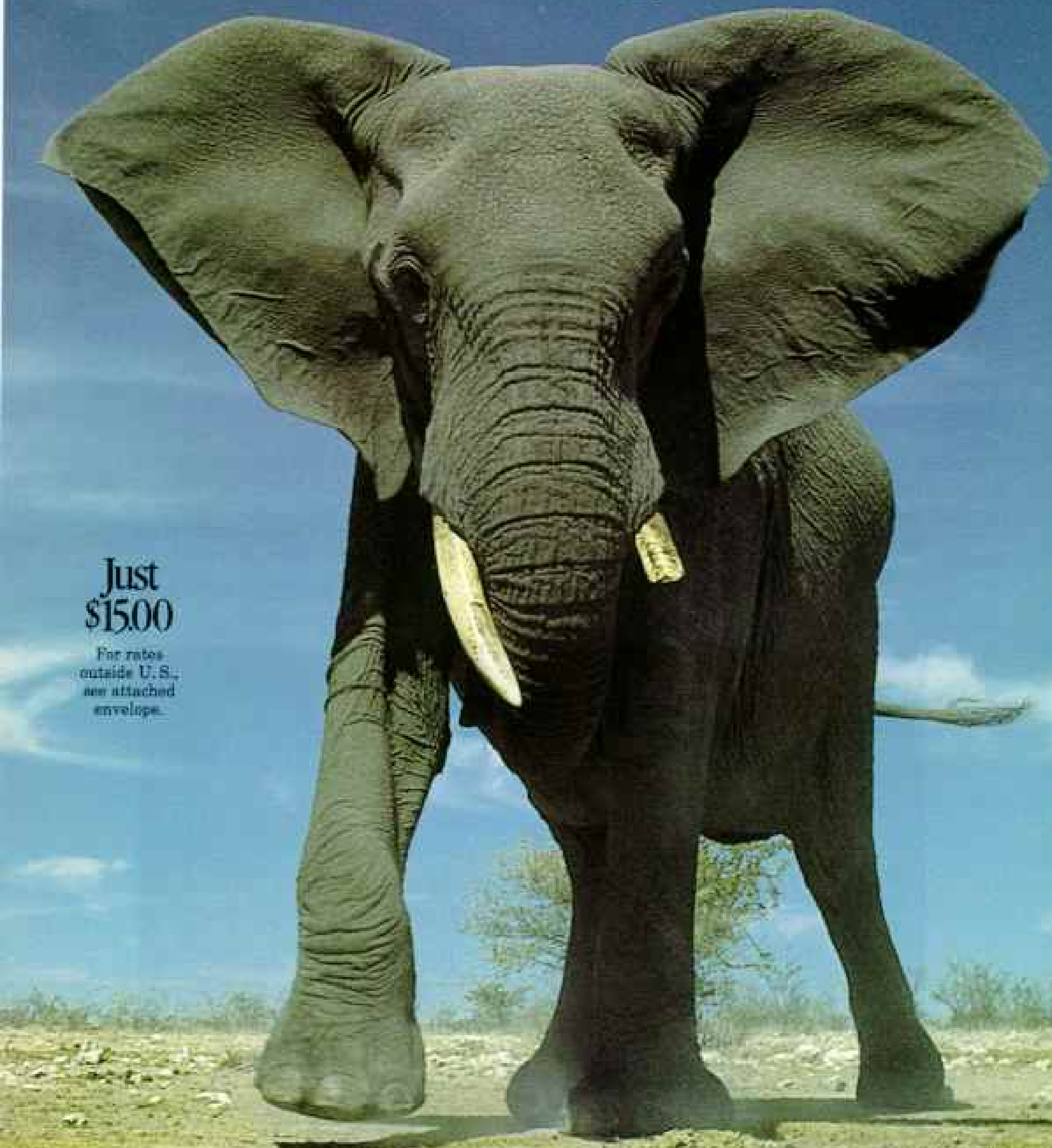

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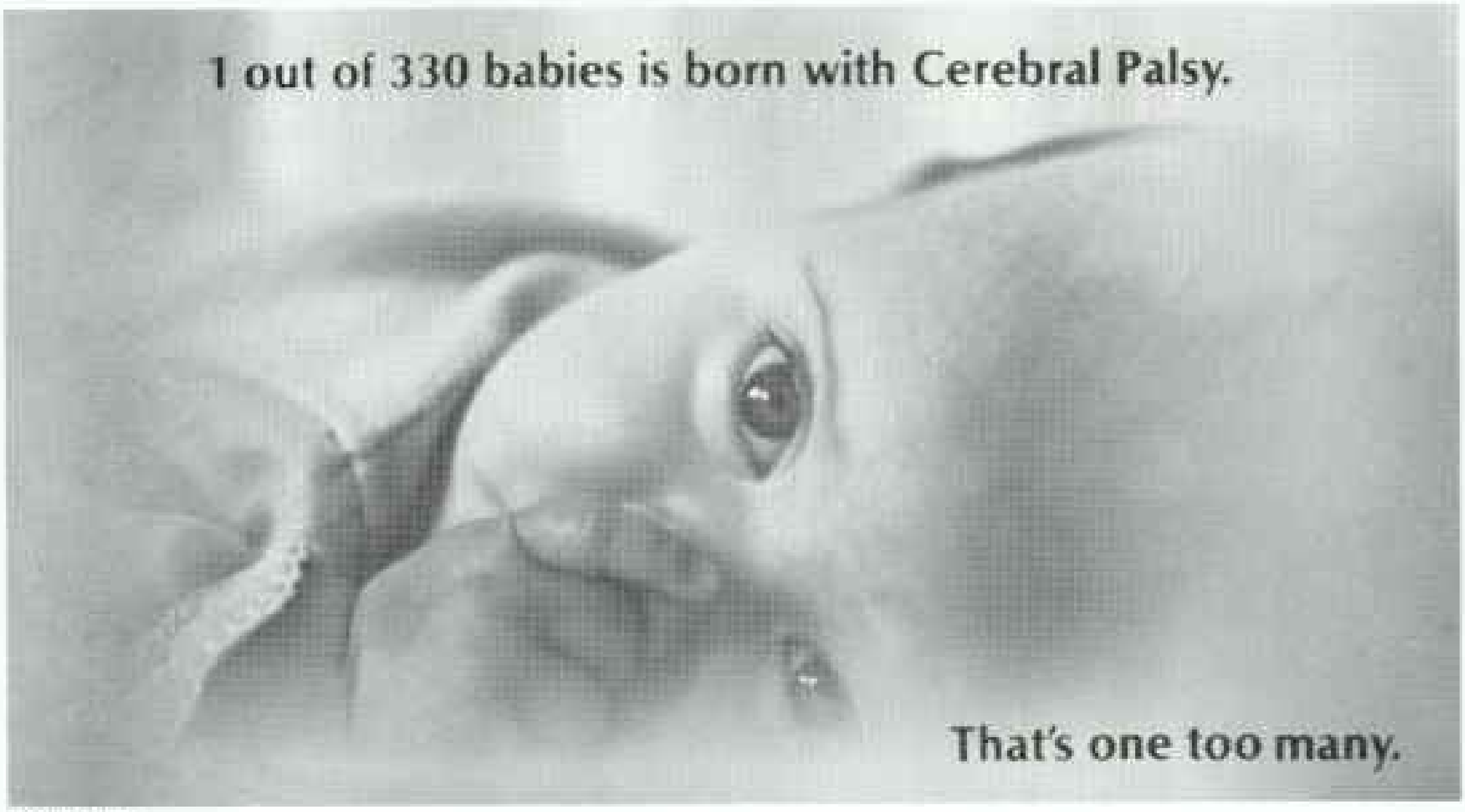

Phoebe Dunn

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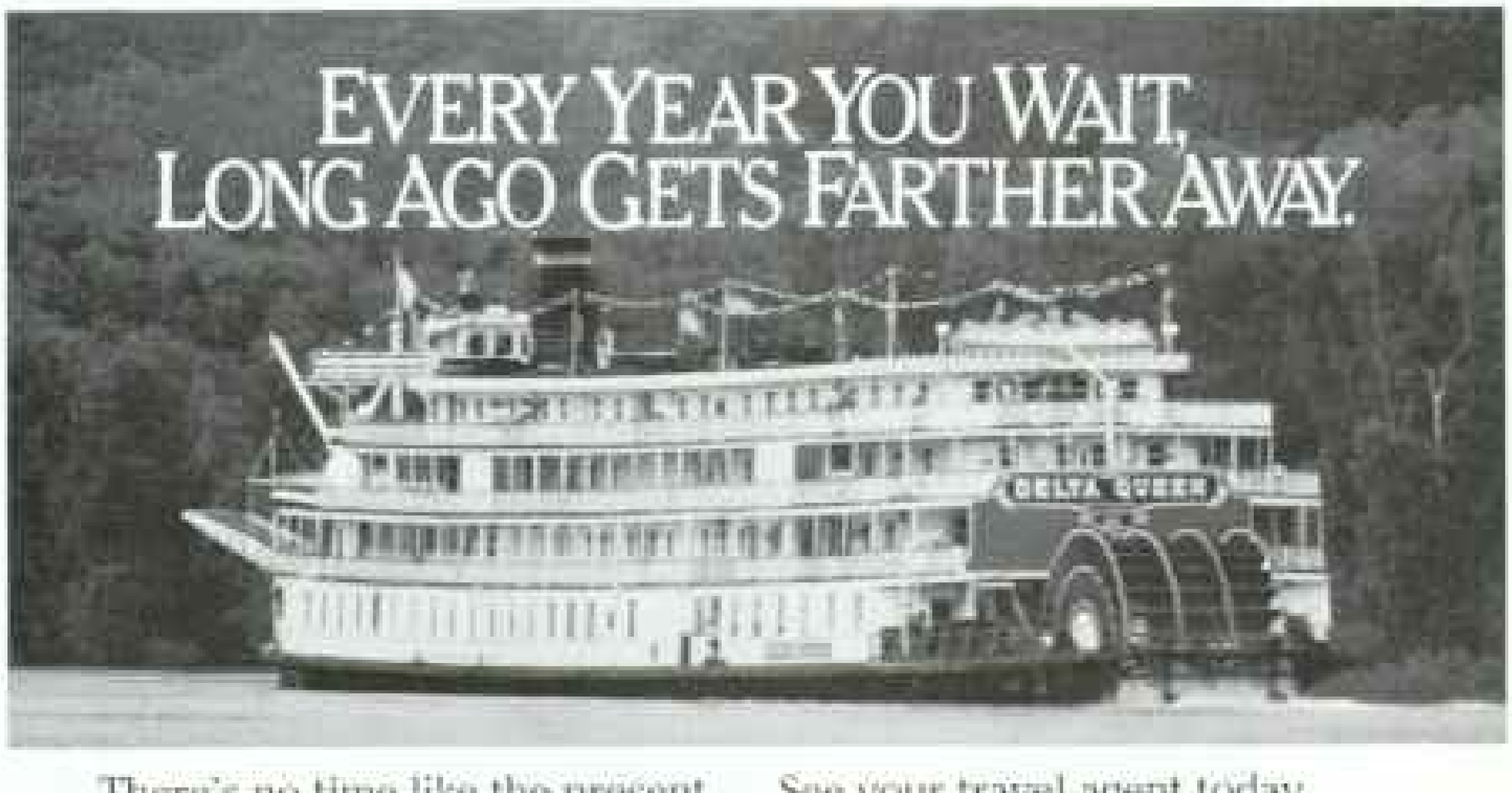

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On Assignment

THE MORNING AFTER a mammoth avalanche roared through California's Alpine Meadows ski area near Lake Tahoe on March 31, 1982, ***David Cupp*** was making his way through the wreckage. "Apart from Mount St. Helens, it was the worst disaster I've ever seen," said the Denver photojournalist—"and I've seen a few."

For the rescue workers who rushed to the scene, the agony of digging out one body after another—seven lives were lost—turned to joy when lift operator Anna Conrad was found alive after five days of burial beneath snow and rubble. The first face she saw was that of Lanny Johnson (***below,*** right), an Alpine Meadows ski patrolman who is also a free-lance photographer.

DAVID CUPP BY LANNY JOHNSON

LANNY JOHNSON BY LYNADA JOHNSON

"I was trying to record the event for the future," he said. "But when I saw Anna, I tossed the camera to another patrolman. Her welfare was the most important thing."

Lanny and the other rescue workers were led to Anna by Bridget, a nine-year-old German shepherd. The veteran avalanche dog and her handler, Roberta Huber, were reunited with Anna a month later at a nearby hospital (***left***).

ANNA CONRAD BY DAVID CUPP

On Friday morning, April 2, Bridget's nose had led her to zero in on the place where Anna lay buried, Roberta recalled. "That dog was doing everything but talking to tell me she had found something." But everyone was soon ordered to leave the site because of severe new avalanche hazards, and it was Monday before they could return.

"When they brought Anna out, Bridget rushed over to kiss her face," said Roberta. "It was just like a movie."

THE 1982 COROLLA SPORTS HARDTOP

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Photographed by J.A. Mills. *Takahe: Genus: Notornis Species: mantelli Adult size: Approximately 51cm high standing Adult weight: Male 2.5kg female slightly less Habitat: Alpine grasslands in New Zealand's Murchison Mountains where snow tussock its preferred food grows Surviving number: About 120*

Wildlife as Canon sees it: A photographic heritage for all generations.

The takahe, a rail unique to New Zealand, has a most unusual story of survival. It disappeared without a trace several times before. But each time, as if defying extinction, it appeared again. Then, in 1948, a number of these birds was accidentally discovered, confirming the species' continued existence. But it is a very precarious existence. The takahe could disappear again.

The takahe may never come back if it were to vanish this time. And while photography can record it for posterity, more importantly it can help save it and the rest of wildlife.

Quick, accurate and dependable, photography can contribute significantly to the scientific research needed for saving the takahe.

In addition, photography has that special capacity for drawing people closer to nature. A photograph of a takahe showing that plumage in its rich interplay of iridescent blues and greens—not only does a photograph like that bring us the beauty of this rare bird, but it can enhance our appreciation and understanding of nature itself.

And understanding is perhaps the single most important factor in saving the takahe and all of wildlife.

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