DOUBLE MAP SUPPLEMENT: ITALY

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NATIONAL GEOGRAPHIC

Maya Masterpiece Revealed at

BONAMPAK 50

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COVER: Maya ruler Chaan Muan downs an enemy in an animated mural painted at Bonampak 1,200 years ago. Computer reconstruction by Doug Stern based on a photograph by Enrico Ferorelli.

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AMA

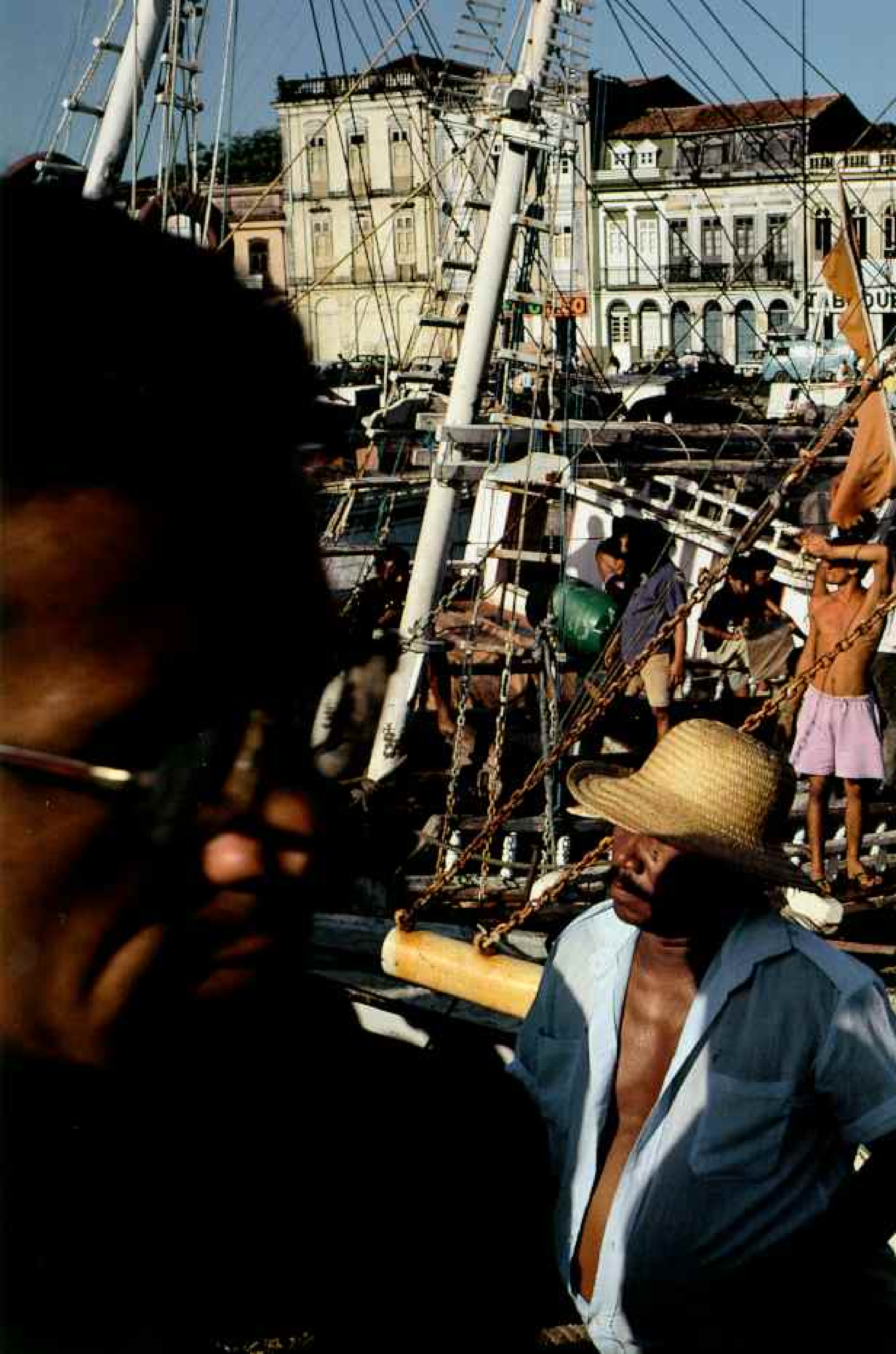
SOUTH AMERICA'S RIVER ROAD

Porch swing

Defying gravity—and the siesta hour—a pet spider monkey stirs up a sleepy afternoon in Tefé, Brazil. Worn smooth by daily torrents of sun and rain, life eddies in timeless patterns on the Amazon. Pioneers come and sweat and brave failure. Bare-knuckled towns boom and bust. And forest tribes face a frontier as fresh as a newly cut stump, as old as conquest. Through it all surges the river—mute, wild, blood warm.

By JERE VAN DYK
Photographs by
ALEX WEBB

ZONE



Dock exchange

Deals flow like water on the riverbanks of Belém, Brazil, where fishermen and peddlers hawk the daily catch. Storms, tidal bores, and piranhas are all part of a day's work on the lower Amazon. "You can get by on courage until you are 45," says one skipper. "Then it runs out."

Tough act

Jaded Yagua children wait to dance for government visitors—and their bodyguards—in Colombia's Amazon frontier. Like other tribes, the Yagua have discovered that tradition pays. Dances carry a price. "We need the money for sugar, rice, and tobacco," says a pragmatic villager. Devaluation-prone Brazilian currency isn't welcome.

Marbled waters

The Rio Negro stains the Amazon with inky organic matter at the rivers' confluence near Manaus, Brazil—a spectacle that swirls on for miles. "River color is a road sign down here," observes an Amazon pilot. "The forest looks like miles of broccoli, but no two rivers are the same."

"On the Amazon River human life always seems to be working its way upstream, fighting currents of water, economics, law, politics, injustice, disease, heat, and the conflicting demands of northern nations."

EVA SANTOS SAT PATIENTLY under an awning on the aft deck of the boat *Peryassu*, somewhere between Belém and Santarém on the Amazon River. Her baby son, Wallace, bounced on her knee. Rain slashed the brown water. Enormous uprooted trees rushed at us, half hidden in the current. Our pilot turned the boat back and forth, dodging the trees as if they were bullets.

Eva was a businesswoman, taking fruit and vegetables upriver to sell. If the trip took too long, the food would rot in the heat; her business might fail. She stared at the river. It looked as if the whole world were a brown flood, going against her.

"I didn't start with money," she said calmly. "I started with courage."

I would remember those words. On the Amazon River human life always seems to be working its way upstream, fighting currents of water, economics, law, politics, injustice, disease, heat, and the conflicting demands of northern nations. But traveling from the mouth to the source, I met many people like Eva Santos, crowded along the riverbanks or moving with a kind of languid determination up and down this wide brown highway. They all would have known exactly what she meant.

But courage on the Amazon is not what we think it is in the temperate world, where mosquitoes, animals, and rivers are largely under control. It is not just momentary bravery in the face of catastrophe. Here on a river that pours five times as much water into the sea as any other river, where floods spread caimans, snakes, and disease into backyards, where human beings sometimes seem as set against one another as tide and current at the river's mouth, courage is different. It is bravery, indeed, but it is also patience—determined patience, endless patience, excruciating patience.

I saw it on the faces of Indians paddling canoes upstream. I saw it on the face of a fisherman waiting like a heron to strike with a harpoon. I saw it on the face of a small boy outside a restaurant where I had gone after looking at the battle of waters at the river's mouth.

I had flown to one of the many outlets of the hundred-mile-wide mouth with photographer Alex Webb. The pilot had

Picture imperfect

The Amazon of the imagination is for sale on the sidewalks of Belém. Asking price: about $20. Romantic images of Brazil's steamy wilderness are nothing new. Francisco de Orellana, the first European to descend the Amazon River, in 1542, went in search of a "very populous and very rich" land of gold and cinnamon. As with uncounted dreamers to follow, reality proved fatal.

JERE VAN DYK has written several articles for NATIONAL GEOGRAPHIC, including "Long Journey of the Brahmaputra" (November 1988). Brooklyn-based photojournalist ALEX WEBB previously covered Paraguay (August 1992) for the magazine.

swept past vultures while we watched a giant wave rolling upstream from the sea. It was the *pororoca,* or big roar, a spectacular tidal bore, as high as 12 feet, that forces its way inland at certain times of year. The big roar marched upstream, its crest white foam. It looked like a huge, crashing line of surf, but against the current it moved slowly—patiently.

The boy moved slowly too. He walked up and stood outside the restaurant, looking at us. He was about eight. He was barefoot. He just watched us, and watched, and watched. His watching was relentless.

Finally we invited him in and bought him a soda. His gratitude was quiet.

"I went to see if I could work cleaning in the market in order to buy a fish to eat," he said. "But there was no work."

"What will you do?" I asked him.

"We won't eat today." It was not a whine, just a statement. Alex and I looked at each other. The boy looked at us. We gave him money.

He solemnly shook our hands and walked slowly away.

As I joined a succession of trading boats moving upstream from the mouth, I saw this slowness all around me. Early in the

THE AMAZON

Artery of a continent, the Amazon River nourishes the lives of Peruvian Indians, Colombian lumbermen, and Brazilian homesteaders. The main stem is undammed and undredged. Its currents remain among the cleanest of any major river in the world—although surging population growth, overfishing, and gold mining imperil its purity.

- Deforested area
- Várzea (flooded forest ecosystem)
- Gold-prospecting area
- Black water (high acidity)
- Clear water
- White water (high sediment)
- Oil field
- Scheduled air service

0 100 MILES

NGS CARTOGRAPHIC DIVISION

- Aluminum
- Copper
- Gold
- Gypsum
- Iron
- Lead
- Manganese
- Silver
- Tin
- Zinc

COLOMBIA

Putumayo

Puerto Ureo

Napo

Pebas

Amazon

Iquitos

Leticia

Benjamin Constant

Japurá

Jutaí

Juruá

Tefé

Coari

Purus

Manaus

Parintins

Itacoatiara

Amazon (Solimões)

Fonte Boa

Tefé

Ipiranga

Jutaí

Juruá

Tefé

Coari

Purus

BRAZIL

Monte Alegre

Iquitos

Nauta

Marañón

Requena

Tigre

Pastaza

Corrientes

Napo

Ucayali

Huallaga

Javari

The headwaters

Tumbling down the Andes, the Amazon reaches Iquitos, Peru, where oceangoing ships can easily dock—2,300 miles from the Atlantic.

PERU

Contamana

Cruzeiro do Sul

Pucallpa

Tingo María

Ucayali

Huallaga

Ene

Apurímac

Ene

Tambo

Urubamba

Andes

Mountains

Andes

Mountains

Huancayo

Ayacucho

Pilcopata

Quillabamba

Cusco

Machiguenga

Amazon Basin

Río Urubamba

Source of the Amazon

Callanga

Apurímac

Río Apurímac

Coporaque

Yanaqua

PACIFIC OCEAN

Acalaya

Valle Esmeralda

Tambo

Andes Mountains

Andes Mountains

Amazon Basin

VENEZUELA

GUYANA

SURINAME

FRENCH GUIANA (France)

AREA ENLARGED

COLOMBIA

EQUATOR

ECUADOR

Amazon

PERU

SOUTH

BRAZIL

AMERICA

BOLIVIA

Amazon Basin

CHILE

PARAGUAY

ARGENTINA

URUGUAY

Mean annual precipitation

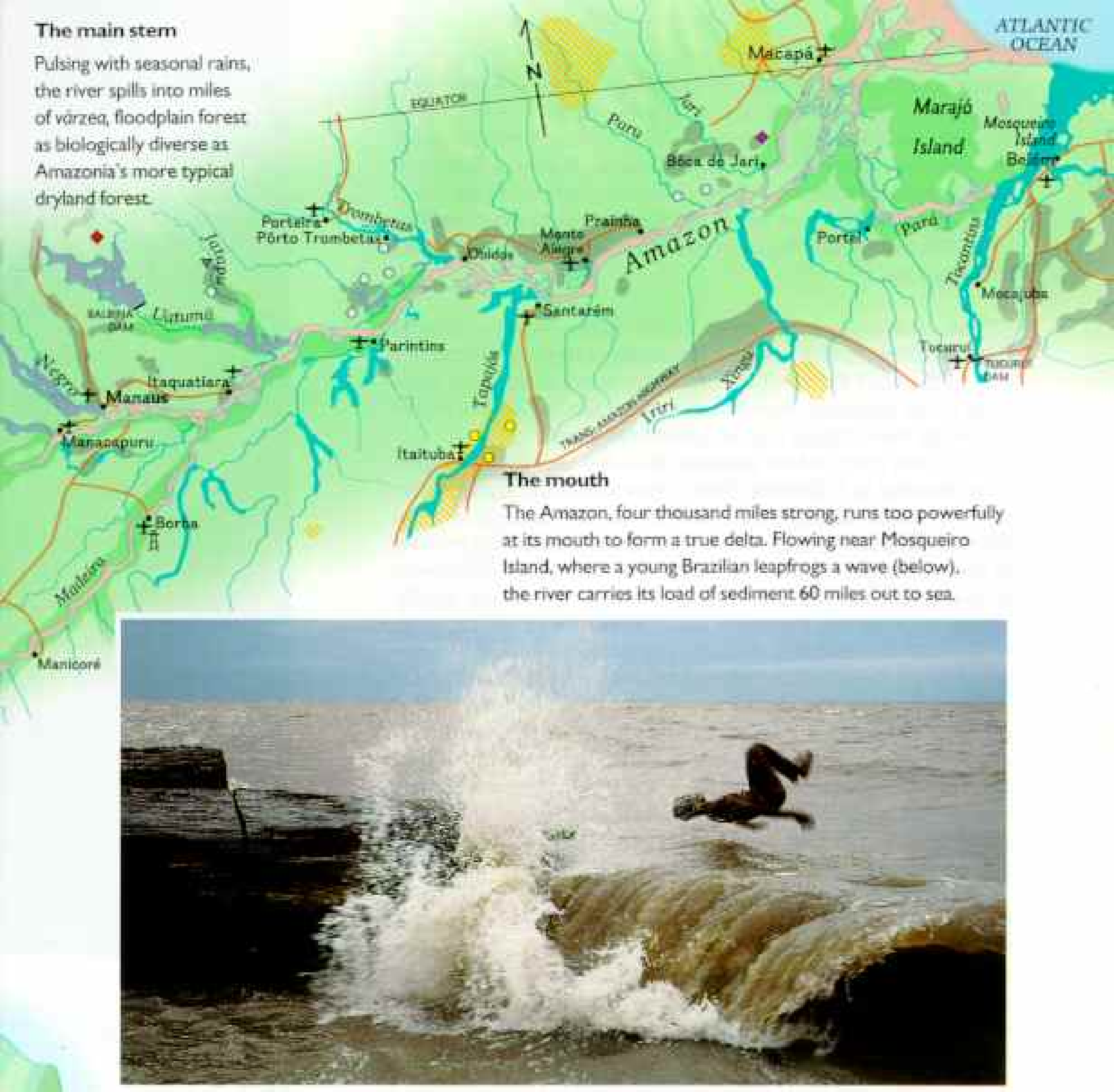
- 120 in or more
- 80–120 in
- 40–80 in
- 20–40 in
- 10–20 in
- less than 10 in

Coca-producing area

0 600 MILES

The main stem

Pulsing with seasonal rains, the river spills into miles of várzea, floodplain forest as biologically diverse as Amazonia's more typical dryland forest.

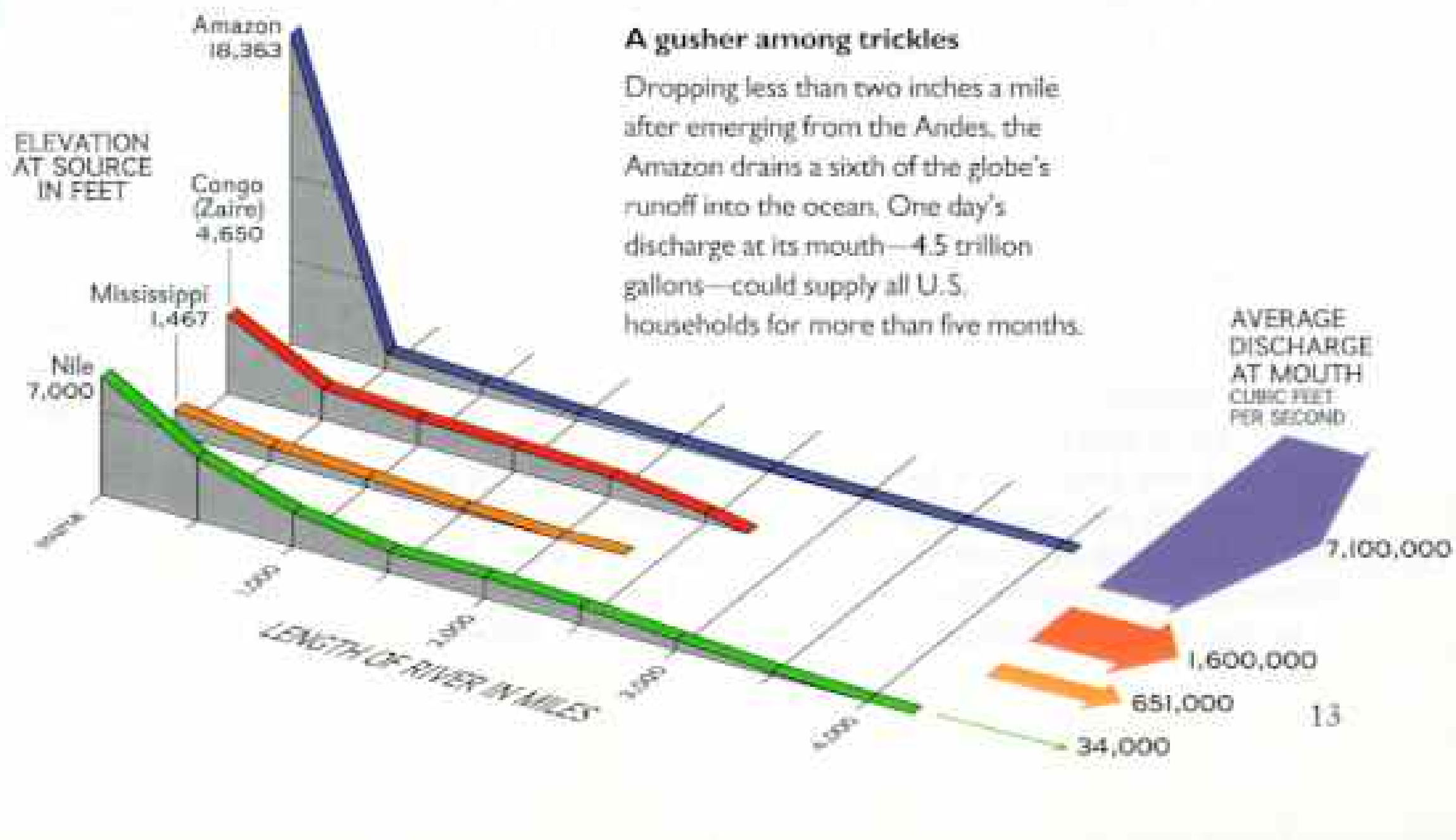


The mouth

The Amazon, four thousand miles strong, runs too powerfully at its mouth to form a true delta. Flowing near Mosqueiro Island, where a young Brazilian leapfrogs a wave (below), the river carries its load of sediment 60 miles out to sea.

A gusher among trickles

Dropping less than two inches a mile after emerging from the Andes, the Amazon drains a sixth of the globe's runoff into the ocean. One day's discharge at its mouth—4.5 trillion gallons—could supply all U.S. households for more than five months.



journey I saw a man in a hammock eating an orange while others unloaded 12-foot-long bundles of palm from a boat, and I thought it was lethargy or laziness. I was wrong. As the nature of the river forced me into the same patterns, I came to believe it was the pacing of the long-distance runner, faced with the run of his life on a course that never changes except to move against you. Eva Santos and those like her knew what it meant to make the long haul.

FOR FOUR MONTHS I moved slowly up the Amazon. Except for a short stretch in which danger from terrorism forced me to divert, I followed what geographers consider the main stem of the Amazon, from Brazil up through the Andes, all the way to its most distant source in southern Peru.

I took the river in four sections: from the mouth to Manaus, from Manaus to Colombia, from Colombia to the high country of Peru, and from there to the source. In each of these sections life was different from the one before, going from urban centers, to near wildness, to a chaos of drugs and terrorism, to the peace of antiquity. Yet through it the river ran on and on, hardly changing at all for hundreds upon hundreds of miles: wide, coffee-colored, plodding. Creeping upstream, I began to understand how this relentless changelessness could become the underlying theme—and challenge—of life. Between the mouth of the river and Iquitos, Peru, 2,300 river miles, the land rises only 300 feet. Across those lowlands the river crawls as if it never need get anywhere. Moving back and forth between trading vessels and passenger boats, I climbed those 300 feet like a man going up a ladder that kept sliding down, step after step that gained only inches.

The river was so broad and the bends so wide that I could hardly tell we were turning. The harsh sun swung overhead as our direction changed, but otherwise everything was the same: brown water, green forest. It was the rainy season, which runs from November to June, and the river was high; water spread out through the forest, covering the *várzea*, the vast Amazon lowland that floods annually for several months.

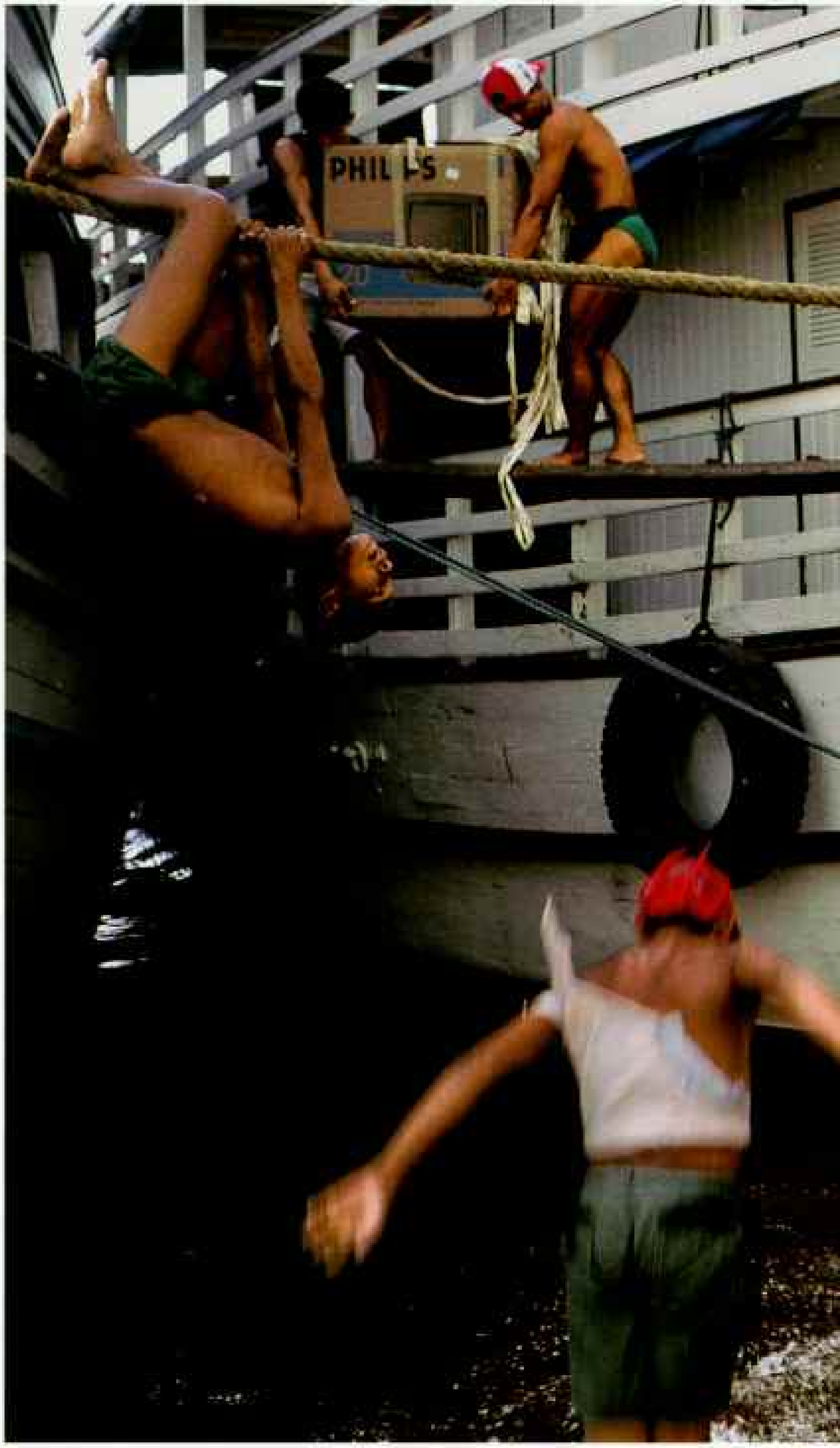
Monotony took over. I moved more slowly. I read. I slept. I watched the river. Each boat carried a tiny cross section of Amazon society. I talked with a man who always carried a Bible, a woman leaving her husband, a policeman who had been shot in the hand. I ate dinner in the galley: chicken and rice. Beans and fish. Chicken and rice. Canoes drifted past. Small wooden passenger boats or traders mumbled their smoky way downstream. No matter how blue the sky, the river never caught the color in reflection; it was loaded with sediment carved from the Andes. Logs and brush and whirlpools moved past in the endless flow, and river dolphins rolled ahead of us.

In the afternoons clouds built up, then streaks of lightning lit the sky and it poured, and we could see maybe a hundred yards. Late each day I went back to the stern, swung an empty paint can on a rope, and poured river water over my head. When night came, the clouds diminished and the sky filled with stars, but lightning shot across the horizon like artillery fire.

In the still, hot darkness, clouds of mosquitoes hovered

Rain and shine

A sunburst heralds yet another shower for Belém, the Amazon River's main port of entry. Water lubricates life in Amazonia; annual rainfall can exceed ten feet. Much of that downpour cycles from the vapor exhaled by an ocean of trees. After an evening storm (right), Belém children dodge puddles during a pick-up soccer match.



Jungle gym

Television has invaded the Amazon, but young *caboclos*—Brazilians of Indian and European bloodlines—still rope together their own entertainment in Parintins. "Theirs is the world of the river," says an anthropologist. "Life is hard. They share."


E23

around the net draped over my hammock. Beetles crawled on the deck. One night clouds of grasshoppers surrounded the boat; another night it was fireflies.

The hours passed unnoticed. Each day flooded the next.

As I sank into timelessness, I remembered Joseph Conrad's *Heart of Darkness,* about a journey up a jungle river. I remembered the despair at its depths: "The horror! The horror!" Conrad wrote. Surely, as human beings try to build life and meaning on the mudbanks beside this inexorable flow, that terrible sameness could only be matched by meeting the river in kind, with an equally relentless courage.

I SAW IT AGAIN at Manaus, in the face of a beautiful woman named Solange Garcia. She stood in a field, in red shorts and black shoes, protecting her home from the government.

Manaus was both the heart and the end of the most civilized section of the river. Between the mouth and Manaus all the forces of the 20th century have been brought to bear on this extraordinary piece of nature. Cities bloom on its banks, ocean-going freighters ply its waters, farms turn its forest to fields, and television reaches even its Indian tribes. Manaus is the unofficial capital of all this: a city of one million spread over the land where the biggest tributary, the Rio Negro, meets the main stem.

Yet life remains hard here. Mines in the area have brought back-breaking work and have turned tributaries into carriers of mercury. The cities have become clogged with peasants fleeing poor living conditions on farms in the interior. Manaus itself is a boom-and-bust town, built on the rubber trade at the turn of the century, then again in an explosion of wealth and population after the Brazilian government declared it a free-trade zone in 1967. Although business continues to grow, the city is crowded with the unemployed.

I stopped in Manaus to change boats, and there, on the edge of town, I met Solange Garcia.

She was standing in the dirt beside her house. She was carefully dressed. But her house was a hovel—a one-room shack in which she lived with her husband, José Alves, and their eight children.

The house was threatened. Solange, José, and their children had moved from a village far up the Amazon two months before, looking for work and schools. José had found no work, and Solange worked only part-time at a snack bar. But they had built the shack on public land without permission, and now Brazil's environmental agency, IBAMA, was going to tear it down. It seems ironic that Brazil's government, which had encouraged settlers to move north into Amazonia, appears anxious to displace them now that they have become a nuisance.

But Solange was determined to keep her house—made up of loose-fitting boards, windows with no glass, a dirt floor, and a leaky roof. "When it rains," she said, "we all have to stand up, to keep from getting splashed." But she wasn't leaving. "I stay here all day in the sun," she said, "to keep other people from coming to take this land or destroy our house."

As Alex and I talked with her, the IBAMA men came in a van. They noticed cameras and notebooks, and did nothing. They

Party animals

Poised for play, a giant ant float awaits action outside the Parintins fairgrounds during *Boi-Bumbá*, the biggest folk festival in the Brazilian Amazon. During the last week in June, Parintins explodes with dueling parades and opposing teams of dancers—each 2,500 strong—whose enthusiasm shimmies over in the streets.


BAR - DOS - DOS

Surreal estate

American salesmen endure a mock tribal initiation near Manaus, courtesy of a New York-based real estate firm that rewards its star agents with exotic excursions. Adventure tourism has taken root in the Amazon. "People come because this is the last destination on earth," boasts one Manaus tour operator.

went away, then came back, but we were still there. They went away again.

Solange unbraided her hair. The men from IBAMA drove by again. We were still there. They didn't push the house over.

"We'll not give up," she said softly. "We'll go to the end."

SLOWLY we moved on upstream. I shared a 45-foot passenger boat with Alex and a crew of three. The captain, who called himself simply Valdecir, pushed hard against the river all day but anchored at night; he didn't want to challenge both logs and darkness. Soon the changeless river engulfed us. Day after day we pushed west, until days didn't matter; we fought the current but surrendered time.

This was the land of the *ribeirinhos*, the people of the river. Towns and farms became smaller and farther apart. Between them jungle crowded down to the river's edge. This was a primitive Amazon, life and memory woven together.

Descended from rubber tappers of European ancestry and Indians, ribeirinhos are now the main residents of the várzea. They live much as their Indian ancestors did, cutting small patches of jungle and then letting them grow back after a few

Field of dreams

Home is where you clear it for tens of thousands of squatters on the outskirts of Manaus, Brazil's Amazonian metropolis. Though deforestation in the Amazon has slowed in recent years, hard times continue to drive failed homesteaders to jungle towns. Says an environmental expert in Manaus, "It's utter, complete chaos."

years' harvest. This way of life has been going on in the Amazon Basin so long that its patterns may have significantly shaped what we think of as the natural jungle.

Ribeirinhos make their living fishing and farming small plots. They raise chickens and grow corn and that staple of the Amazonian diet, manioc. They buy supplies from a trader called a *regatão*, who goes up and down the river from the little towns.

The ribeirinhos we met had a closer relationship to the river than the more modern river people to the east, but it was an edgy kind of life. They were afraid—of malaria, of cholera, of the wilderness. "When the water is low, the jaguars come," a ribeirinho told me while his five-year-old daughter chopped skin off a manioc root with a machete. "When it's high, it's the snakes." His wife talked angrily about the caimans. "A caiman attacked a boy and his uncle in a canoe. It took the boy's arms before the uncle could pull him away."

ONE DAY, FARTHER UPSTREAM, I canoed deep into the várzea with a ribeirinho boy named Elcio. Among the trees the water was black. I eyed submerged logs with suspicion, wondering which would turn into a caiman. Elcio carried a bow and an arrow on a line. He paddled slowly, watching the water. He was after pirarucu, a red, gold, and brown fish that can weigh more than 200 pounds. An air-breather, the pirarucu must come up for oxygen; Elcio searched for a dimple on the surface.

Under the thick and lazy heat I could sense a familiar undertow of desperation. For Elcio there was no margin. "My father died last year," he had said. "A few days after he accepted Jesus." Now Elcio was the family provider, and there was nothing in the canoe.

"There are piranhas in here," said my interpreter, Marco.

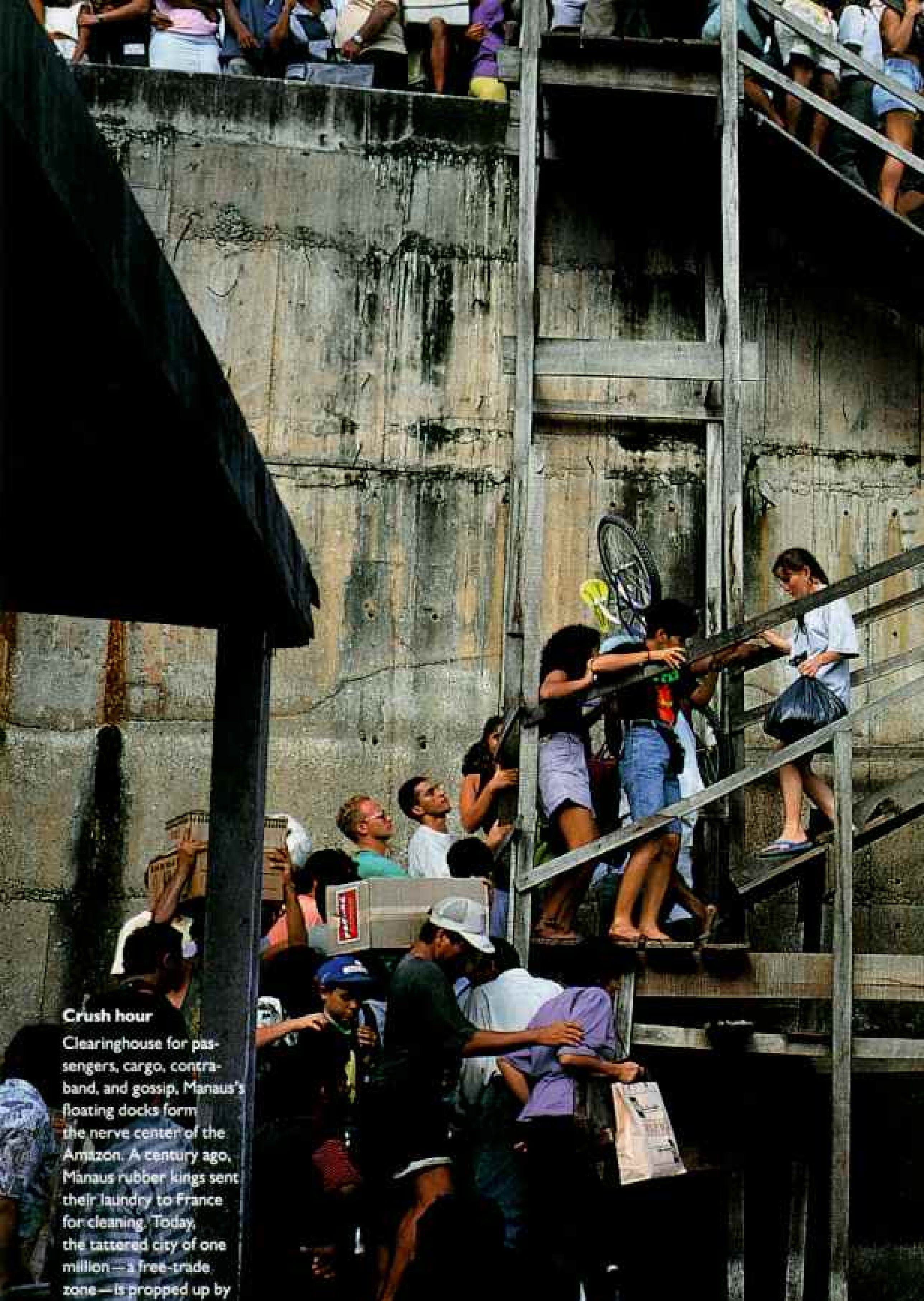
"I am only afraid of caimans and snakes," said Elcio. He was bold. He was lithe and strong. He was 16. He reminded me of Eva Santos.

We stopped under trees thick with passion-fruit vines. Tall grass grew out of the water. Branches hung low. Egrets stood poised. Macaws flew overhead. Elcio raised his bow, inserted the arrow, waited, then fired at something he saw in the water. "*Nada*," he said. He pulled the arrow back into the canoe. He paddled with his left hand and held the bow in his right.

The canoe moved quietly, patiently, through water and heat, among climbing vines whose roots hung down like hair. Elcio stopped, waited, fired again, then again. Nothing. Darkness approached. The canoe was still empty.

"We must go," Marco told him. Reluctantly Elcio turned his canoe. It rustled through grass. Then he stopped and raised the bow once more. The arrow made almost no sound slicing air and water, but this time a pirarucu splashed on the end of the line, shot through the mouth. Elcio hauled it into the boat and smiled with relief. Finally he could play the role of guide. "See," he said, "there's a cowbird." He started to paddle for home.

We left Elcio and went on up the river. Small boys came out in canoes to trade Brazil nuts and manioc for salt and sugar. Villages all looked the same: one or two roads, a Roman Catholic



Crush hour

Clearinghouse for passengers, cargo, contraband, and gossip, Manaus's floating docks form the nerve center of the Amazon. A century ago, Manaus rubber kings sent their laundry to France for cleaning. Today, the tattered city of one million—a free-trade zone—is propped up by government incentives.

Liquid highway

"All sorts of things happen. Fights. Somebody's shoes get stolen. Romances bloom in the bathrooms," says a veteran riverboat traveler on the Amazon. As the lifeline for the region's people, the river teems with barges, patrol boats, canoes, even floating clinics. Sweltering blue tarps on one boat (left) fend off rain.

church and an Assembly of God church, a small market, stacks of beer crates, boys playing soccer. A man begged for sugar; a boy begged for money for a fishhook. One day we came upon a soccer tournament in a field: four teams fighting it out for first prize, a roast duck.

In one town I talked to a man sorting Brazil nuts. He wore no shirt. I asked him a question that came often to my mind: "How do you cope with these mosquitoes?"

"You get used to them," he said.

In another town I met an Irish nurse who had been there more than a year. I asked her if she was used to the clouds of mosquitoes. She swatted another one: "They say it takes five years." Patience!

Some things take longer to get used to. Diseases seldom seen in more developed countries persist in the Amazon, holding out because of climate, unsanitary conditions, and poverty, which keeps people from treatment. In the small hospital where the nurse worked, I saw a poster that declared: "Cure yourself of discrimination."

"Is that about race?" I asked her.

"No. Leprosy."

WE URGED Valdecir to go faster, so he ran the boat later into the night. He grew anxious. In the spotlight floating trees reared like horses, and once in a while two red dots stared back at the light: the eyes of a caiman. We anchored late, and I slept uneasily in the heat. Once I awoke and saw six Indians paddling past just a few feet away, arrow-shaped paddles dipping silently in the river.

It seemed an ancient image, almost a dream. Highly organized Indian tribes once dominated the Amazon Basin. Today the tribes are dwindling, and most of the Indians are gone. Though they still speak some 180 different languages in the Brazilian Amazon alone, their total numbers are down to 150,000, and they are under continued pressure. As we came to the end of Brazil, we sensed the pressure firsthand.

We were about a hundred miles from Colombia. "You are entering the black hole," a man said at a village store. He warned us that this was an outlaw region controlled by drug runners, corrupt politicians, and leftist guerrillas. Valdecir grew even more anxious, and the crew argued among themselves.

The river looked no different. The bends were the same. The sun swung overhead. The rain fell. Then one day we came around a bend, and things changed. The Indians were waiting.

They stood there on the bank, silent, watching: about 75 men, women, and children. Most of the women held babies on their hips. No one smiled. They just watched. They were Tikuna, the second largest Indian group left in Brazil. By 1988 the Brazilian government had set aside more than a million acres for them. Lumbermen, angry that they had to leave, had come with their guns. They killed 14 people in this village, including five children, and threw the bodies in the river.

As I watched the Indians watching us, their fear washed over me, and I knew the character of the river had changed again. The stretch between the mouth and Manaus had been a frontier

of civilization, one in which modern tools fought the river and the jungle. The stretch between Manaus and here had been an older kind of frontier, one in which men and women struggled with nature and disease. This was different. Here people were afraid of one another. Cocaine and terrorism threatened. But I could see that same patient courage in these faces too.

"Once we were great warriors," said Pedro Inácio Pinheiro, who described himself as the village captain. We had walked through the village, past rows of palm-thatched houses, a cross 20 feet high, a radio antenna, two solar panels, women making baskets, and someone cooking a monkey for dinner. We talked in a community building. There was a shortwave radio in a corner. He described the way his tribe struggles today—using spokesmen rather than guns—to protect its land from continued demands for its resources.

"If we fought today," Pinheiro went on, his face solemn, "even if we had weapons, they would exterminate us. Now it is important to fight with the tongue."

Pinheiro gave me a necklace made of dark, polished wood. "It is not much," he said. "I hope you will not be offended." I held it gently. "We must hold on to our land and culture," he said. "We can never give these up."

We walked back to the boat. I gave Pinheiro bags of rice, sugar, crackers, and beans. I asked him my familiar question: "How do you cope with these mosquitoes?"

A sudden, sly smile opened in his face. He laughed. "They're part of our culture," he said.

"YESTERDAY WE WERE SAD," said a young woman in the town of Benjamin Constant, which is named for a founder of the Brazilian republic. She had just jumped down from dancing on a table. "But today there is Carnival!" As we worked our way upstream, life became more and more like that—fear and laughter mingled more abruptly, more harshly, more chaotically. Earlier that day Carnival music blared from loudspeakers on a small car while bells of the Catholic church played. Just upstream across the river, in Leticia, Colombia, television comedies ran between announcements showing guerrilla leaders and cocaine dealers along with the rewards for their capture.

"My husband was killed last year," said a woman I will call María, who owned a store. "They came up to him with guns, demanded the money he was carrying. He wouldn't give it to them. I was afraid to go to the newspapers."

Authorities had told me that the cocaine industry had been smothered here by police and military action, but María didn't believe it.

"No one will admit it," she said, "but the big business here is cocaine." Outside María's store soldiers patrolled the streets—young men in fatigues, carrying automatic weapons. "Cocaine is still leaving this area," she said. "But it needs a face. The face of the business is fish. They just caught a planeload of fish in Bogotá. The fish were filled with cocaine."

The influence of northerners—particularly from the United States—was clear. From the small airport at Leticia I saw what

Fish tales

Angling for empathy, a child masquerades as a pirarucu, a beleaguered Amazon fish, during an Earth Day celebration in Iquitos, Peru (above). The real item, meanwhile, parades to the fish market—and the cutting board. Once common, the pirarucu—one of the world's largest freshwater fish—has been depleted along much of the river.


ANHATTAN

looked like a radar site, a long, low building surrounded by a high Cyclone fence.

"We don't know what they're doing there," a taxi driver said. "A big American plane comes in twice a week. No one knows what's going on."

Again and again I heard the same story. Americans demanded that people stop cutting the rain forest. Americans demanded timber. Americans demanded that people stop growing coca. Americans demanded cocaine.

"The Americans," a Colombian man said near Leticia, "have us with a ring through our nose."

AT LETICIA I signed on to a faster boat. Soon the river would change its name. The main stem of the Amazon bears many names as it comes out of the Andes; not far ahead it would become the Ucayali.

I boarded with trepidation. Soldiers checked my gear. On the lower river, going upstream had seemed just a matter of forgetting time and surviving monotony. Here patience was still the only way to face the river, but the stakes were higher: Now life itself seemed in danger.

But when catastrophe struck it was not what I had feared: The danger came not from the people but from the river, with unexpected swiftness.

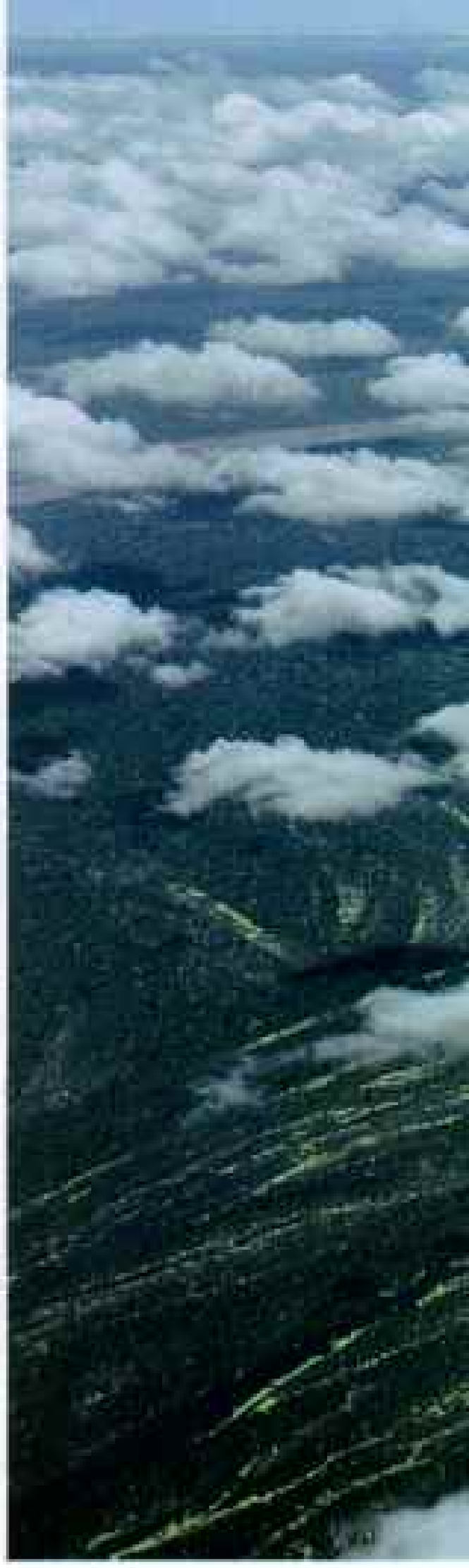
The lights of Iquitos, the largest city in eastern Peru, appeared in the dark. It was raining. The ride from Colombia had been comfortable enough: The boat, a 30-foot ferry, had plastic windows, cushioned seats, and a VCR. But the captain had struggled to find fuel. We had to stop four times, finally arranging to siphon gas from a tank at someone's home in a village. And now it was midnight. The passengers were half asleep, moving and murmuring in the dark. But the fuel was not quite enough.

Suddenly the roar of the engine stopped. The captain and pilot rushed aft. But the current was swift, and we began to turn. I realized that the boat was out of control. I had fought the river upstream for 2,000 miles, and now, effortlessly, the river had taken over.

Passengers screamed. The boat swung around, helpless as a leaf, and caromed off a steel barrier near a moored freighter. Water surged in—perhaps through a gash in the hull.

I ran for the stern, helping a small boy as I went. A cable loomed in front of us, reaching from shadowy shapes above us toward the freighter. It swept toward us at eye level. I pushed the boy's head down. The cable missed us, then ripped across the top of the boat, smashing the flimsy superstructure. Our boat crashed into the dock and stopped.

I clambered onto the dock and helped others jump across. A parrot flew out of the boat and fell in the water with an indignant squawk. Someone grabbed it. A woman screamed. I looked up. A child dangled from the cable, holding on like a gymnast with one arm and a leg. What looked like the whole force of the Amazon River surged under him. It sucked beneath our boat and the freighter. If he fell, the Amazon would take him. But men inched out along the cable and brought him back.



Rambling waters

Scarred by old meanders, the forest bordering Peru's Ucayali River—part of the upper Amazon—shows the uneasy tracks of a river that can't keep to its bed. Flooding can shift banks a hundred feet a year. "Whole villages have disappeared on this stretch of the Ucayali," says a local missionary. "People just move on and build a new place from scratch."

WE TOOK A QUICK COUNT. Everyone was safe. People stood on the dock, cut, bruised, barefoot, shocked into silence. A woman hugged the parrot.

"What's its name?" I asked her.

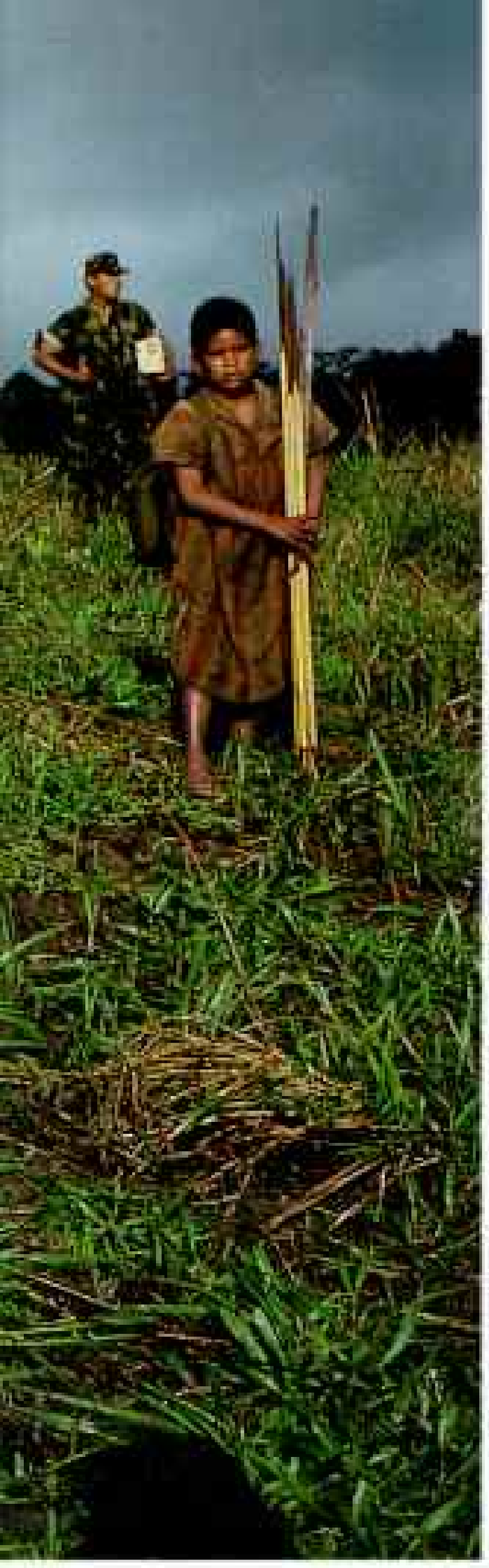
She looked up, hesitating. "Salvación," she said. Then she started to cry.

It seemed appropriate that Salvation was a parrot; this part of the Amazon was both grim and absurd. I will always remember it as a place where young men wore flak jackets, wielded Israeli-made guns, and walked around in U. S. Army boots, where stories of murder mingled with prayers, where the big river carried cocaine to America, enemies to their battles, logs to market, and cholera to the towns. There was a kind of frenzy in the air, the flip side to the enduring courage I had already met on the river, as if some of the people here had run out of both patience and good sense all at once.

Some of this frenzy was benign, and still pretty brave. At Iquitos I met a missionary who was building an ultralight aircraft on floats in his church to visit his people. He and his parishioners had already built a 72-foot boat, in which he lived, and he had taught himself dentistry and cataract surgery. Some of the

Totem of mud

Hungry sentinel, a buzzard stakes out the raw riverfront in Pucallpa, Peru. The Ucayali can drop 30 feet during the dry season. The squalor revealed by shrunken currents is deceptive. True hard times come with the return of cleansing high waters, when fields are inundated and fishing stocks disperse.



Homeless

Caught in the bloody pincers of civil war, Peru's Ashéninca Indians (above) have borne the brunt of fighting between the military and leftist Shining Path guerrillas. Government-backed Indian militias (left) have helped quell the insurgency. Even so, the Ashéninca's heartland is shattered: Thousands are dead or displaced, and survivors now crowd fortified villages.

frenzy was pragmatic. Farther upriver, when the main stem of the river became the Ucayali, I met a farmer who had once turned to working coca. "I would buy it from the growers and take it to the labs," he said. "I worked on commission. The main transportation is the river. You put it in dried fish."

But some of the frenzy was deadly. Upstream from Iquitos, people worried less about the cocaine war and more about a violently impatient organization: the Shining Path guerrilla movement. Since the 1970s civil war has claimed at least 29,000 people in Peru, among them a few foreign tourists and many poor Peruvians. Peruvian authorities told me that because of Shining Path, the Tambo—the main stem of the Amazon above the town of Atalaya—was a "red zone," and too dangerous for my upstream journey.

But missionaries are sometimes as bold as soldiers, and I found a missionary pilot named Jon Schmidt who flew me and my interpreter, Ana Cecilia Gonzales Vigil, a Peruvian photojournalist, up the Tambo. As we flew, he pointed out villages on the map that had been destroyed by Shining Path—then landed at one that had survived—so far. And there, again, I saw the timeless courage that so marks life along this river.

The town was a small camp in a clearing, called Valle Esmeralda. In the abrupt silence after the engine stopped, the people of the village crowded around the plane, their faces bearing paint. They were Asháninca Indians. A leader introduced himself. His name was Santiago Cororaw. He wore a shirt and slacks. He was 22.

"This is the edge," he said. "Half an hour away are the terrorists." He pointed to the low hills nearby. "They're watching us," he said.

The village was a group of palm huts. There an old chief asked us for medicine. We had none to give him. "There is malaria, typhoid, hepatitis, and cholera here," he said. "Sometimes a military helicopter comes but not often enough." Nearby a woman was making *masato*, a fermented drink of manioc and saliva.

At the edge of the forest was a bunker surrounded by sandbags. An Asháninca guard sat outside it. It was too hot to get in it. Next to him was a bow and half a dozen arrows. I thought of Shining Path guns.

"We only have three rifles," Santiago said. He reminded me of Elcio; he also reminded me of Eva Santos.

THREE WEEKS LATER, after I took a canoe up a rapids to a road, then rode a truck and a train into central Peru, almost all the Amazon was below me.

On a windy May morning I, Ana Cecilia, and two others left the Peruvian town of Yanque at sunup, riding horses slowly up a narrow, rocky trail. Our companions were Mauricio de Romana, a farmer and well-known guide, and a man named Felipe, who tended the horses. We were in the highlands of southern Peru, at about 11,000 feet.

Venus was still bright in the sky. We rode slowly through a village. Our horses' hoofs echoed off stone walls.

"Where are you going?" an old man shouted from a doorway.

"To Mismi," Mauricio said.

Plowing the clouds

Preparing to till stony, dream-misted fields, an Andean boy harnesses his oxen near the chiseled crags of Curahuasi village, one of Peru's most rugged mountain redoubts. The Apurímac River—fed by the plunging stream in the distance—forms the merest tendril of the Amazon, now a crisp mountain stream.

"Beware of the cold," the man shouted back.

We crossed a water ditch made of stone and passed along a wall. A woman watched us go.

"Beware of the cold," she said.

In the valleys below, terraced fields lapped together like coins of green and gold. Above us mountains rose, huge, snow-capped, and stony: the Chila Range. There were no trees. Because of the high, rugged terrain we had been forced to approach the source of the Amazon from the Pacific side of the mountains, sneaking up from behind.

At about 14,000 feet we stopped at a pile of stones.

"It's an *apacheta*, a tribute to an *apu*," Felipe said. Apu, he explained, was a word in Quechua, the language of the Inca. It meant a god or commanding general. "You pray to leave behind pain and sorrows and bad luck, and to have a good journey."

I threw a pebble on the pile.

WE WORKED OUR WAY around the southwestern side of the ridges. Above were the dark slopes of Nevado Mismi, the mountain where the Amazon begins, 18,363 feet above sea level. The day was ending. The air was dry and sharp. I thought of the warning: Beware of the cold. That was all there was left to fear. In this final section of the Amazon I had left the assault of civilization, the ribeirinhos' timeless struggle, and the chaos of drugs and terrorism, and climbed quietly up the hills into antiquity and unsurpassed beauty.

Here patterns of existence were very old. An irrigation ditch on the side of a ridge had been in use for almost 2,000 years. The path we walked was a thousand-year-old trading route between Cailloma and Coporaque, across the divide between the Amazon and the Pacific. The people lived in ways almost unchanged through generations. A man, a woman, and a boy came by with a small herd of llamas. The man spun wool on a spool in his hands as he walked. He would trade the wool for rice, flour, and sugar down in the valley we had left.

"We never use money," he said.

We spent two nights camped in a mountain hut. A four-wheel-drive vehicle from Cailloma was supposed to meet us on the third morning, but it didn't come. "Something has happened," said Mauricio. "I must find out." He took food, a poncho, a sleeping bag, a flashlight, and his pistol, and rode away over the hill.

The day passed. Night came. We slept in the hut again. In the morning the land was gray with new snow. Our food was almost gone. Our camp stove ran out of fuel. I was hungry and on edge.

I hiked up a hill alone and rested on the top. In October 1971, Loren McIntyre, a photographer and writer, came here as part of the first team to scientifically measure and mark the great river's source, a project sponsored by the National Geographic Society. I now looked out on the waters he had described as the first trickle of the Amazon.

On one side of the ridge a stream glittered in the sun: the Lluctuema. On the other side was the Lloqueta. Into it flowed the creek called the Carhuasanta, the one McIntyre identified as the most distant source. The streams flowed into the Hornillos,

Chill birth

Snowflakes dust the mossy beginnings of Peru's Carhuasanta River—the ultimate source of the Amazon. Silent, icy, clear as glass, the river pools here for a moment at 16,000 feet, gathering its breath for the continent-spanning journey ahead. "Touch the water," says a Peruvian geographer, "and you touch the sea."

which joined the loud waters in the canyon of the Apurimac, which joined the Ene, the Tambo, the Ucayali. And there, 4,000 miles away, was the mouth of the Amazon, pouring seven million cubic feet of water a second into the sea.

I looked at the mountain: Apu Mismi, bathed in light. On nearby ridges stood dark cairns of rocks and pebbles—apachetas, shrines to hope. They looked like the shadows of pilgrims, climbing the face of the Amazon. An apu, Felipe had said, was a mountain and also a river god that brought water, and thus life, to earth.

The sun shone, and I began to grow calm. It was cold, and I didn't know when we were going to get out, but by now I knew how to wait.

I waited. The cold wind flowed around me; the source of the great river glittered in the sun. For a few minutes I understood the courage of Eva Santos and all those others as they faced the Amazon and its long, slow future of inexorable flood and inevitable human conflict. It is a powerful kind of bravery, this patience, forever carrying pebbles of hope upstream.

I waited and watched. I started back down. Far away dust rose beyond a ridge. Slowly, a vehicle came over the hill. □

Remote World of the

Earth's most powerful raptor, the harpy eagle inhabits a shrinking domain in New World rain forests. After feeding on a capuchin monkey until the remains were light enough to carry, a female eagle in Guyana wings toward the nest where her ravenous chick waits.

By NEIL RETTIG

Photographs by the author and KIM HAYES

Harpy Eagle

LORDS OF AN IMPERILED REALM

Poised on her nest high in the canopy of a South American rain forest, a female harpy strikes an imperious pose. Feathers atop her head fan into a crest, commonly displayed when the eagles hear a noise. Smaller feathers create a facial disk that may focus sound waves to enhance hearing, a feature also found in owls. Weighing up to 18 pounds, equipped with a seven-foot wingspan, and armed with talons longer than a grizzly bear's claws, harpies are superb predators.

Little is known about *Harpia harpyja*, an endangered species whose numbers have declined as its habitat has shrunk. To document its behavior, Kim Hayes and I traveled to southwestern Guyana five times over the past six years. Just getting there was an ordeal. After driving or flying from the capital of Georgetown to the town of Lethem, we had a 25-mile drive on unpaved roads to the Indian village of Nappi near the remote Kanuku Mountains. From there we walked for four hours to our campsite, a hike we and our local assistants sometimes made in water up to our waists during the rainy season, carrying equipment all the way.

To capture this regal harpy on film, I sat in a blind on a branch 30 feet from her nest. We chose not to climb directly to occupied nests to avoid disturbing the eagles and for our own safety: The birds fiercely defend their eggs and young, and an attack could seriously injure one of us.

Early explorers in South America were awed when they saw these eagles seize and lift monkeys and sloths high into the forest canopy. They called them harpies for the predatory monsters—half woman, half bird—of Greek mythology.

In Guyana harpies favor the towering silk-cotton tree and usually build nests 90 to 130 feet up. We paid members of two local Indian tribes, the Macushi and the Wapishana, for each nest they located. Some offered to bring us live eagles, surprised that we wanted only to look at nests. Although the Indians occasionally hunt the birds for food and feathers, the Kanuku region still harbors one of the greatest concentrations of harpies. In light of the eagles' overall decline, we were pleased when the Indians found so many nests that we were able to discontinue the search.

Guyana is a land of great diversity that includes savanna, gallery forests growing along streams, stands of semideciduous trees, lowland forest, and montane evergreen forest.

It is also a threatened land. Guyana is susceptible to the same kinds of deforestation that have ravaged other parts of South America. The despoliation could be accelerated by a new road linking Brazil to the Atlantic port at Georgetown.

Guyana currently has only one legally protected forest area—the 29,000-acre Kaieteur National Park. The government may establish another reserve in the Kanuku region. Such protected areas could help safeguard one of the world's largest tracts of unmolested rain forest.

Harpy eagles are scattered throughout the tropical forests of Central and South America—a habitat devastated by development, logging, and agricultural pioneering. Conservationists are pressing for more nature preserves and for less destructive forest industries such as ecotourism.

NEIL RETTIG is a naturalist and filmmaker who counts two Emmys among his many awards. Camera assistant and sound recordist KIM HAYES has worked on 28 films.

HOMING IN ON EAGLE AERIES

With landing gear locked, a male harpy returns to tend his five-month-old chick. For nest sites, the eagles prefer trees with widely spaced branches, which allow clear flight paths to and from the nest. Females lay one or two eggs in the large nest, but only one will survive. As soon as a chick hatches, it gets all the attention; the other egg perishes from lack of incubation.

Females are about one-third larger than males and hunt heftier prey, but males are more agile and fly faster. These complementary abilities increase a pair's chances of finding food.

To catalog their diet, I used a crossbow to shoot rope over the stout limbs of silk-cotton trees and climbed up to examine vacant nests. When nearing occupied nests, I wore protective clothing to guard against attack.

We have visited nine harpy nests, photographing, measuring, and collecting prey remains. Eight nests were in silk-cotton trees. Also called kapok trees, they reach heights of 200 feet. Many have been spared the chain saw, thanks to the reverence in which they are held by local Indians, who consider it bad luck to cut one down.

Back home in Prairie du Chien, Wisconsin, I examined the prey remains, which included the skulls of a juvenile and an adult capuchin monkey. I was aided by scientists at Chicago's Field Museum, who painstakingly identified even the smallest of bone fragments. Our studies revealed that harpies hunt at least 19 species of mammals, 16 of which are tree dwelling. Sloths make up slightly

RON HAYES (ABOVE AND TOP RIGHT)

more than a third of the diet and primates slightly less than a third. The eagles prey on animals as large as 11-pound red howler monkeys and even 17-pound two-toed sloths, creatures too heavy to be carried whole.

We recently found that harpy eagles also feed on birds such as macaws, smaller parrots, and gray-winged trumpeters, though these make up only about 5 percent of the prey taken. Knowing what harpies eat could help determine the size and type of habitat preserve needed to safeguard the eagle population.

FROM NESTLING TO FIRST FLIGHT

Dinner is served to a three-week-old male as its mother offers the remains of a red-and-green macaw (right). Even though the colorful parrots make up only a small percentage of the eagles' diet, trappers who sell macaws to the pet trade (getting only two dollars a bird) sometimes kill harpy eagles, viewing them as competitors.

We observed this young male for six months. At 13 weeks he was slowly growing into his adult plumage and screaming loudly for food (left). Parents bring food every two to three days on average, though the interval can be as long as five days. In another three months this fledgling will begin his halting attempts at flight, but his parents will continue to feed him for ten months or more after that. With such a long dependency period, it's little wonder that adults raise only one chick every two or three years.

When this harpy was just ten days old, he was plagued by fly maggots. Making sure the parents were away, we climbed to the nest and picked the parasites from his feet. Contrary to a popular belief, parents will not reject a chick handled by humans, since most birds, including harpies, lack a well-developed sense of smell.

At the age of five and a half months this young male marched off the nest and onto a branch (center right). He sometimes ventured 60 feet away, then walked all the way back. By six months he was testing his wings for his first short flights (right). Harpies are masters at conserving energy, spending hours quietly perched as they watch and listen, then investing their calories in short bursts of speed to zero in on their prey.

AWKWARD ADOLESCENCE

Halfway between the ungainliness of youth and the sleekness of adulthood, a five-and-a-half-month-old male cries for food, his tongue lolling to the side and his wings outstretched as if to signal for attention. Light shines through his wings where feathers have been either thinned by parasites or worn down by his movements around the nest.

Even after leaving the nest itself, this young bird will linger in or near the nest tree and be fed for up to a year. But his parents will gradually provide less food, forcing him to fly off and fend for himself. When he becomes sexually mature between the ages of four and five years, he might return to nest in the same tree.

Because the harpy's range stretches in patches from Central America to northern Argentina, an accurate count of the remaining population has been impossible to make. We will continue our efforts in Guyana, and we feel hopeful that the Kanuku Mountain region—and other vital areas—will be protected to guarantee a future for the magnificent harpy and all creatures of the rain forests. □

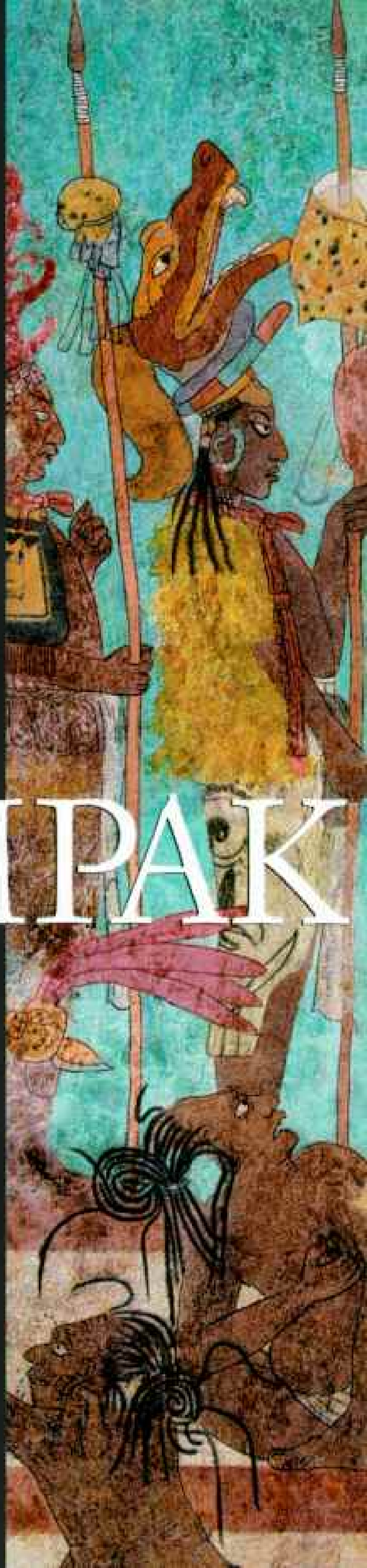
By MARY MILLER

Photographs by ENRICO FERORELLI

Computer reconstructions by DOUG STERN

Maya Masterpiece Revealed at BONAMPAK

Clear as the cries of tortured captives, stony-eyed warriors emerge from the shadows of an ancient and faded Maya mural (overleaf) at Bonampak, Mexico. Brilliant details unseen for centuries—of ritual bloodlettings, brutal warfare, and regal finery—are now coming alive through meticulous computer-aided reconstruction (right).



Nearly 20 years ago I swooped into eastern Chiapas, Mexico, in a wobbly Cessna—and stepped back in time. Surrounded by the silent ruins of a Maya city, I stood in bright sunlight before a crumbling structure. Its three dark rooms held a renowned treasure: the most complete and extraordinary paintings from the ancient New World yet discovered. Guided by local Lacandon Indians—descendants of the ancient Maya—American explorer-photographer Giles Healey in 1946 was the first outsider to see the murals, which date from the late eighth century A.D. The site was subsequently named Bonampak, from the Maya words for "painted wall." As an art historian with a passion for everything Maya, I yearned for my first glimpse.

It was a disappointment. As my eyes adjusted to the dim light, I saw that the murals were covered with a thick white frosting of calcite. The building had been constructed in such a way that rainwater leaked through its limestone walls, depositing the brittle crust. But this had been a blessing. While other Maya paintings deteriorated with age, Bonampak's murals were protected by the opaque coat, as if nature had colluded to preserve a masterpiece. Yet I could barely make out the jeweled ladies, clashing warriors, and dancing lords that I had seen in early copies done by artists who had soaked the walls to make the murals more visible.

Even obscured, the ghostly shadows moved me. There was no mistaking the power and artistry of these magnificent works, which

Bonampak's bleached ruins and terraced hills hint at the thousands of Maya who once thrived here. Archaeologists have unearthed a tomb in front of one small temple, perhaps built as an ornate shrine. A larger structure, now thinly roofed to keep out rain, houses the murals of Bonampak—an eloquent Maya legacy.

MARY MILLER chairs the art history department at Yale University. This is her first article for NATIONAL GEOGRAPHIC. ENRICO FERORELLI, a free-lance photographer based in Manhattan, covered "Mural Masterpieces of Ancient Cacaxtla" in September 1992. DOUG STERN, a computer artist, started his career in the Society's Cartographic Division.

depict a Classic Maya dynasty that flourished 1,200 years ago. Standing alone in Room Two, I could just discern the outlines of naked captives, blood dripping from tortured fingers. Most striking was the exquisite corpse draped across the steps, the diagonal line of his body dominating the wall. How had he met his end?

"You've got Bonampakitis," warned a friend. He was right. I have revisited the murals often over the past 19 years, each time discovering new details that answer—or raise—a question. Though scholars vigorously debate the meaning of these works, I see each room as a chapter in an epic tale. Room One depicts a young heir being presented to prestigious lords, who then hold a lavish celebration. In Room Two a chaotic battle provides captives for human sacrifice to appease the gods and honor the new heir. In Room Three Bonampak's elite seal the heir's right to the throne with a dramatic bloodletting ritual.

These scenes of pomp, warfare, and intimacy profoundly altered—and humbled—Maya scholarship. Mayanists had long believed that Classic Maya civilization, spanning A.D. 250 to 900, was a peaceful Eden ruled by benevolent astronomer-priests. Yet Bonampak's graphic depiction of combat, cruelty, vanity, music, and humor—displayed by a cast of more than 200 characters—demonstrates that the Maya exhibited all the flaws and grace of humanity.

Scholars had also once held that Maya glyphs merely described

A schematic slice of Bonampak's vaulted rooms exposes scenes of celebration, battle, and sacrifice. (Five of the scenes appear in this article.) Along a wall in Room One (facing page), gourd-rattle players move "as if in a flip book," says the author. "You can feel the action."

Once painted red (below), the building likely flanked a thatched assembly house on Bonampak's acropolis—a theatrical stage for public rituals.

PAINTINGS BY NATIONAL GEOGRAPHIC ARTIST CHRISTOPHER A. KLEIN

arcane celestial events. As epigraphers began to debunk that theory, Bonampak bolstered their case: Its long glyphic text includes elaborate details of political affiliations, dates, and deeds in the life of the city's last known ruler, Chaan Muan.

Murky and timeworn, the murals of Bonampak might have remained hopelessly obscure. But in 1984 the Mexican government began a three-year program to clean off the murals' calcite skin. Details I had never seen leaped from the walls. Pearls gleamed. Dancers paused for the next drumbeat. Ghostly bodies of defeated foes floated to the surface like drowned men rising from the depths.

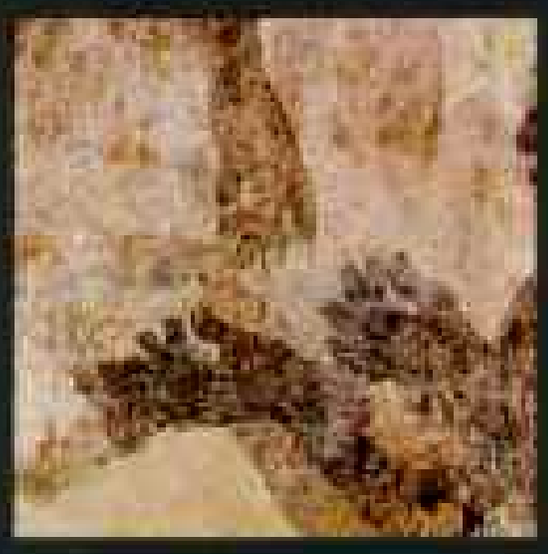
Before the cleaning, only four hand-drawn copies of these exquisite images had been made—all incomplete or lacking detail. A new kind of copy was needed before time could damage the paintings

At the heart of Mexico's largest tropical rain forest, Bonampak lies in lush but steamy isolation—"a cross between heaven and hell," says photographer Enrico Ferorelli. Dense jungle—once thinned by the Maya for fuel, food, and shelter—now chokes the site and may hide remnants of dwellings lost long ago.

further. With permission from Mexico's National Institute of Anthropology and History, NATIONAL GEOGRAPHIC took color photographs of the cleaned murals and scanned these images into a computer. Analysis of pigments by a team of specialists from the National Autonomous University of Mexico helped us to replicate colors. We added details seen in infrared photographs and at the site. The resulting computer reconstructions—showing about one-fifth of the murals—are as close to the originals as anyone could come without actually having been there as the paint dried.

The murals at Bonampak, like the Maya themselves, still retain many secrets. Classic Maya civilization in the region was near collapse at the time the paintings were done. Perhaps the Maya suffered famine or warfare. We know only that these murals were never finished and that the young heir they celebrate likely never reached the throne: Bonampak seems to have been abandoned soon after the murals were painted. Perhaps through reconstructing and studying these priceless works, we'll begin to understand why.

GILES HEALEY



▲ ORIGINAL FERORELLI PHOTOGRAPHY

▲ INFRARED PHOTOGRAPHY

▲ LINE ART DRAWN ON ACETATE

▲ FINAL COMPUTER RECONSTRUCTION

Restoring faded beauty

As if daubing fresh blush on pallid cheeks, computer artist Doug Stern and I labor to restore a regal lady of Bonampak to her original luster. We magnify her stoic face. Suddenly, a green blur is revealed as a jade nose bead—a gem invisible for centuries. Yet getting to this exciting stage took time and teamwork.

It began a decade ago, when Mexican archaeologists cleaned the calcite off Bonampak's murals. Muted ochers, indigos, and greens—plant and mineral dyes painted on stucco—gained new brilliance. But the details of many scenes were still obscured.

In the spring of 1992 Enrico Ferorelli went to Bonampak to take the color photographs of the cleaned murals that appear in these pages. In the fall of 1993 Stern and I followed. Rising with the roosters, we worked for three days inside the hot, cramped rooms, to the roar of a generator that gave us light. Stern laid transparent acetate sheets over enlargements of Ferorelli's photos. As we studied the murals, Stern drew onto the acetate visible details that did not show up clearly in the color pictures, such as the delicate curve of this noblewoman's eyelash.

CHRIS JOHNS

Back home, Stern worked with Ferorelli's photographs, which had been scanned into a computer. With an electronic pen he added new fragments we had drawn on acetate at the site as well as details gleaned from infrared photographs taken by NATIONAL GEOGRAPHIC art researcher David Wooddell and by Bonampak discoverer Giles Healey. Through such computer reconstruction, a delicate trio of hands (top, detail from page 52) regained their hidden nails.

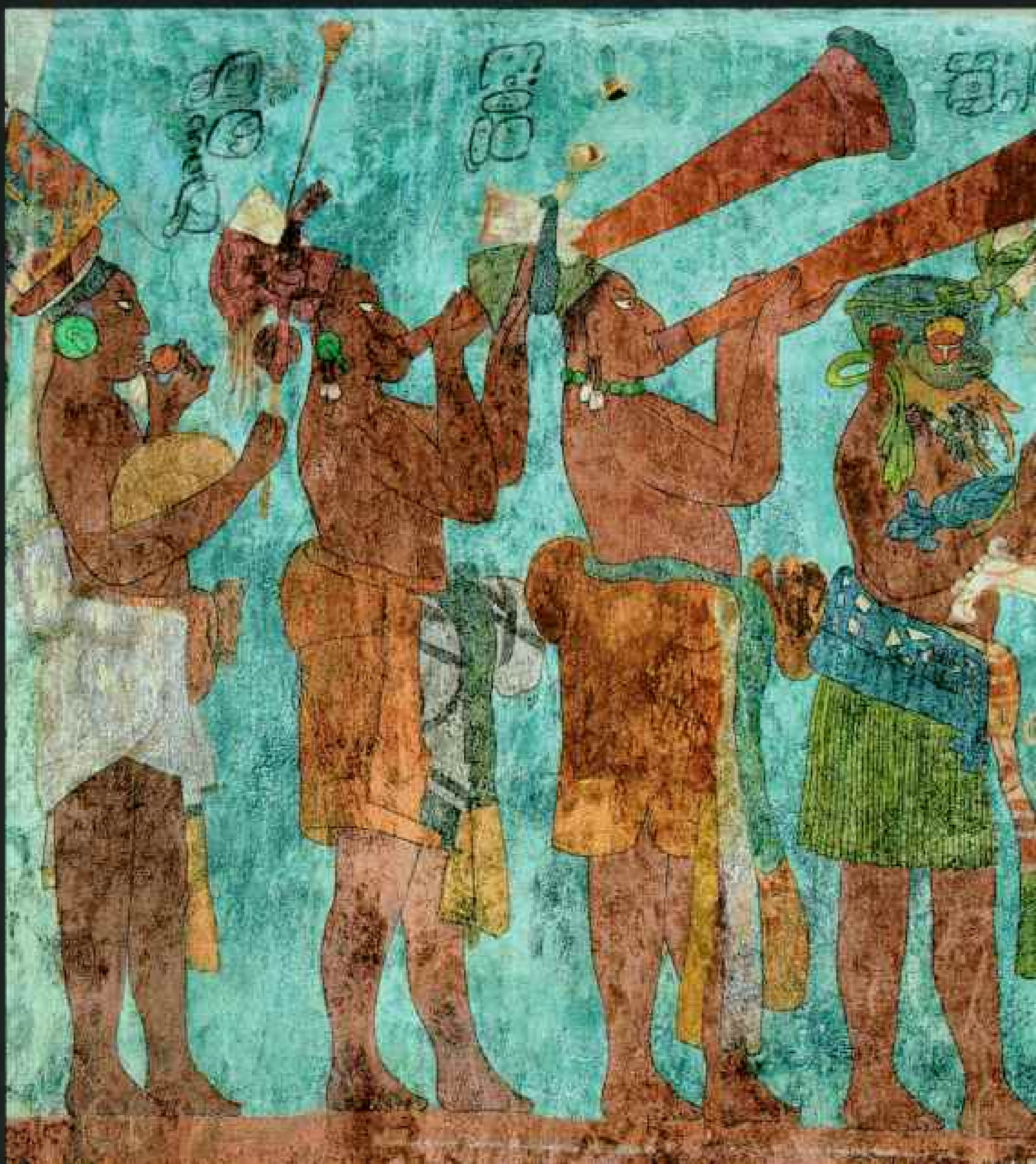
Because our reconstructions are based largely on photographs, they capture without alteration the murals' original hues, mottled flesh, distinctive style, and even mistakes (some individuals have transparent fingers or two left hands). We included only what we saw. And what we saw was magnificent.

Room One

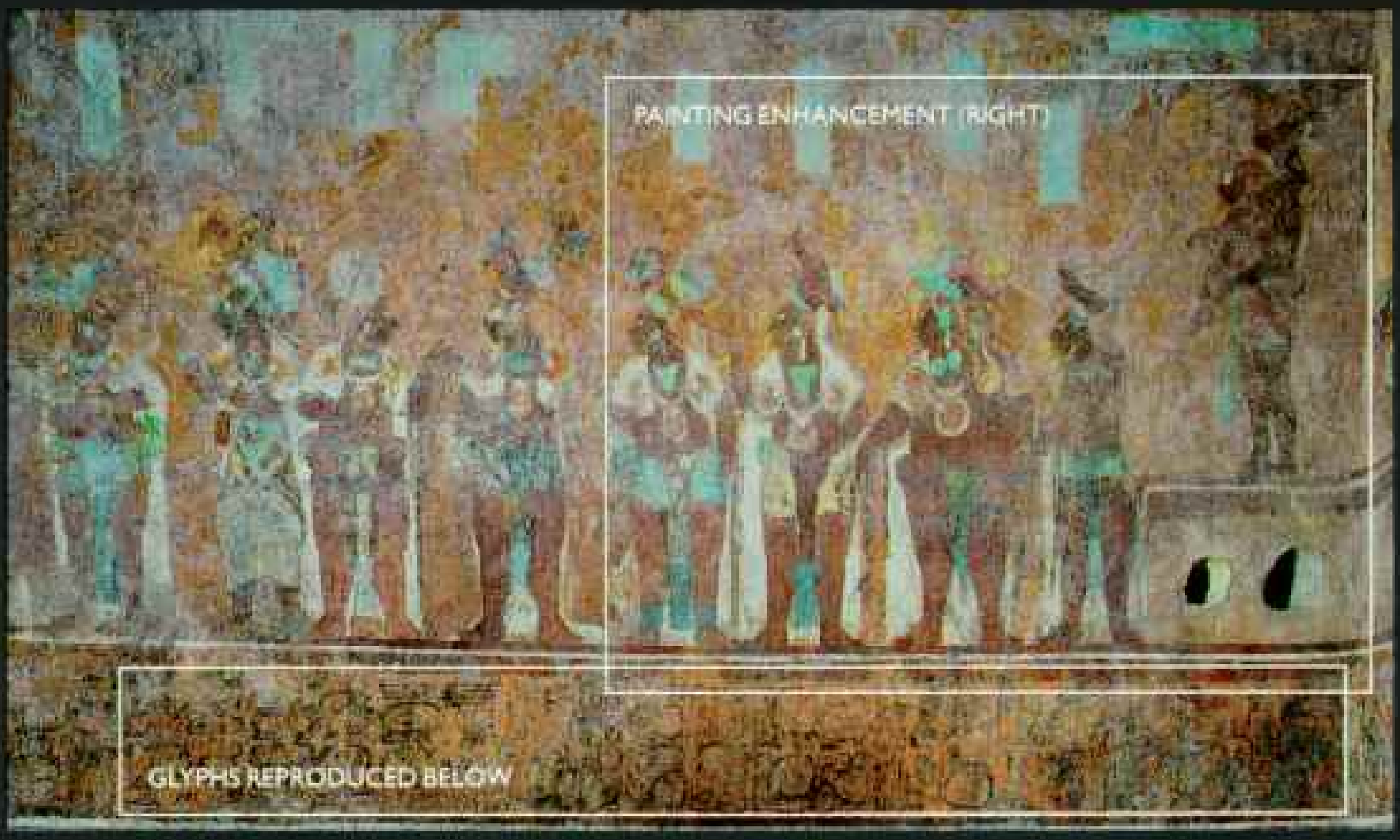
Duet of music and magic

Parading along an eight-foot wall, this raucous celebration for a new heir has become Bonampak's most cherished scene. In no other Maya art do costumes of such fantastic creatures exist. Victims of their own beauty, they drew the fascination of early tourists, who splashed kerosene on this wall to turn its calcite coating translucent, allowing clearer snapshots. Those frequent kerosene baths may explain the purplish tinge visible in Ferorelli's photograph (right).

Our reconstruction enlivens the fierce caiman (A), flailing crayfish (B), and graceful carp (C)—river dwellers that signify life-giving water. A green ear of maize (D)—sacred to the Maya—suggests earthly renewal. Among our most exciting finds are a plump cushion (E), the caiman's beard, and the zesty puff of trumpeters' cheeks.




A
B
C
D
E



STEPHEN HOUSTON

Room One

Making an heir apparent

Darting eyes, cocked wrists, and the near-audible shuffle of sandaled feet lend palpable excitement to Room One, where wealthy lords await Bonampak's tiny heir. Precious spondylus shells—bloodred at their core—adorn each robe. Jade pendants dangle. Fantastic headdresses cap proud faces. With distinct features and heft, these are portraits of honored nobles. Yet their names—which should appear in the blue boxes above them—were never painted.

Great care was lavished on the glyphic text under this scene. "Its portrayal of ritual activity is the richest ever seen in Maya art," says Stephen Houston, an epigrapher from Brigham Young University, who was able to decipher many glyphs by studying infrared images of the cleaned text. It describes rites—such as god impersonations and fire ceremonies—held in 790 and 791 both to honor Bonampak's heir and to dedicate the building that houses the murals. Four glyphs (beige tint above and left) reveal political ties in the region. They say the accession is being supervised by the holy lord of Yaxchilán—a city to the north that held sway over Bonampak. This lord is also described as the captor of Torch Macaw, a noble whose submission bestowed prestige.

Still intriguing is the heir himself, who hovers homely and ignored in this strange composition. His eye has been gouged out. I suspect this was an ancient act—a common form of ritual killing meant to symbolically rob power from artworks and those they portrayed.

Room Two

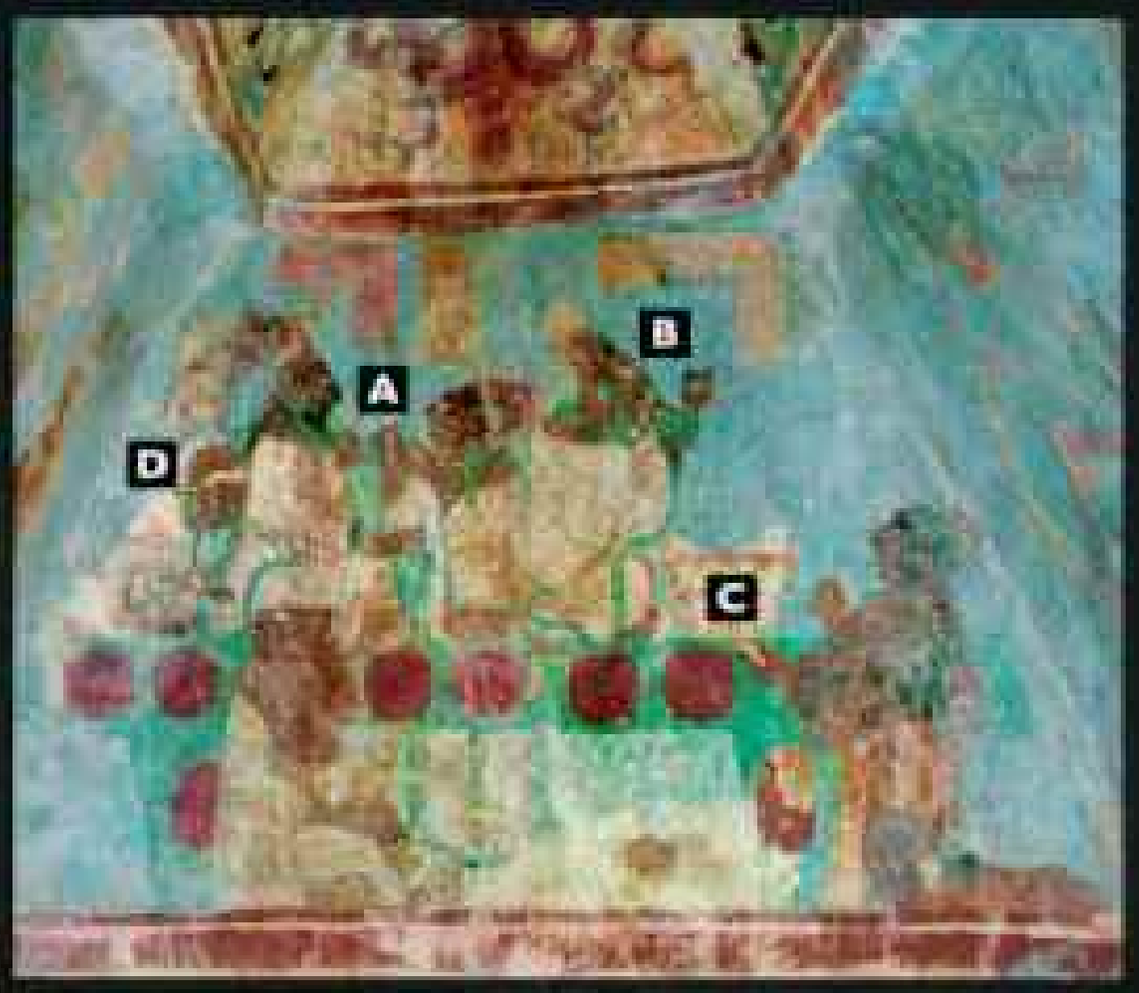
Agony frozen in time

Freed from its muted haze, a battle rages. Bonampak's ruler Chaan Muan (A) dominates this chaotic jungle raid—fought to capture victims for sacrifice and servitude. His jaguar-pelt jerkin symbolically imbues him with that cat's indomitable power. A gruesome trophy head—possibly the beaded skull of a defeated foe—dangles menacingly from his neck.

More compelling to me than Chaan Muan's force is his enemy's fall. Severely obscured by calcite, this vanquished character (B) had never been copied correctly. Now we can finally see how his legs fly and his spear snaps as he is flung down. Completing his humiliation, he is shown stripped of his finery, with his hair firmly gripped by Chaan Muan—a Maya sign of defeat.

Reconstruction is helping us untangle the jumble of torsos tumbling from the scene. We spotted Chaan Muan's intriguing mask (C), hinted at, as was common in Maya art, by a thin outline. And in the text, Stephen Houston discovered the emblem for the city of Lacanhá (beige tint at right)—a political superior and ally to Bonampak in the battle. But because patches of concrete—applied long ago where paint had crumbled—still cover parts of this mural, some fragments are forever lost.

STEPHEN HOUSTON



Room Three

Of blood and human bondage

The calm dignity of these voluptuous Maya women belies their grisly task: At the royal throne, attended by a kneeling courtier, they prepare to pierce their tongues in a sacred bloodletting ritual.

Blood was the mortar of Maya life, spilled to honor the gods, communicate with ancestors, and seal events such as victory in battle or an heir's accession. "Royals were intermediaries between the divine and the human plane," says Karl Taube, an expert on Mesoamerican iconography. "Bloodletting was an honor and responsibility they were proud of."

Pride had its obvious price. The Maya used thorns, flints, or stingray spines to impale their tongues or genitals; some pulled a cord through the wounds. We can now see in painful detail that two of the women hold such a cord (A). A third woman (B)—who I suspect is Lady Rabbit, Chaan Muan's wife—will prick her tongue and let drops fall on paper in the clay pot before her (C). The paper will be burned, sending blood-tinged smoke to conjure the gods.

Human tenderness softens this scene. Looking down, a girl (D) hands a spine to a woman holding a child. I believe this child is the new heir, who spreads his fingers as if in preparation for his first bloodletting. It seems fitting that this poignant rite of passage—the final chapter of Bonampak—is now restored. □

More Than a Dream
VENICE

Keeper of the hours, Alberto Peratoner refurbishes the figurines of the Clock Tower in the Piazza San Marco, which has tolled the rise and fall of Venice through five centuries. Flamboyant, radiantly beautiful, Venice owes her grandeur to the sea, a bond celebrated yearly through regattas such as the Vogalonga (overleaf). Today it is a human tide that washes over her—millions come to capture a glimmer of her charms. "Somehow," says Peratoner, "the soul of this city keeps shining through."

By ERLA ZWINGLE
ASSISTANT EDITOR

Photographs by SAM ABELL
NATIONAL GEOGRAPHIC PHOTOGRAPHER

Panache goes on parade during Venice's Carnival. Today's pageantry lasts only ten

days—a shadow of the two-month-long bacchanals of the 1700s.

ENRICO MINGARDI spent a good part of the morning with me explaining his ideas on how to improve the water-bus service in Venice. Being the chairman of the ACTV, the public transportation company, he discovered that some of his ideas weren't very popular. But he did think it would be easy enough to change the timetable on one line.

Almost immediately, he told me, a petition was delivered from people who liked it better the old way. "They collected 750 signatures against the change," he recalled, "so I said OK, I'll put it back." He put it back. Another petition arrived. This one carried 1,500 names of outraged residents protesting the reversion; they had liked it better the new way.

"Were some of the names the same?" I asked, joking.

He shrugged. "Sure," he replied.

Venice. The mere name summons associations from its astonishing 1,500 years, an incomparable legacy of art, politics, and commerce. Ten million visitors a year arrive to marvel at the remains of its glory, the architecture and paintings, and to be seduced by the dreamlike allure of a place that seems to exist somehow apart from real life, a kind of baroque elegy adrift in its lagoon, floating in mist and shadow, entranced by the ceaseless murmur of the water as it never tires of kissing the stones.

But Venice is not a dream. In these days it is facing more than its share of reality. In fact, as the episode of the bus petitions demonstrated yet again, Venice at heart is a classic small town, trapped in the body of a monument.

TO BEGIN WITH, Venice actually *is* small. The sweep of the vistas across the Venetian Lagoon, the immense, moody arc of the sky, the grandiose facades all give the illusion of amplitude; it comes as a shock to learn that Venice, dense as a diamond, covers a mere three square miles. You could walk from one end to the other in an hour. And you will walk, because the streets are usually the size of an average sidewalk, or less. Walking, as much as the surrounding water, dictates the shape of Venetian life: the reasonable pace, the sudden street-corner encounters with friends, the pause to talk. Among the many things the Venetians love about their town—no cars, virtually no crime—this intimacy is the best. They like to say their city is like a living room.

Is Venice still sinking? This is the question everybody outside Venice seems to ask. In a word, yes, though the rate has slowed, mainly because the pumping of groundwater for industries on the mainland has been stopped. The catastrophic flood of November 4, 1966, inundated parts of the city with as much as four feet of water for 24 hours. Since then, a tremendous international effort has been made to repair the palaces and churches, restore the works of art, and protect the surrounding lagoon from future tidal calamity.

But today a rising tide of troubles is more likely to swamp the city. A new sense of desperation seems to have taken hold. Businesses have moved out; the population has shrunk over the past 30 years from 138,000 to a mere 70,000; 1,500 people a year leave Venice, especially young families unwilling to cope with the cost of living, finding a good job and an affordable house or apartment. These are the unglamorous facts of life in any city, but in Venice they have been compounded by the political favoritism and corruption that have beset the rest of Italy.

Venetians can't get over the fact that while everyone seems to love their city, hardly anyone seems to care about them. Randolph Guthrie is president of an American committee called Save Venice, which raises some $500,000 a year to restore the buildings and works of art. But, he admits, "There's no point in preserving the artifacts if the city itself can't survive."

Venice's fate is also tied to a city just across the bridge that no one ever hears of: Mestre. Since 1926 the political entity called Venice has included Mestre, which with about 180,000 people is more than twice the size of island-Venice. As a city planner put it bluntly to me, "Venice is not a city, it's a small village. *Mestre* is a city." Thus the mayor of Venice is responsible for two virtually opposite towns, each inevitably convinced that he secretly favors the other.

As in any small town, Venetians can be conservative, self-absorbed, addicted to gossip, obsessed by minutiae, full of opinions, and amazingly quick to note the speck in their brother's eye. They are also kind, curious, and generous. Most of them have known one another from birth. They are also essentially island people, living offshore in their own self-contained universe. "I don't like going to the

mainland," one elderly gondolier told me, with a flourish. "When I need mountain air, I go to the top of the Accademia Bridge." The Venetians even speak their own language, a sibilant tongue from which most of the consonants have long since been worn away. I suspect they may like the notion of being difficult to understand; in any case, it may be one of the few ways they can sustain at least the illusion of privacy in what must be one of the world's most public cities.

"The Venetian really closes himself in," said Ninalee Craig, once married to a Venetian count. "But there are eyes everywhere in Venice. If I left the palazzo to go to the Piazza San Marco, by the time I got there, two cousins and three nieces would know what color hat I was wearing."

Today the sadness and anxiety of the Venetians have become something more complex than you could account for by listing the problems. It is a sensation deeply involved with their own lost grandeur, the echo of the centuries when Venice was an independent city-state, ruler of the eastern Mediterranean, providing ships and funds to crusaders' armies, and deviser of a form of government so tolerant and stable for its day that the framers of the United States Constitution studied it. Venice fell to Napoleon in 1797; then came an Austrian army, then annexation to Italy. Some remnant of anguish remains, a synthesis of longing and fatalism. And there is that unfathomable beauty.

"Venice is a place that overwhelms you," Clarenza Catullo said frankly as we sat at dinner one winter evening. She is a senior assistant at a museum; her Venetian parents moved to the mainland, but she moved back. "Every time I leave Venice, I have not only psychological pain but physical pain too. Deep pain. It's stupid; I can't explain it. When you're away, you feel that something is lost. Because here people are different, relationships are different, houses are different, *everything* is different. When I see the lagoon from the airplane, I thank God that I'm back."

DAWN IN VENICE. The water awakens first. Along the smaller canals there is a tentative rippling. The air is chilly with three kinds of coolness: from the darkness, the stones, and the damp. Beneath a translucent violet sky the Grand Canal is empty, except for the faithful Number 1 water-bus, the local, progressing along the litany of the stops (S. Silvestro, S. Angelo, S. Tomà, pray for us . . .) toward the more open water of the Basin of San Marco and beyond it to the slender barrier island called the Lido. Although the streets are still deserted as the water-bus pulls up to the floating bus stop, I am surprised to see so many passengers, people already going to or from work. To the east a dull, orange sun, so huge and flat it seemed cut from paper, began to lift itself slowly above the pinnacles, domes, and towers. Above the tangled finials of the Basilica of San Marco, it paused. The water made little clapping sounds.

In the dawn light, joggers appear along the wider pavements at the water's edge. At a corner of the Campo San Vio, the rich smell of bread pours from the bakery into the street. At 6:00, up in the farther reaches of the quarter called Cannaregio, Andrea Cerini, a former professional soccer player, is opening up his newsstand. Men on their way to work will begin to buy copies of *Il Gazzettino*, one of two local papers dependably full of cranky letters to the editor, the latest in the operatic political wrangles over every aspect of city life, and a steady supply of obituaries in this aging town (the average age is 46, the highest in Italy). Later, students on their way to the nearby school of *(Continued on page 82)*

A millennium of glory rests upon Venice as a benediction and a burden. "When I went to Venice," wrote Marcel Proust, "my dream became my 'address.'" But for too long the splendor of this incomparable, ethereal city has masked the increasing pressures of modern life. Now, the Venetians must awaken from their own dream of themselves.

Mirrored in troubling waters, the Basilica of San Marco floats over the central square, Venice's lowest point. High waters are a recurring fact of life in the city, which has sunk five inches during the past century even as the sea has risen four. Venice is still sinking, albeit more slowly.

Ponte della Libertà

Austrian occupiers erected a rail bridge to the Italian coast in the 1840s, ending Venice's isolation. Having lost its seagoing empire, the city became tethered to the mainland economy.

The ailing lagoon

The pearl of Venice is couched in a delicate liquid shell—an ancient lagoon flushed by tides. Pollution from fertilizer and factory waste is now being cleaned up.

San Secondo

To Mestre

PONTE DELLA LIBERTÀ

Tronchetto

Santa Lucia Railroad Station

CANNAREGIO

Community of Betania

Grand Canal

Rialto market

SAN POLO

SANTA CROCE

San Silvestro

San Pantalon

Ca' Rezzonico

DORSODURO

Maritime Station

Basin of San Marco

Giudecca Canal

La Giudecca

La Grazia

Church

0 1/4 MILES

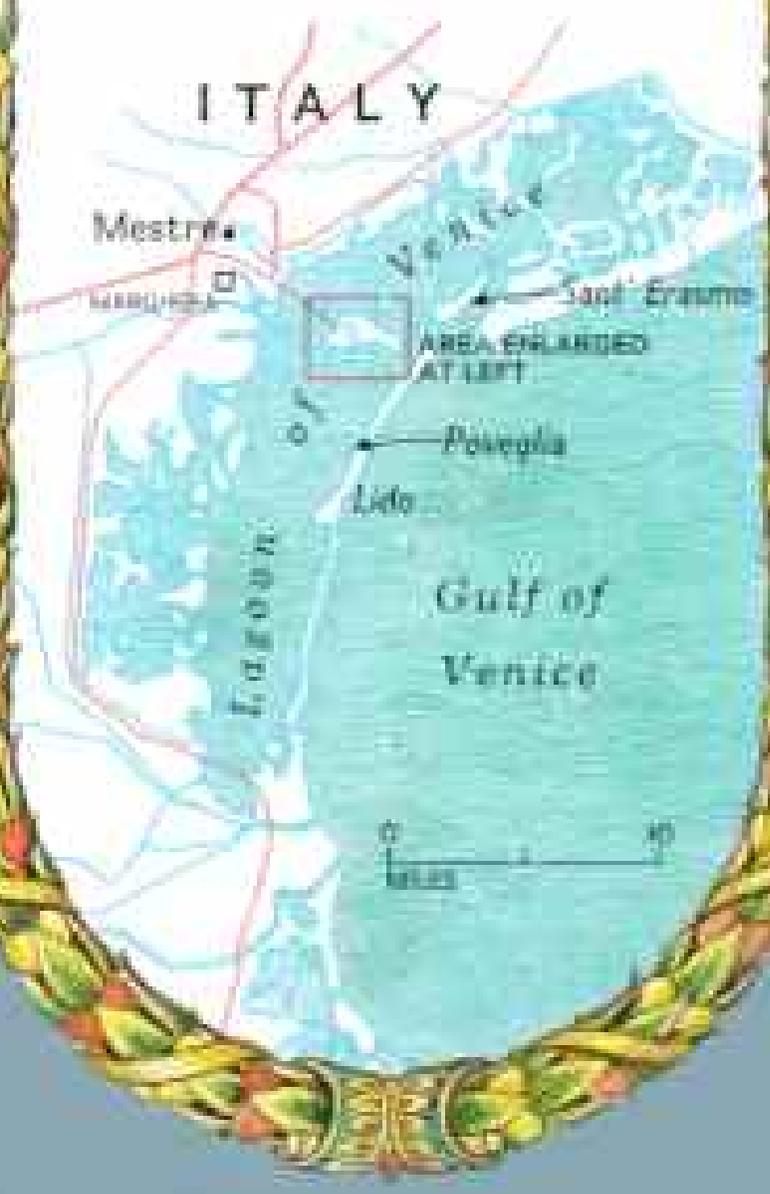
MILE CARTOGRAPHIC DIVISION

PAINTING BY KINUKO Y. CRAFT

BASE DATA: TOURING CLUB ITALIANO

Venice

Built on wooden pilings sunk in the ooze of a backwater lagoon, Venice rose over a millennium to become a city-state of dazzling power. By the 15th century she was the envy of Europe—her markets overflowing with Asian silks, her workshops the source of the world's finest glassware, and her government so stable that she was dubbed the Most Serene Republic. New trade routes to the Orient eventually sapped her monopolies. When Napoleon seized Venice in 1797, the Queen of the Adriatic had already become a faded dowager haunted by gilded memories.



Murano

Venice moved its fabled glassworks to Murano in 1291 as a fire-prevention measure — but also to hide manufacturing secrets from foreign eyes.

San Michele

On San Michele, a cemetery for Venetians since the early 19th century, limited space means temporary burial. Most bodies are moved elsewhere after 10 to 12 years.

City of islands

Venice administers dozens of islands, some uninhabited and dotted with ruins. Cash-strapped officials have put 13 up for rent, hoping private tenants will finance renovations.

(Continued from page 77) nursing will stop in for candy, cigarettes, ballpoint pens. Even later, housewives will come for stamps, lottery tickets, water-bus tickets.

By 7:30 the canals have begun to rumble with the workaday barges. They move heavily, unfurling heavy waves, usually with a dog at the prow as self-appointed guard, lookout, and alarm system. The barges are loaded with anything: bags of cement powder, towering stacks of clean hotel laundry, mounds of luggage, crates of bottled mineral water. At the Rialto market, just beyond the famous bridge, Luigi Smerghetto has just finished loading his barge with the day's orders of produce and is about to begin his rounds. Paola Cristel, my interpreter, and I climb aboard.

The Grand Canal looks remarkably less grand viewed above piles of cauliflower, oranges, and broccoli. There are transport companies, but Luigi is independent. He lives on the nearby island of Sant' Erasmo and is up every morning at 4:00, sometimes not getting home again till past 8:00 at night. He's been doing this for 20 years.

We cross the wide Giudecca Canal toward the island cluster called La Giudecca and head for #517, Amerigo Avezzu's shop. Here Luigi unloads the daily standing order of leeks, celery, oranges, tomatoes, bananas, eggplant, and a huge bag of California walnuts. We proceed to the canteen for the power company, leaving cartons of fennel and bags of potatoes destined to form part of the day's 400 lunches. Then we tie up at the water entry to the Passageway of the Grapes, and Francesco Sambuco arrives with a helper to carry the produce to his stand in the nearby square.

The Venetians say that their city is expensive because everything has to arrive by boat. It sounds logical, but Amadeo Rumor, president of a small transportation company at the Rialto market, disputes this. It's not that boat transport is inherently more costly, he says, but that the price of goods and labor is high. Because there isn't enough space in the city for large warehouses, cargoes have to be smaller and are therefore more costly. And to move any item from the boat to its destination requires people, usually pushing some variety of wheelbarrow. The narrow streets and bridges dictate a boutique approach to commerce, and until there is no more water, this will undoubtedly be the case.

Venetians don't worry about the water the way outsiders do. They're used to high water; although it can occur as often as 40 times a year, usually between November and May, it doesn't necessarily rise very high, and in any case it doesn't stay more than a few hours.

Car-free and built to human scale, Venice cocoons its inhabitants. Baker Stefano Secco (above left) balances work and leisure on alleyway deliveries. High tide, meanwhile, puts the squeeze on barges.

Slithering, sucking, sloshing through the silvery fog in winter, the aquamarine radiance of spring, the brilliance of noon in summer, when the tops of the waves seem to be scattered with blinding chips of glittering mica, the water is never silent. Venetians even call the mainland *terra ferma*, as if their own city

were somehow less than solid. The floating bus-stop platforms creak and sway, the pavements undulate. The entire city seems suspended in a liquid medium: You not only hear the water, you feel it. In the winter the damp, chill fog seeps into your skin; in the summer the air can be soggy and heavy.

To the inevitable question, Francesco Bandarin replies, "Venice will always sink." Bandarin has been working with a group called the Consorzio Venezia Nuova (New Venice Consortium) to restore the lagoon. "Venice wasn't built very high, and the city is built on sand, silt, and hard clay, which tend to compact. It's not much each year, but over history this natural sinking alone comes to 30 inches. Then when they pumped out the groundwater on the mainland, the entire area sank almost another five inches.

"I don't think there's much you can do," he concludes matter-of-factly. "You can't lower the sea or raise the city."

But memories linger of the disastrous flood of 1966. Because that flood was the result of an unprecedented combination of circumstances, the likelihood of another is small. Yet there was an irresistible urge to try to do something to control the tide. The result: A vast floodgate project informally called Operation Moses.

A series of empty metal caissons would be submerged at the three entrances to the lagoon; with the arrival of an unusually high tide, the caissons would be filled with air to float up and form a barrier against the incoming water. But ten years have passed since the project was begun. Now public enthusiasm has waned; money is short. The prototype is parked beside the Arsenal, waiting for more funds to be approved.

Happily, scores of more humble projects well under way in the lagoon are already benefiting Venice. The consortium is restoring tidal marshes, reclaiming shoreline, and building jetties on the string of barrier islands to prevent beach erosion. It also monitors polluting runoff from the 720-square-mile drainage basin that empties into the lagoon, especially the agricultural chemicals that for years have been feeding floating mats of voracious algae. It hopes, perhaps ten years from now, to have brought pollution under better control. For the moment it simply controls the algae, sending out a flotilla of machines to rip it out.

The worst offenders along the shoreline, primarily the petrochemical plants in Porto Marghera, have either adopted more stringent controls on effluents or closed. "In the late eighties we reduced the toxic pollution to one-fifth," Alberto Bernstein, the consortium's environmental planner, told me. But the public seems ever ready to believe the worst. "You may have clear water that is toxic and green, muddy water that is not," he says. "The mayor says he used to be able to swim in

Cruising where galleys once off-loaded the riches of a merchant empire, a luxury liner carries a commodity galling to many Venetians: tourists. "We live here," pleads a native. "Tourists think Venice is only a facade and we're just characters in a play."

the lagoon when he was little, but it was much more dangerous then than it is now."

Actually low tide is as much of a problem as high tide. Because of political wrangling over how to spend certain allotments of money, the canals have not been dredged for 30 years. Consequently some canals have silted up to the point where they are dry at low tide, a serious problem for ambulances and fireboats. Finally, though, money and a reasonable plan for using it are both in hand, and dredging began last fall. The engineers thought it best to wait till then; they weren't sure the tourists could stand it.

MIDDAY IN VENICE. On a springtime Saturday the flood of tourists is rising. I had heard Venetians complaining, but it wasn't until now that I could see what they meant. I was hurrying to an appointment not far from the Piazza San Marco, which is where every tourist eventually heads, and it was clear I wasn't going to make it. The streets were completely filled with sluggish streams of people shuffling along, looking in shopwindows, peering around, stopping suddenly to grapple with their maps. It was maddening. I couldn't understand why they had to take up every inch of space, oblivious to everyone else. I asked them to excuse me, and I began to push.

Tourists are at the core of most debates about the future of life in Venice. The Venetians know they need tourists in order to survive but can't figure out how to reduce their impact, how to make coping with them every day somehow less of a struggle. Apart from the inconvenience, their constant presence represents a kind of silent battle for emotional ownership. And the commercial diversity of the city has shrunk drastically over the years; though the port and the glass furnaces are still active, beleaguered artisans and small shopkeepers struggle to prosper as taxes consume up to half of their gross. Everyone senses a danger for the city in depending almost completely on tourists for survival.

"We have 50,000 visitors between 8 a.m. and 8 p.m.," said Silvio Testa, a political reporter for *Il Gazzettino*. "I think the main point is that in Venice there should be a new class formed by businessmen working to revitalize Venice but not bound only to tourism. To give back to Venice the character of a complete city."

Dousing flames—and dealing with stranded cats, sinking boats, and bees' nests in attics—Venice's firemen motor down the Grand Canal. "The fireman should be a bread-and-salami person," notes a brigade member, "very friendly, not formal at all."

The irony is sharp. The power of Venice was largely based on commerce; rice, coffee, sugar, spices found their way to Europe through Venetian hands. Even without considering Marco Polo, a random look at just a few street names reveals the city's former strength: the Street of the Spice Dealer, of the Almond Dealer, of Beans, Wine, Oil, Iron Pots, Oysters, the Gondola Yard; inevitably, the Street of Lawyers and, my own favorite as a sort of subcontractor, the Street of the Assassins. The stupendous palaces and churches were the outward and visible sign of the almost inconceivable wealth of these businessmen, yet it is the allure of these palaces and churches that now provides the city's only economic muscle. In a way, the Venetians have become victims of the very beauty that sustains them; no one asks or expects more of the city than just to be there. "The problem is that Venice is beautiful," Mara Vittori, a young Venetian, told me. "That's all."

Two critical events showed the pressure at its worst. On "black Sunday," May 3, 1987, some 150,000 tourists arrived in the city; it was one of several days that spring when the police had to be called out to deal with the crush. Then, on July 15, 1989, the rock band Pink Floyd gave a concert from a raft tied up near the Piazza San Marco. Hordes of fans—reportedly 200,000—overwhelmed the city, leaving mountains of trash. The breakdown seemed complete when one young man was videotaped urinating against the doors of the basilica. "I understand that tourism is a big resource and that we earn a lot of money without doing anything," said a retired Venetian businessman. "But there will be a point at which it won't work anymore."

To be fair, it doesn't appear that many Venetians do much to resist or reduce the general sense of degradation. To stand on the crest of the Rialto Bridge, for instance, admiring the elegant sweep of the Grand Canal, is almost inevitably to hear the approaching gondola bearing an accordion player and a tenor bellowing "Santa Lucia" or " 'O Sole Mio!," which are songs from Naples. (One especially horrifying day the tenor switched to singing "My Way.") When you ask the gondoliers why you hear these songs so often, and not Venetian ones, the answer is a bland "People ask for them."

Gianfranco Mossetto is one of several people I met who are trying to come up with new ideas on how to improve the situation.

Young, energetic, and a professor of economics, he is the new deputy mayor for culture, tourism, and museums. He has even published a book with the intriguing title *The Economics of Art Cities*.

"Economically speaking, there is a difference between a useful good and a beautiful one," he told me eagerly. His office is on the Piazza San Marco, and his windows look straight into the face of the basilica. As he spoke, I watched the sinking sun set the angels' wings on fire and strike sparks of gold from the mosaics. I wasn't sure why beauty could not also be useful. But this was exactly his point.

The crux of the problem is how to preserve the artistic heritage while accommodating the hordes who come to admire it. "If you have 120,000 people in a town like Venice, as we did last Saturday, you run the risk of having the good destroyed," Mossetto said. "You can't afford it." His solution: Ration access to the city. This could mean either selling tickets to

Under a doleful sky, mourners carry wreaths for a fisherman killed in a boating accident. Venice faces a less dramatic end; the population grays as the young flee a high cost of living. "Many parishioners are old and alone," says neighborhood priest Ferruccio Gavagnin.

limit the total number of people allowed into the city or organizing itineraries so they don't all arrive at San Marco by the same route at the same time. The theory makes sense, but many Venetians aren't convinced.

"Mossetto's not Venetian, and he's very rational," said one young professional woman. "My friends think his ideas are a bit too strict. It's not democratic. This isn't Russia."

I SUPPOSE every activity could eventually be traced to tourism, but there is a sturdy, workaday Venice devoted primarily to itself (in fact, 40,000 people commute into Venice to work every day). The street sweepers and trash collectors throwing piles of plastic bags of garbage into the hydraulic maw of a waiting barge; the neighborhood barber, through whose shopwindow I glimpsed a serious little boy perched high in the chair, watching his haircut as if it were happening on television; architects drawing plans for somebody's new kitchen or extra bathroom. Dry cleaners, bus drivers, grave diggers, bank tellers.

Meanwhile, somewhere in or around the church of San Pantalon, Don Ferruccio Gavagnin is also hard at work. He is always working: He's the priest of what is technically the smallest parish in Venice, but his congregation won't stay small. "The other priests are a little bit jealous," he says. "But I can't refuse people. If they need help, they know they can find me."

Don Ferruccio has been at San Pantalon for the past 26 of his 41 years as a priest. He's balding, compact, and his keen, kind eyes

Adrift in bliss, Venetian newlyweds ride a gondola down the Grand Canal. In a city with 42 boating associations, rowing is serious business. "You should see no visible effort," says an aficionado, "just beautiful movement."

framed by steel-rimmed glasses miss nothing. He has a tendency to bustle, and a let's-get-on-with-it way of talking. He's up at 5:00 to pray, do paperwork, and look after his 93-year-old mother, who lives with him in the small house attached to the church. At 7:00 he opens the church, and eventually, being a shepherd, he heads out to check on his flock.

In and out of shops and cafés, a quick cup of coffee, a quick word, a smile, a wave—into the butcher shop, into the optician's shop, into the firemen's headquarters (he's their parish priest). We stride down the street past the church of San Silvestro—"The ugliest church in Venice"—we pause in the church of the Carmini, where he speaks with one of the friars about the bishop's impending visit. I notice that the friar smiles at him with particular coolness—the interparish rivalry continues.

There's always too much to do. Catechism classes, visiting the sick in four different hospitals, planning a funeral or a wedding. "Yesterday was a hard day, and at the end of the day I received two young people who asked me to marry them. They met at a hospital—they both had an eye disease. I told the boy 'You probably didn't see her properly.' "

I can't lure Don Ferruccio into a long conversation; he has no time, and less inclination. Favorite Bible story? He twinkles at me; not a chance. Besides, "I don't believe in words," he tells me briskly. "I believe in fact. Words are not important."

There is a long, slender crack in the austere, dark-brick facade of the church of San Pantalon. Don Ferruccio says it's always been there; a surveyor recently reported that it might, or might not, get worse over time. As long as Don Ferruccio is there, I don't think it would dare get worse.

EVENING IN VENICE. The twilight sky gleams with opal and silver, the mainland succumbs to the mist. The dancing water in the lagoon glows with the light it has been gathering all day. The Venetians begin to turn homeward. It is a domestic moment of the day in what at heart is a deeply domestic city. By 9:00 the shutters will be closed, dinner will almost be finished, the televisions will begin to come on. They are at home.

But homes are one of the biggest problems in Venice. Any discussion of the city's prospects ends up with housing. The basic difficulty is an exotic tangle of laws that, in one way or the other, work against both the owners and the tenants.

The price of housing is just as problematic. With 23,000 students attending the two universities and several smaller institutions, rents keep rising. If an owner can charge six

"It is like being on a boat," says Count Brandino Brandolini (in white shirt) of his secluded rooftop terrace—a Venetian amenity devised to add sunlit space to cramped houses. Such rafts of privacy also float atop humbler abodes across the city.

students the equivalent of $400 each every month, he's not likely to offer the space to a Venetian for less. There's something about Venetians cutting one another out of their own city in this way that especially stings.

But worst of all are the empty houses. Over the years many foreigners—Americans, Japanese, French, even wealthy Italians—have bought houses in Venice. They restore them, which is good, but they use them mainly for vacation.

"On the street where I live, there remain only three Venetian families," one Venetian man told me. "Most of the other houses have been bought by strangers. They just come to stay for 15 days each year. The top floor of the palace facing my house has been bought by Fiat heiress Susanna Agnelli, and she comes to Venice maybe two or three days a year. It would have been better if it had been sold to people living in Venice—even if very wealthy people, but *living* here."

Venetians know the houses in the same intimate way they know one another.

"Do you see that little yellow house?" Sandro Gaggiato, an art dealer, asked me as he rowed me down the Grand Canal in his small boat toward the Rialto Bridge. I saw it, flanked by two impressive palaces that are undoubtedly in the guidebooks. "That's where my wife and I lived just after we were married. We had such a wonderful view. . . ."

"Do you see that red house?" I heard a man saying as I walked down a street near the Campo San Barnaba. "I was born there, behind the window with the balcony. I lived there till I was 22. My mother used to put tomatoes on the windowsill to ripen, and I would throw them at the gondoliers. . . ."

"I love this corner," Paola, my interpreter, suddenly said as we turned near the Campo Sant' Angelo. "That was our first house in Venice. I was nine. We lived on the top floor. I remember there was a cat on the roof next to ours, and she had babies. We used to throw her little pieces of meat. . . ."

Claudio Orazio, the new deputy mayor for housing, is working hard to help Venetians move back. He recognizes—as do most Venetians—that the big challenge is to encourage middle-class people to stay in Venice, till now the very class least likely to qualify for municipal help.

"Housing is the main reason people move out," Orazio explained. "There are enough habitable houses in Venice, so the main problem is the money."

New programs are already under way: low-cost loans to help homeowners make repairs and subsidies to young families trying to buy their first home. Orazio is also beginning to induce owners to be more willing to rent. "The point is to make them aware that solving the problem of housing is important for everybody," he said. "It's a problem of Venice."

THE PROBLEMS of Venice. On a golden spring afternoon, I wandered along the shore of Poveglia, a deserted island in the lagoon. To the northwest, on the hazy shoreline, were the metal towers and pinnacles of the industrial zone of Marghera, flaring with gas burn-off, a kind of infernal mirror image to the towers and pinnacles of Venice. It was difficult to judge which seemed more unreal. I wondered why Venice's problems had come to seem so overwhelming. I remembered an exchange between two young professional women.

"One good thing is that there are people willing to do things for Venice," Gilda had been saying. "They still believe in this town and Venetians, and they do everything they can to bring it alive again. But most of them aren't Venetians—they're foreigners."

"It's just because the Venetians are lazy," Giovanna retorted.

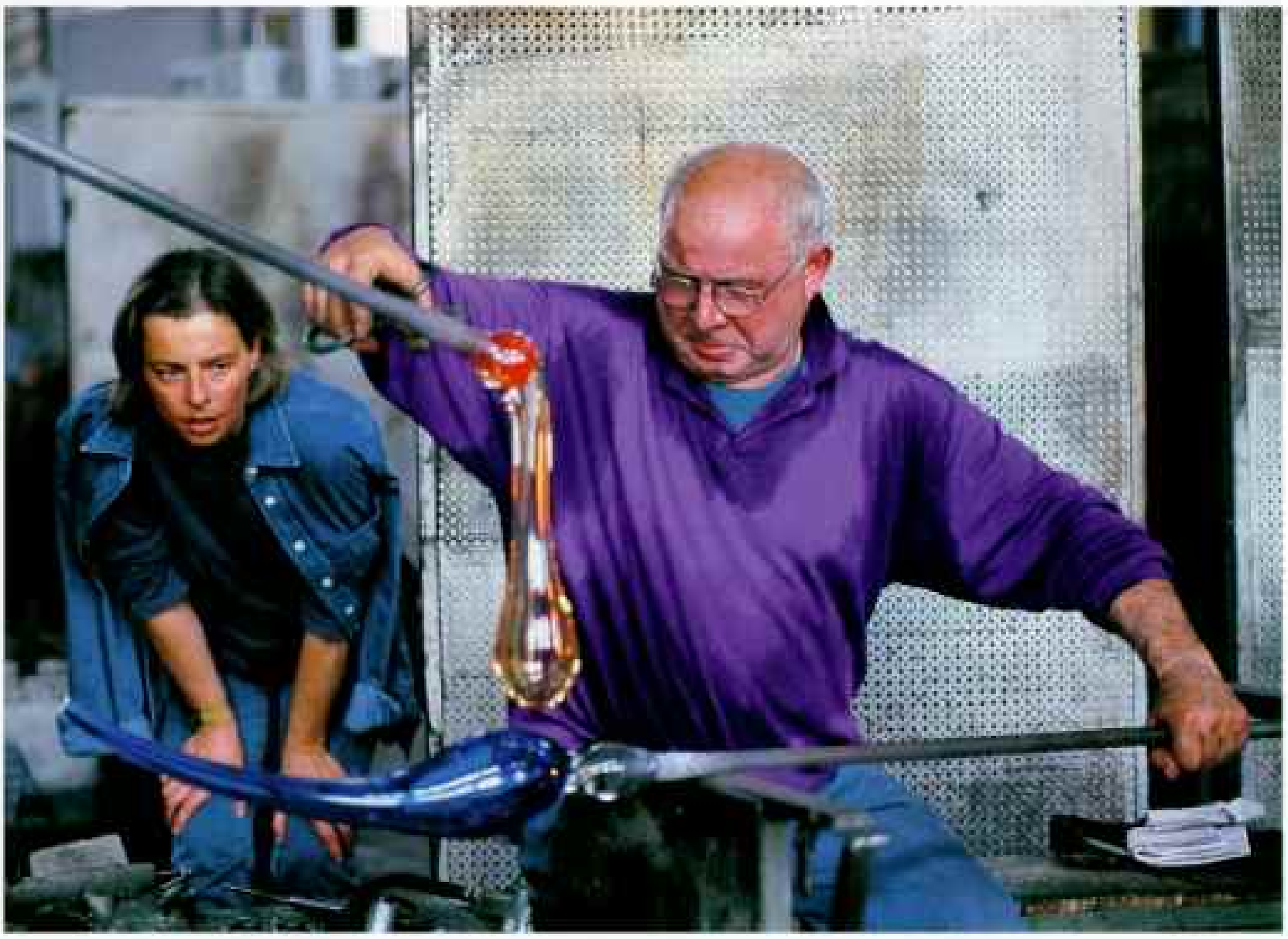
"Maybe they're used to belonging to a golden circle," Gilda mused. "They're used to having people do things for them."

"They just care for themselves, and that's it," Giovanna said firmly. "If you look at most Venetian houses, inside they're beautiful. They don't care about the facades, but everything is new inside. They don't care what people see outside. 'Why do I have to do it and not somebody else?' That's the question each Venetian is asking himself."

The Venetian outlook: My notes are littered with the things they say about themselves. "The Venetian will complain even if he doesn't need to," said Enrico Mingardi at the ACTV. "He has a lot of habits he doesn't want to change."

"These problems aren't so difficult to solve," said Giulio Zannier, an architect. "But everything you do in Venice, you find someone who says, 'No, we can't do it.' "

"They just live for the day, because they were merchants, living by chance with no way to plan," said a young woman who works as a



"It's alchemy," says artist Laura de Santillana of the fluid magic of glass. Working with maestros like Lino Tagliapietra, Venetian artisans keep the city's luminous glassmaking heritage alive.

tourist guide. "So they say, 'This is today—why worry about tomorrow?' "

The real problem, Deputy Mayor Mossetto believes, is that the town lacks a ruling class and has been at the mercy of a string of political opportunists. This is true. Yet some Venetians also acknowledge that there hasn't been any need, till now, to try to change. With the constant donations of money, the endless supply of tourists, and the years of political scavenging and manipulation, the Venetians have become passive, introverted. They recognize the problems but can't see how to get a grip on them. Yet their love for their city seems to grow at the same rate as their frustration. "The quality of life is very high here," Gilda said simply. "If you care about life."

NIGHT IN VENICE. The streets are silent, except for the sound of my heels as I walk slowly toward the Grand Canal. I pass through a tiny street smelling of jasmine and cat urine and am just crossing the Bridge of the Tree when I hear music: a woman singing to a piano accompaniment. I pause. Looking up, I see the slightly open shutters of a Gothic window; golden light slips out with the sweet, unaffected melody. A young couple stops, then a middle-aged blond woman in a red dress. Nobody speaks. We simply stand there together in the empty street, unable to leave.

For the first time that day I wasn't thinking about the problems. I was remembering some of the people who weren't waiting for someone else to come up with an idea. I thought again of the elderly gondolier; he'd said, "There is a hand that sustains Venice, an army of angels with chains of gold that keep it up." It had seemed extravagant at the time.

Near the Campo Santo Stefano is Giuliano Nalesso's classical music shop. Every day recorded music ripples into the Street of the Spice Dealer as a kind of benediction. Often it is pieces by the great Venetians, especially

Spectators chug in the wake of il palio—*a regatta pitting rowers from Venice against Genoa, Pisa, and Amalfi, Italy's other maritime republics. Despite strict speed limits, waves churned up by motorboats are eroding the foundations of Venice. "Every day we are destroying ourselves," laments one city dweller.*

Vivaldi, whose shimmering music seems to be the water itself transcribed for orchestra.

"Until eight years ago there wasn't a music shop in Venice," Nalesso told me as we sat in the courtyard among various pieces of Venetian sculpture. "I was a violin teacher in the conservatory, and the professors and students were forced to go outside. Venice, the center of the world of music in the 16th century! So I invented myself as a shopkeeper. It was an abandoned courtyard, and the shop used to be a potato warehouse."

Now he sells not only tapes and CDs but also books, instruments, and sheet music; he even prints music. But he is looking at more than business. "I want to speak about transformation," he said thoughtfully. "This very

place where we're sitting could show what Venice could be in the future. Restore the buildings and create cultural activities too."

It is because of Nalesso that live music also pours from the quartets playing at two cafés in the Piazza San Marco. "This city was born for music," he said. "So every corner should resound with music. And the attitude of the citizens should change. A new type of Venetian citizen should be created with a grand cultural conscience. We should be aware that every step is on holy pavement."

And the lost Venetians have been comforted today. On the northern edge of the city there is a shelter called Betania, where for ten years a gentle deacon named Tiziano Scatto has tended the homeless. Anyone who needs a good dinner can come here any night of the week; they can also have a shower, wash their clothes, be seen by a doctor or dentist, talk with a psychologist or a lawyer.

"The idea was not only to create a shelter," Tiziano explained as we sat in the tranquil upstairs kitchen with its high white walls, "but to create a testimony of the church in Venice. You have to love the poorest people, because through the love of your brother you can reach God." This is not the only organized shelter in Venice, but it may be the most personal. As surprised as I was to discover derelicts in Venice—50 to 60 people come to Betania every day, primarily men—it was even more remarkable to learn that as many as 400 Venetians volunteer to help them.

"We don't only try to assist people," Tiziano said in his quiet way, "but also, when we can, to restore them. In this way six years ago we opened a place where people could go and talk about themselves, in order to find out what was really the problem, or to help them find work.

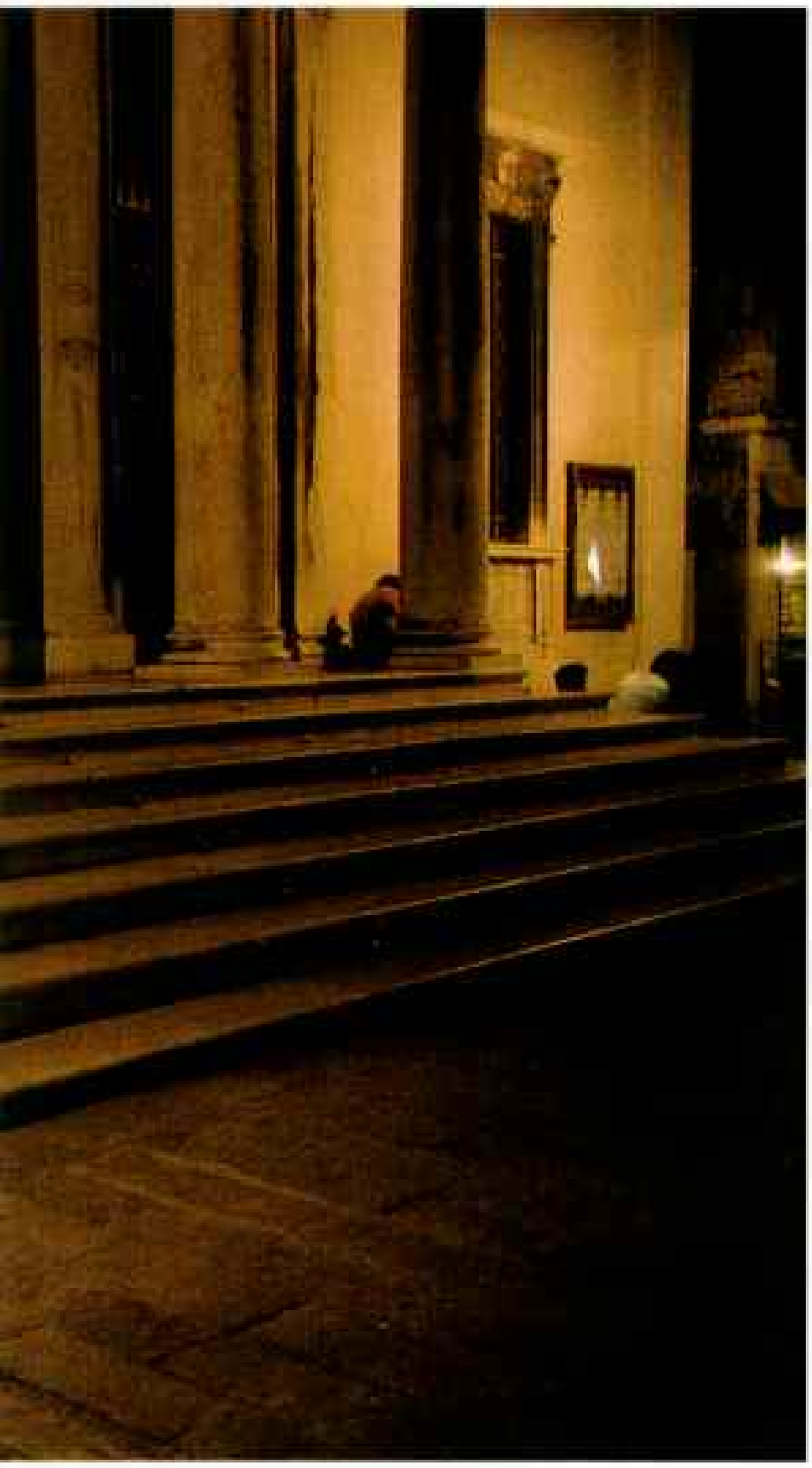
"And at the end we also provide the coffin when they die."

WHAT KIND OF FUTURE could there be for a city like this? Rinio Bruttomesso is the director of the International Centre Cities on Water and a professor of urban design. He thinks about this question in a large way.

"You can't always think about Venice; you must think about Mestre too," he told me one hot afternoon in late spring. We opened the windows over the canal, but *that tenor* kept drifting by below and we finally had to close them again. "We should think of Venice as a metropolitan area. Then we'd have some sort of way to choose activities for Venice that are better for its particular urban fabric.

"I think in the future the waterfront area will be a crucial spot for linking Venice and Mestre." He pointed on a map to the shoreline. "We've been studying how we can replan this area where the oil refineries are. In my opinion in ten to fifteen years these refineries will close. So this could be a very important area for Venice."

He is especially keen on establishing ashore a scientific and technological park, which could naturally draw on the two universities in Venice and the nearby University of Padua.



Intimate arias unfold on the steps of Teatro La Fenice, Venice's opera house. Trapped in the myth of her lustrous beauty, Venice beguiles, and remains elusive. "She is like a girlfriend who drives you crazy," sighs a bargeman. "She's the girl you couldn't leave if you tried."

I had heard others, including the new mayor, mention this idea. The talent is already there, and the benefits to the city would be many.

"A lot of people are realizing that we are arriving at a crucial moment for the future of Venice," Bruttomesso said frankly. "Will it become just a museum? The strange thing is, we realize it's a crucial moment and we *should* make a choice. But there's no will and no ability to create a consensus.

"I foresee the risky thing is that in 20 years, no decision will have been made. And on your next visit you'll find a city with 40,000 people, merchants, Carnival mask sellers, and this would be the end of Venice. It would be Disneyland, not Venice, even if we're very close to Disneyland now."

Disneyland. It's a word that is often spoken with a kind of horror, because the Venetians know that, as Giuliano Nalesso put it, "The real life of the city is in the normal things." They can't imagine living in a city in which, in fact, nothing is real anymore.

I walked to the top of the Accademia Bridge and gazed at the Grand Canal. The city was silent, except for the murmur of the water. It was as if, behind the veil of darkness, Venice was returning to her true self, a creature of the lagoon rising on the brimming water trying to join the stars. I often heard Venetians talk about the canals as the city's blood; they didn't see that they themselves were its blood. The city felt deserted, a suddenly terrible sensation. Venice without Venetians?

"We are still in time to save Venice," a friend had told me with conviction. "Anyone who loves Venice is a part of Venice. We can still save what we have."

Why should Venice be saved? I used to think the answer was obvious. But the answer has become more elusive, though no less compelling. I think the Venetians would simply say, because our children were born here and our parents are buried here. It's home.

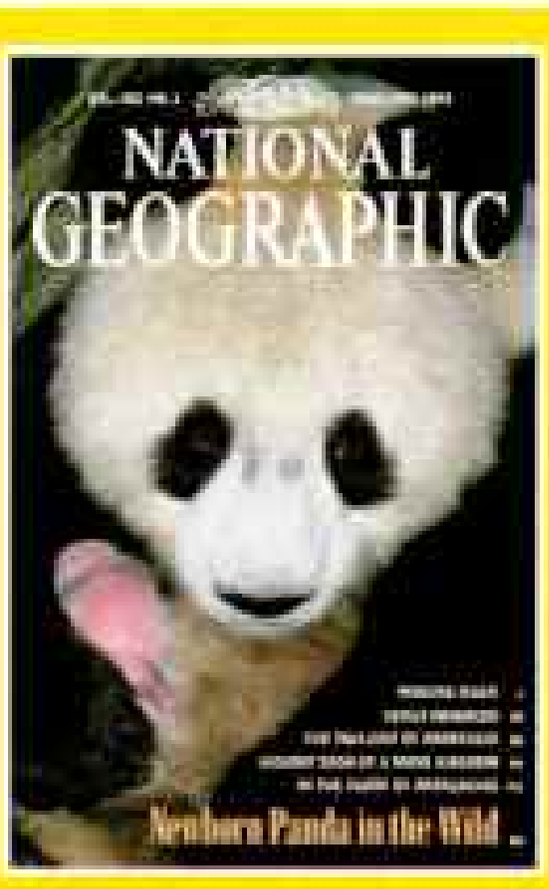
One darkening winter afternoon I was out on the lagoon having a rowing lesson. The shallow water was clear as glass and perfectly smooth except for small patches scuffed by the breeze. The pale sun set, and the distant skyline blurred, woven into the soft fibers of the gathering fog. We paused to simply float, and invisible wavelets made gentle stroking sounds against the boat. Then out of the darkness came the heavy, tolling note of the bell in the campanile of San Marco. It is the voice of Venice. The city had completely disappeared, yet the bell was surprisingly strong. At that moment it all seemed very sad. So why do I remember it with so much happiness? □

GROWING UP WILD

New Hope for China's

Yes, we still have Hope.

I first saw the little panda when she was about ten days old, snuggled like a furry pink mouse against her mother's chest—a scene featured in the February 1993 GEOGRAPHIC (below). My colleagues and I named her Xi Wang—Hope—a wish for her species' survival. Nine months later she had grown from a tiny, helpless infant into a robust 50-pound adolescent frolicking in an oak (right). Since her birth in August 1992 we have discovered other newborn pandas and watched as Xi Wang has grown up in her Qin Ling mountain home.



Mirroring her maturity, China's panda conservation strategy may finally be coming of age too. An ambitious official program is creating new panda sanctuaries and preserving existing habitat. In our own new reserve we have seen loggers relocated—solid evidence that the government means business.

Giant Pandas

By PAN WENSHI
BEIJING UNIVERSITY

To observe pandas so closely for so long without disturbing them—that's what has excited me about this project. As a zoologist with Beijing University, I have studied pandas in the Qin Ling area since 1984. But it was a special privilege to watch the relationship unfold between Xi Wang and her mother, Jiao Jiao—Double Charm.

Two months old and a chubby ten pounds

milk Xi Wang needs by feeding as much as 14 hours a day.

Jiao Jiao's home range falls within a 580-square-mile area in the Qin Ling mountains in Shaanxi Province (map, bottom left). Within it, the pandas we study roam some 80 square miles. Out of perhaps 1,200 pandas that remain in China, about 230 live in the Qin Ling, at elevations between 4,000 and 10,000 feet—higher during the warmer months, June through August, and lower during the rest of the year. Our study population is composed of about 80 pandas. In the past seven years we have recorded 11 births and only 4 deaths.

(above), the cub nurses in the den, a small cave where Jiao Jiao has given birth twice in a row. When Xi Wang reached three and a half months and began to move around, her mother spread additional pine boughs as a cushion (above right). At four months and 20 pounds, on shaky legs, she made one of her first forays (right). Like all pandas, she will not begin to regularly eat solid food—bamboo, adults' sole source of nourishment—until she is about a year old. Meanwhile, her mother produces the

LU ZHI AND PAN WENSHI (ALL)

BRADLEY SIMPSON AND LE JEN CHEN

Atop a pine tree, Xi Wang snoozes contentedly while her mother forages for bamboo nearby. As young pandas mature, their mothers sometimes leave them alone for as long as 52 hours, we discovered. In the past, other researchers and hikers who found a lone cub assumed that it was abandoned and took it to a care center. These orphans became part of China's captive breeding program—of 113 pandas in captivity, 35 of them were taken as cubs from the wild. Such "rescues" must cease.

Poaching and loss of habitat are still serious threats. Pelts sell for more than $10,000 in Hong Kong, Taiwan, and Japan. Although the government has gone to the extreme of executing several poachers recently, illegal hunting remains a major problem. In the Qin Ling we have lost six pandas to poachers in ten years. But we are just as concerned about deforestation. In 20 years panda territory has been halved; only six forest fragments are left. The small, isolated panda populations may suffer from inbreeding.

To safeguard what remains, the Chinese government, in concert with the World Wide Fund for Nature, is implementing a ten-year plan that would expand the 13 existing reserves and create 14 new ones. Ten thousand loggers and farmers now working in these areas would be paid to move out. The entire effort could cost a staggering 80 million dollars. China has budgeted 13 million and hopes the balance will come from international conservation groups. One source could be new long-term loans of captive pandas for breeding in zoos and parks worldwide. Instead of a few months, the old norm, such loans are being made for ten years and bring at least ten million dollars each.

Bamboo will soon be Xi Wang's staff of life. But for now, she depends primarily on Jiao Jiao's milk and chews bamboo shoots merely for the practice (left). Three months later, by her first birthday, she had mastered the art. Bamboo offers so little nourishment to pandas that adults must devour as much as 80 pounds of shoots, stems, and leaves daily. Two bamboo species offer seasonal fare in the Qin Ling: one in the pandas' summer range in higher elevations and the other the rest of the year down below.

At 19 months and about 120 pounds, Xi Wang is nearly as big as her mother, who feeds while her cub looks on (below). Even at this stage Xi Wang nursed once in a while. But a month later came a turning point. For the first time since Xi Wang was born, Jiao Jiao mated. And as new life began within her mother, Xi Wang found herself abandoned.

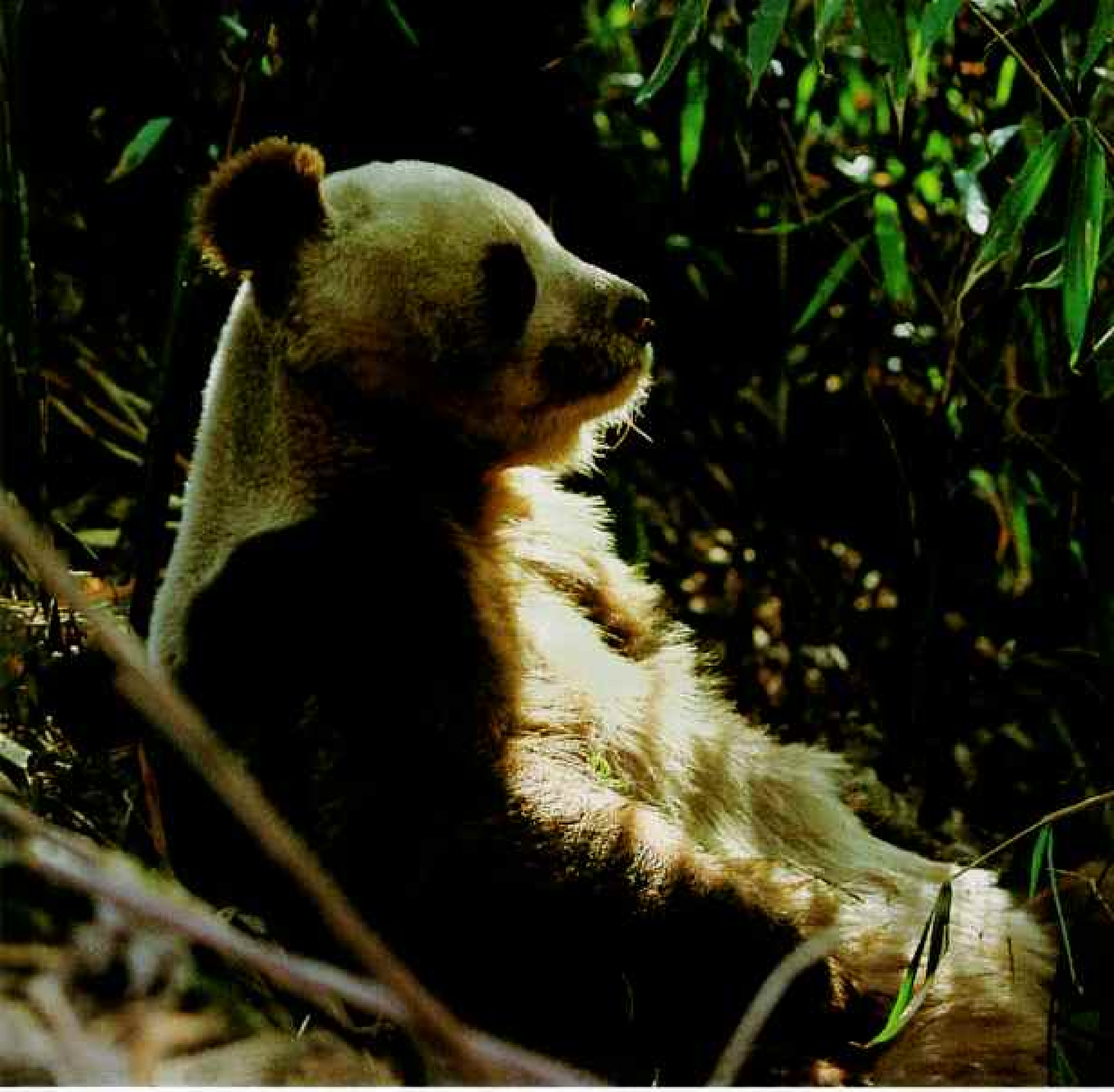
Xi Wang was born into her mother's group of about 12 pandas living near the Youshui River (facing page), which marks the group's eastern boundary. This aged male lives with one of two other groups inhabiting the river valley. Such populations usually include breeding males and females, their cubs, and immature males.

We will be eager to see whether Xi Wang moves to a different group, as three other young females here have done—perhaps a natural deterrent to inbreeding. She will become sexually mature at about six years old, as males do.

In the Qin Ling mountains individuals of both sexes coexist in areas usually covering about two square miles. But before spring mating, males expand their ranges to about five square miles, encompassing the areas of several females. A dominant male may control his mating grounds for three or four years. Most other males keep their distance, and combat is rare.

Females, on the other hand, can be more aggressive with one another. Each has a core area where neighboring females trespass at their peril. We once saw Jiao Jiao chase an intruder out of her area, bloodying the interloper's face.

LI ZHI AND PAN WENSHI (ABOVE); BRADLEY SIMPSON AND LE JEN CHEK



"Wild pandas are always dirty," I told Lü Zhi, one of my students, after she climbed a tree and reported seeing a panda with a brown-and-white coat. I thought it was probably just muddy. But ten days later local farmers came and told us they had found a sick panda. When we investigated, the animal (which did indeed have a digestion problem) proved to be a rare brown panda (above), one of only three I have ever seen. We cared for the female in a special sanctuary within our reserve until she could travel to the zoo in Xian for further examination.

I know of reports of other mammals giving birth to young that are brown and later change color. Could brown be the panda's true ancestral color, I wondered, occasionally revealed by a recessive gene that may date back two and a half million years to the panda's origin?

By late 1993 a Beijing University zoologist, Lü Zhi (top right, at right) had spent countless hours with me in the field.

XIANG DING QIAN

LÜ ZHI AND PAN WENSHI (ABOVE AND LEFT)

Together we examined a seven-week-old cub we named Gui Ye for a moon fairy. She was delicate, weighing three pounds—less than half Xi Wang's weight at the same age—possibly because she was the firstborn of her mother, named Mo-Mo.

Lü Zhi helps inspect Xi Wang's 14-month-old teeth (above), which show fragments of the bamboo leaves and stems that make up her diet. The 27-year-old researcher recently spent a year studying genetics at the National Cancer Institute in the United States.

Armed with her knowledge, we hope to address a long-range danger that may persist even if we save the pandas' habitat—inbreeding, which can impair a population's reproductivity and make it more vulnerable to disease. China's remaining pandas are scattered in 24 small populations widely separated by both geographic barriers and human encroachment. We want to determine the exact kinship of our animals, investigate our groups' genetic diversity, and compare their diversity with that of other pandas, wild and captive.

BRADLEY SIMPSON AND LE JEN CHEN (BOTH)

Traveling bearback: A feeble old male gets a ride from farmers near our reserve (opposite). We had tranquilized him with a dart in dense undergrowth and hired the farmers to carry him to a riverbank. There we could more easily examine him and take a blood sample for genetic analysis. His eyes are quite milky; he is more than 15 years old, nearing the end of the male's average life span. After releasing him, we often saw him around the Youshui River. Eventually he went blind and was transported to a care facility.

One of our field researchers, Xiang Ding Qian (above), homes in on one of the 30 radio-collared pandas, including Xi Wang, we currently track. Beyond lies clear-cut pine forest that once was panda habitat within our reserve. Logging in the Qin Ling mountains has caused one group of 20 pandas to split up and join other groups, with unknown consequences. But in November 1993 the roar of the chain saws ceased: The government had pledged three million dollars to reorganize a local logging company into five separate factories. In them 2,300 former loggers will make paper products, biofertilizer, and other goods.

BRADLEY SIMPSON AND LE JEN CHEN (ABOVE AND TOP)

Bellying up to the bamboo, Xi Wang's big brother, Hu Zi, or Little Tiger, just can't get enough of a good thing. Probably Jiao Jiao's first cub, he was born in August 1989, three years before Xi Wang. His forepaw (left) features a specialized panda adaptation—a sixth digit called a pseudothumb, bulging on the top of the paw. It is actually a greatly enlarged wrist bone that functions like an opposable thumb when the panda uses it with the other digits to grasp

LI ZHI AND FAN WENSHI

and manipulate bamboo shoots.

There were dramatic differences in the ways Jiao Jiao raised these two cubs. When Hu Zi was born, she did not leave his side for nine days, neither feeding nor defecating; with Xi Wang that period lasted 25 days. All told, Hu Zi stayed with his mother for two and a half years before she mated and left him—an unusually long time. Xi Wang was on her own in a year and a half—a more common pattern.

Once he was alone, Hu Zi seemed to take a cautious approach to life. For months he stayed close to a large adult male, maybe for protection. His first sexual stirrings were likewise tentative. At three and a half, he began to haunt mating sites, small areas of forest scent-marked by females in estrus. Here Hu Zi watches from a tree (above) as the female Mo-Mo waits for males to appear; several mated with her. A year later Hu Zi fought another young male over breeding rights, lost, and was badly injured. Though now sexually mature, he still has not mated.

LÜ ZHI AND FAN WENSHI (ABOVE AND FAR RIGHT)

Generations to come: Gently grasping her five-day-old cub, Mo-Mo moves the infant to a new den for safety. Young and inexperienced, Mo-Mo gave birth to the cub, Gui Ye, with just a rock ledge as shelter from rain and from martens, leopards, and black bears. For a time Gui Ye thrived. At seven weeks (above right) her eyes were just opening, and her cry sounded like a puppy's. But ultimately she did not survive.

In August 1993 Lü Zhi and I

BRADLEY SIMPSON AND LE JEN CHEN

observed another female, Snow. We suspected that she had given birth in a den beneath a rocky shelf. When we arrived, Snow was not there. We entered. On the stone floor was the youngest newborn panda ever seen or photographed in the wild—just 36 hours old (far left).

At the time, their den was within earshot of logging operations. Snow—a shy mother—had to raise her cub amid the rumble of heavy equipment and blasts of explosives. Such disturbances have long reverberated in China's forests. In 1875 Père Armand David, a Basque missionary and naturalist who explored this country, observed, "From one year's end to another, one hears the hatchet and the axe. . . . With the great trees will disappear . . . all the animals, small and large, which need the forest in order to live and perpetuate their species."

For the time being, at least, our newborn pandas and their mothers will be spared such sound and fury. And we have a new addition. Last August 16, Jiao Jiao gave birth again. Xi Wang has a little brother. □

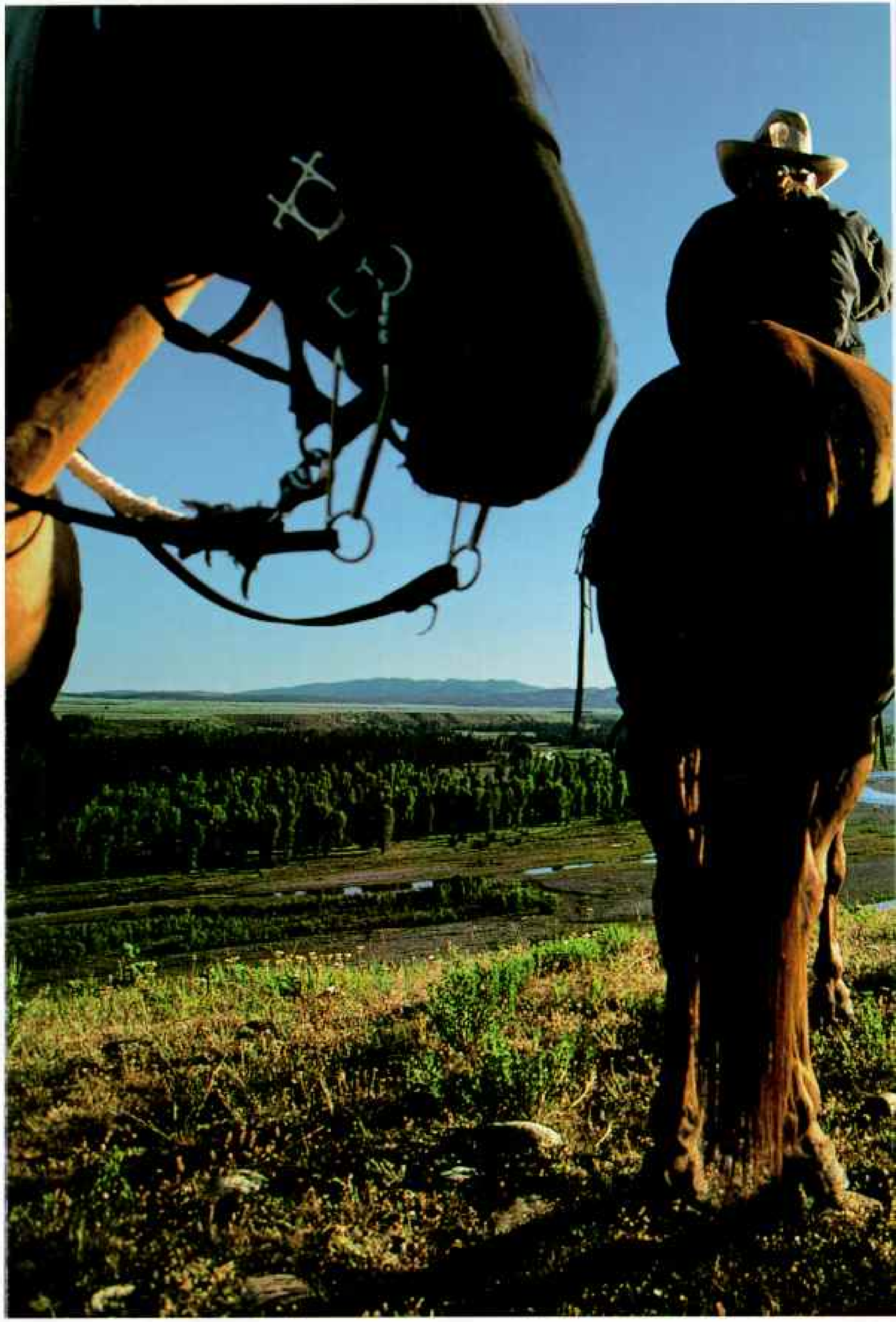
Airborne wrangler: a helicopter shadows an elk herd across Jackson Hole while taking a population survey. In summer, as many as 4,000 head roam the park's sagebrush flats and forested slopes, joined by elk from Yellowstone National Park and nearby national forests during winter, they beat a path to the adjacent National Elk Refuge, where some 8,500 are protected and fed.

BY BRYAN HODGSON

PHOTOGRAPHS BY JOSÉ AZEL

Walking a fine line between access and excess, Wyoming's Grand Teton National Park weighs demands of visitors in climbing shoes and cowboy boots (overleaf) while preserving the head-spinning beauty that draws them.

GRAND TETON



GUESTS OF LOST CREEK RANCH REST THEIR HORSES ON AN OVERLOOK, WITH THE SNAKE RIVER BEYOND.

IF YOU BUY A PLANE TICKET TO JACKSON, WYOMING, YOU GET ONE OF AMERICA'S MOST BELOVED NATIONAL PARKS THROWN IN FREE. JACKSON HOLE AIRPORT sprawls inside the southern boundary of Grand Teton National Park, only 12 miles from the summit of 13,770-foot Grand Teton. Collect your bags, rent a car, and in an hour or so you can be hiking through some of the most inspiring alpine scenery on earth.

The 40-mile-long Teton Range thrusts skyward from its girdle of forests and morainal lakes, an exquisite arrangement of jagged peaks and precipitous canyons freshly hewed by glaciers that retreated only a few thousand years ago. It is a world in the throes of creation still, battered by sudden storms, raked by avalanches and calamitous tumblings of stone, savage and serene by turns. From perennial snows pour cataracts that are a very baptism of the earth, nourishing secret meadows and glades of quaking aspen haunted by moose and elk and bear, and then tumbling through hoops of their own rainbows to join the Snake River in the silvery sagebrush valley called Jackson Hole. It is a place vivid with omens, with a falcon's flight and the cry of its prey, with fire-stricken pines that seem a charcoal sketch of disaster until you count their seedlings shining in the sun.

That's the good news. The bad news is that instant access is contributing to a surge of development that threatens to turn the park into a glorified rock garden, echoing with the sound of as many as 12 jet flights a day, surrounded by suburbs of million-dollar vacation homes, and seething with highway traffic that brings 3.5 million visitors a year.

How has the National Park Service, that bastion of nature-knows-best conservationism, come so intimately to embrace the jet age? A man who was instrumental in making it possible admires his handiwork from his home in Jackson. "The airport was there long before the park," says James Watt, the controversial secretary of the interior in the Reagan Administration. "When I came into office in 1981, Interior had given notice that the airport lease wouldn't be extended. That was dumb. I gave the airport a 50-year extension. I thought it was selfish to deny tens of thousands of visitors access to Jackson. It's important to keep perspective. The park is surrounded by federal forest lands that will never be developed."

True? Jackson, once a workaday western village, has become a fashionable enclave of motels and boutiques, where housing prices have quadrupled in the past five years. Three major ski resorts abut the park, and this winter thousands of visitors are buzzing through the park on the 340-mile Continental Divide Snowmobile Trail between Lander, Wyoming, and nearby Yellowstone National Park.

Wilderness shuttles, commercial jets bring 100,000 of the 3.5 million people who visit the park every year. They land at Jackson Hole Airport, in operation before this area became part of the park in 1950. The only commercial airport fully within a U. S. national park, it is a source of controversy.

In recent years seven commercial jets have run off the tarmac, stopping

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Former staff writer BRYAN HODGSON reported on buffalo in the November 1994 GEOGRAPHIC. Freelance photographer JOSÉ AZEL's most recent article for the magazine was "Recycling" in July 1994. He lives in Maine.

just short of disaster. "One plane rolled within ten feet of a ditch," says a pilot. "If it'd gone in, it could have burned."

Airport officials want to extend the runway, but opponents fear the move would bring larger planes, more visitors, and more noise and visual intrusion into the park. Both sides are in a holding pattern until studies are completed.

"There's no longer any slack season," says Park Superintendent Jack Neckels. "More and more people are doing winter camping and mountaineering, backcountry skiing, even dogsledding. And now we get jet commuters from New York and Chicago who keep their businesses going with faxes and cellular telephones. They have a whole new set of expectations. They want a sort of Central Park, where the horses wear English saddles and the bikeways are smooth. I'm not saying that's good or bad—just that it's a fact."

CONFLICTING EXPECTATIONS have caused problems in Jackson Hole ever since Congress carved a 96,000-acre national park out of Teton National Forest in 1929. Its boundaries clung to the mountains' pinnacles and eastern slopes, leaving Jackson Lake, the Snake River, and Jackson Hole up for developmental grabs.

Philanthropist John D. Rockefeller, Jr., used front men to gradually buy 35,000 acres of rangeland from unsuspecting homesteaders for donation to the government. But when he suggested that the land be used to expand the park, local cattle ranchers and politicians joined the Forest Service in persuading Congress to block the plan. In 1943, when President Franklin D. Roosevelt included most of the disputed land in a 221,000-acre Jackson Hole National Monument, critics compared the deed to Pearl Harbor's "day of infamy." Even some conservationists objected. The new monument contained "nothing entitled to be called scenery," sniffed a spokesman for the Wilderness Society.

GRAND TETON NATIONAL PARK

Arrayed on the park's western edge, the Tetons began rising about ten million years ago along a 40-mile-long fault; plains east of the fault dropped, forming Jackson Hole.

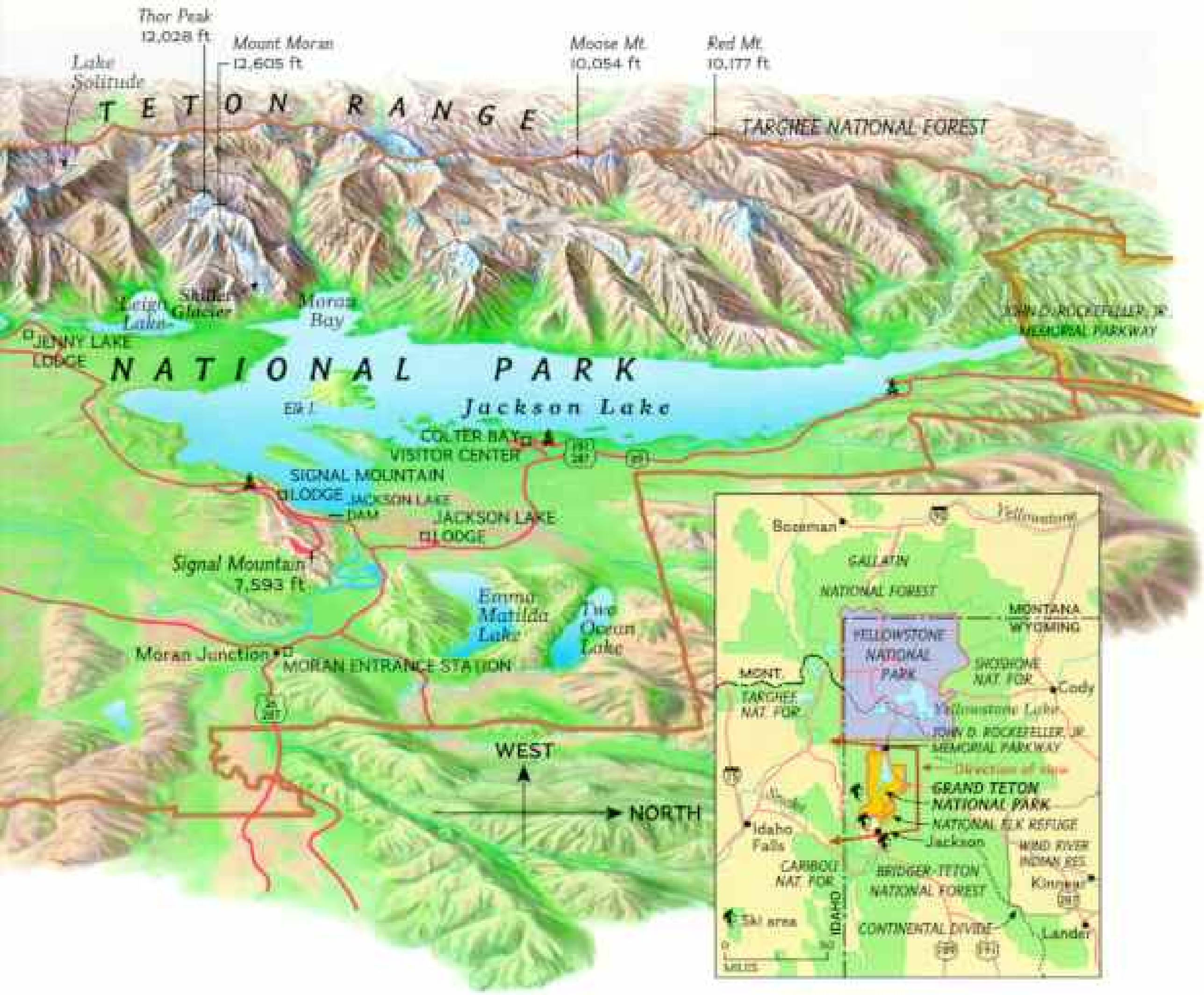
To preserve this scenic valley, philanthropist John D. Rockefeller, Jr., began buying 35,000 acres from unsuspecting homesteaders in 1927. When he attempted to give most of the land to the federal government to enlarge the park—created in 1929—local ranchers who grazed cattle here were outraged and blocked the extension. His gift was finally added in 1950. Now 310,000 acres, the park preserves remnants of homestead days such as a weathered fence on Mormon Row (opposite).

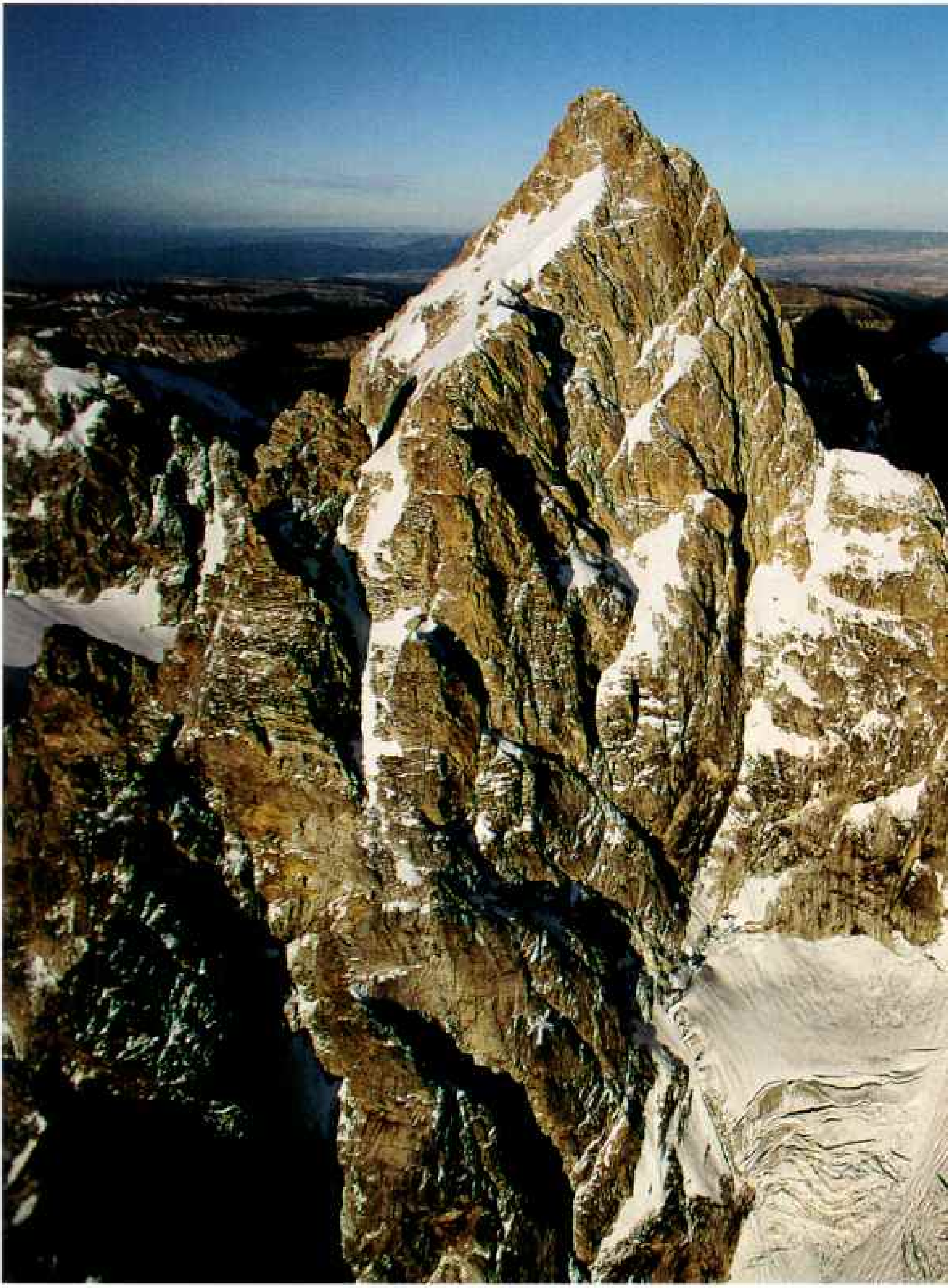
Nevertheless, Congress combined park and monument on September 14, 1950. Gazing at the magnificent open vistas from Blacktail Butte and Signal Mountain, today's visitors have no doubt that lawmakers did the right thing. Cattle and pronghorn share the flats that otherwise would surely be filled with costly homes, and old dirt roads still offer gentle encounters with America's frontier heritage.

Clark and Veda May Moulton are the last residents on Mormon Row, so called for homesteaders who came to Jackson Hole in 1912 and settled in the Mormon community of Grovont. Their white house is sheltered by cottonwoods he planted on their wedding day 58 years ago. At 82 and 80 respectively, they look as though the excitement hasn't faded.

"This was the main road in those days," Veda May says. "My grandmother was postmistress. She put up a sign that said, 'MEALS 35 CENTS AT ALL HOURS.' I saw the first automobile to come here. That was wonderful!"

Clark remembers the great buyout. "My father refused the Rockefeller deal," he says. "But quite a few of the older folks were ready to sell out and go. It took us 30 years to realize that being included in the park was the best thing that happened to us. We started to get a lot of pressure to sell our land for condominiums. So we were glad when the park people offered us a fair price. But we kept one acre for ourselves. Nobody can touch that. The kids will inherit!"


Thor Peak
12,028 ft
Mount Moran
12,605 ft
Moose Mt.
10,054 ft
Red Mt.
10,177 ft
Lake Solitude
TETON RANGE
TARGHEE NATIONAL FOREST
Leigh Lake
Skillet Glacier
Moran Bay
JOHN D. ROCKEFELLER, JR. MEMORIAL PARKWAY
JENNY LAKE LODGE
NATIONAL PARK
Elk I.
Jackson Lake
COLTER BAY VISITOR CENTER
SIGNAL MOUNTAIN LODGE
JACKSON LAKE DAM
JACKSON LAKE LODGE
Signal Mountain
7,593 ft
Emma Matilda Lake
Two Ocean Lake
Moran Junction
MORAN ENTRANCE STATION
WEST
NORTH
Bozeman
Yellowstone
GALLATIN NATIONAL FOREST
MONTANA
WYOMING
YELLOWSTONE NATIONAL PARK
SHOSHONE NAT. FOR.
Cody
MONT. TARGHEE NAT. FOR.
Yellowstone Lake
JOHN D. ROCKEFELLER, JR. MEMORIAL PARKWAY
GRAND TETON NATIONAL PARK
NATIONAL ELK REFUGE
Idaho Falls
Jackson
WIND RIVER INDIAN RES.
CARIBOU NAT. FOR.
BRIDGER-TETON NATIONAL FOREST
Ski area
IDAHO
CONTINENTAL DIVIDE
Lander



"Mountains piled on Mountains and capped with three spiral peaks which pierce the cloud," trapper Osborne Russell wrote of the Teton Range in 1835. At 13,770 feet, Grand Teton is the highest peak in a range much younger than others in the Rocky Mountain chain.

BUT HERITAGE and inheritance are sadly at odds nowadays. Federal taxes can gobble up half the value of an estate—a fact that has helped cause 53 percent of Teton County's privately owned ranchland to vanish into subdivisions since the mid-1960s.

"A 600-acre ranch might be worth $300,000 as agricultural land but ten times that as development land—and inheritance taxes are based on the land's highest economic value," says Jackson economic analyst Jonathan Schechter. "Heirs usually don't have that kind of money, so they sell to subdividers. I think it won't be long before ranching here will be reduced to ornamental status."

Against such latter-day claim jumping, Paul Walton has posted his 2,000-acre ranch near Wilson with signs of the times:

CONSERVATION PROPERTY

The Jackson Hole Land Trust holds a conservation easement over this property. Together the Land Trust and the landowner cooperate to permanently preserve the scenic vista and wildlife habitat.

Taking time out from supervising pregnancy tests on 700 cows—one of ranching's less ornamental chores—Walton explains how some of the Old West is being newly won. "A while ago I got very ill—thought my days were numbered," he says. "My accountant said we'd owe the government four million dollars inheritance taxes, and the only way to pay that would be to sell to developers. Well, I was goddamned if I'd see houses on the land." Today the nonprofit land trust Walton helped found holds protective easements that prohibit most development and dramatically reduce the taxable value of 7,833 acres—10 percent of all private land in Teton County.

"But I'm ranching in the middle of a subdivision," he says, looking around at elaborate houses burgeoning on surrounding hillsides. "They're even advertising me as part of the view." For ranchers who depend on summer grazing lands leased from Bridger-Teton National

Snacking on snowflakes, a climber in Garnet Canyon is suited up for a summer snowstorm—a danger at higher altitudes, where any mistake can be fatal. Using a wheeled stretcher (below), park rangers rescue a mountaineer who sprained his ankle—one of some 30 people injured in the park in 1993. Four others died. "People so often aren't prepared for the conditions," says ranger Jim Springer. "They can slip on a patch of snow, hit a rock, and die."

Forest, there's a new range war brewing. "The environmentalists want to get cattle off the range. Eastern liberals want us under glass, just to look at," Walton growled. "My family settled in Utah in 1852 and fought Indians and grizzlies. So I'm damned if I'll give up here."

ENVIRONMENTAL DEBATES about modern lifestyles are part of the political landscape in Jackson Hole, but only the question of what to do about Jackson Hole Airport is a matter of lifestyle and death. Some 190,000 travelers pass through the airport each year. Airliners have skidded off the end of its 6,300-foot runway seven times in recent years, miraculously escaping damage. Boosters want the runway lengthened, drawing accusations from conservationists that a longer runway would allow larger jets to land. Park officials, objecting to the noise, would prefer to see the airport moved rather than expanded. "A very reasonable airport site is Idaho Falls, only a hundred miles from here—two hours by car or bus. How much difference would that make to Jackson?" asks Park Superintendent Neckels.

Passengers who have experienced full-brakes-and-reverse-thrust

Seeking an elusive target, Ervin Clark of Kinnear, Wyoming (below), was among 2,300 hunters appointed temporary park rangers to bag protected elk (left) during a special hunting season; his family tagged along for the annual event. The program is designed to reduce the large elk population and preserve the animals' winter habitat. Elk browse on aspen saplings and other young trees needed to replace older stands in the park and the National Elk Refuge. Yet herd reduction is slow: Only 565 elk were harvested in the park in 1993, along with 272 in the refuge, which runs its own hunting lottery.

landings might be interested in the opinion of Kenneth E. Wood, a United Airlines captain who moved to the area 15 years ago.

"The runway is safe," Captain Wood says. "The Federal Aviation Administration says it's safe, and I agree, except for the human factor. Pilots can make mistakes—helped by unpredictable crosswinds. That's bad enough. But if you should lose an engine during that critical moment when you reach takeoff speed, you have only about two seconds here to decide whether to abort or continue.

"I've got a fix: Pave a thousand feet of overrun, as a cushion for that dummy like me that makes a mistake. And put in a tower! At the height of the season we get 50 flights a day—commercial and private aircraft mixing in a totally uncontrolled airspace."

WHEN IT COMES to potential catastrophe, geophysicist Bob Smith warns not to sell mother nature short. The University of Utah professor has been studying volcanism and seismicity in the Grand Teton and Yellowstone region for 25 years and believes Jackson Hole is due for a major earthquake along the 40-mile-long

Cloaked in mist and morning clouds, Mount Moran rises like the sun from the shores of Jackson Lake. The 25,500-acre lake is fed by the Snake River, whose chill waters draw rafters, challenge fishermen, and flow on to irrigate potato farms in Idaho.

Prepared for anything—including June snow—a group of Boy Scouts begins a long-planned raft trip down the Snake River (above). "Snow can fall here anytime," says the trip organizer. "I don't recall taking my jacket off last summer."

Under clear skies a sunbather dips her toes in icy Lake Solitude, nicknamed Lake Multitude for the crowds it draws, despite a ban on camping.

Teton Fault, which descends ten miles beneath the valley.

"The fault started rupturing 10 to 12 million years ago, thrusting one side up to form the mountains while the eastern side dropped down to create Jackson Hole," explains Smith. "It ruptures every few thousand years at a magnitude of 7 or so. If you look near the base of the mountains, you can see the fault scarps as tall as 115 feet that were created by several major quakes over 16,000 years. These quakes produce 7- to 16-foot scarps—meaning that the valley floor drops down very suddenly.

"The last two earthquakes happened about 7,000 and 4,000 years ago," he says. "A conservative estimate is that we are right on time—or behind schedule—for the next big one."

The town of Jackson lies in the fault zone, as does Jackson Lake Dam, an earthen and concrete structure built in 1911 and raised to its present 65-foot height in 1916. Engineers concluded that a major earthquake could literally vibrate the dam's earthen portions into a slurry of mud and water, releasing water from 25,500-acre Jackson Lake to surge down the Snake River, where much of the new development lies on the old floodplain. The Bureau of Reclamation recently spent more than 50 million dollars to strengthen the dam against a maximum credible earthquake by pounding it with 32-ton weights and nailing it in place by drilling scores of vertical holes with an auger that mixed cement into the dirt as it turned.

"Now we think the worst that could happen is that a quake could create a seiche wave that might slop over the dam," says Bureau of Reclamation official Earl Corless.

MUCH OF THE SNAKE'S WATER is diverted to Idaho farmers, who irrigate alfalfa, grain, and the country's largest crop of seed potatoes. For fly fishermen the river is a priceless refuge for Snake River cutthroat trout; elsewhere cutthroats have been diminished

in the competition for food with brown trout, imported many years ago from Germany and Scotland. Tourists prefer dreamlike cruises on rubber rafts, watching the Tetons disappear and reappear beyond canyon walls and marveling at the rich variety of birdlife. On bottomland meadows, scores of nesting blue herons squawk and clatter in ragged treetop condominiums. Families of Canada geese and mergansers patrol sandbars, and flights of swallows twitter around tiny riverbank caves.

It is this experience of wildness that development most threatens,

Paw power churns snow on the park's unplowed roads. Dogsleds, like snowmobiles, are not permitted on foot trails; officials worry that the dogs and their barking might disturb wildlife. But local dogsledder Frank Teasley says of his team of huskies, "Contrary to belief, the dogs are too busy pulling to bark."

according to Dan Burgette, who stands guard at what may be Grand Teton's last frontier. He is chief ranger of the Colter Bay subdistrict, which contains the most crowded campgrounds as well as much of the park's backcountry wilderness.

"The toys people bring to the park have changed," he says. "Twenty-five years ago they would have a car and a tent. Now they come with a motor home, a boat, trail bikes, and a car in tow. Parking lots built in the 1960s just aren't big enough. One of our biggest chores is getting people to turn off their TV sets and gas-powered electric generators at ten o'clock at night." Burgette has spent most of his 20-year career as a climbing ranger, and for him protecting the high country is the highest calling of all.

"Pristine areas, with no trails, are the real treasure of the park," he says. "The people who tend to go into these areas are willing to work hard to get there and use low-impact techniques. In some areas we've discovered that five nights' use a year can create a bare campsite that takes years to recover. Our object is to manage the land so people can

come here a hundred years from now and have the same experiences possible today."

Yet the park's very beauty can easily deceive newcomers into thinking it is benign—a mistake that can be fatal. "Slipping on snowfields is the greatest hazard," says Scott Berkenfield, of the park's rescue service. "We tell hikers always to carry an ice ax in high country and learn to use it to arrest a fall."

Two memorable tragedies have helped drive that message home. In July 1983 a climber slipped on a steep snowfield below Grand Teton, waving cheerfully to a bystander before he realized he was plunging into a tunnel carved by meltwater beneath the snow. It took Scott and other rescuers two days to recover the body. Three years later two young women descending Mount Moran's Skillet Glacier slid helplessly from 12,200 feet to 10,400 feet. One miraculously survived; the other died in a crevasse.

Treacherous weather also takes a toll. Rangers still talk about the fate of five experienced men who climbed Grand Teton on a bright summer day in 1985. A sudden storm engulfed them in blinding snow and hurricane-force winds. Three froze to death. Rescuers scaled the mountain in total darkness to get two survivors to safety.

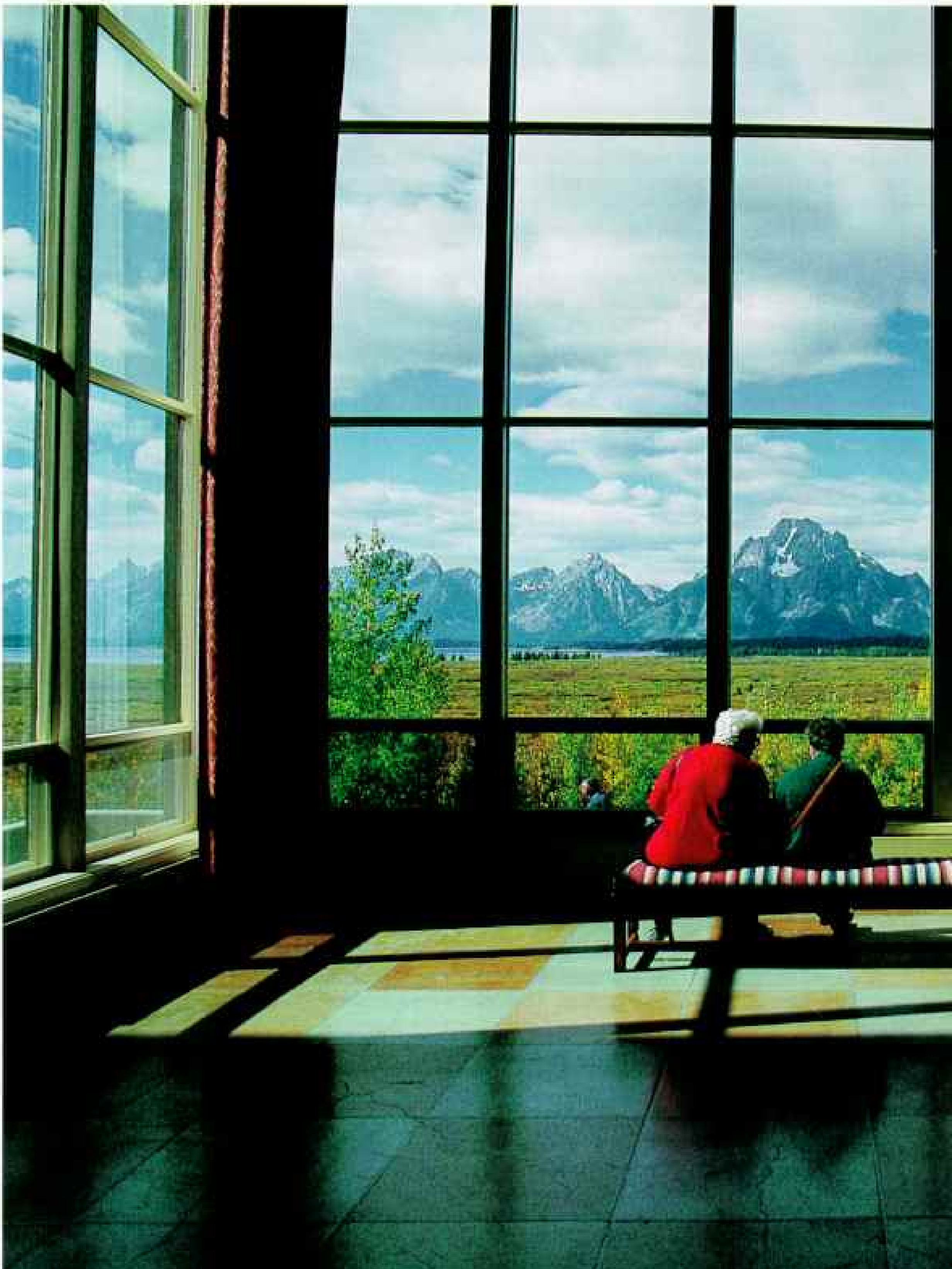
Park rangers lead complicated lives. "I began one day by rescuing a man who'd been thrown from a horse, hand-carrying him out of a swamp and getting him to the hospital," Scott says. "I'm also a certified emergency medical technician. The physician asked me to help him muscle the victim's dislocated hip into place, so I scrubbed and put on hospital greens. Then I got called to help a ranger subdue a felony suspect, so I strapped my gun belt over the greens, went out and put the guy on the ground and handcuffed him. After that we got a mountain emergency, so I took off the gun belt and greens, got my flight helmet and climbing gear, and away we went in the helicopter."

Fishing Jackson Lake through five feet of ice, a hardy soul studies his rig for signs of a strike. He got here, like many "ice junkies," by scooting across the lake in a snowplane—a cab on skis powered by an aircraft engine. Sound fast? Says one man: "Get her revved up, and she's gone like a cut cat."

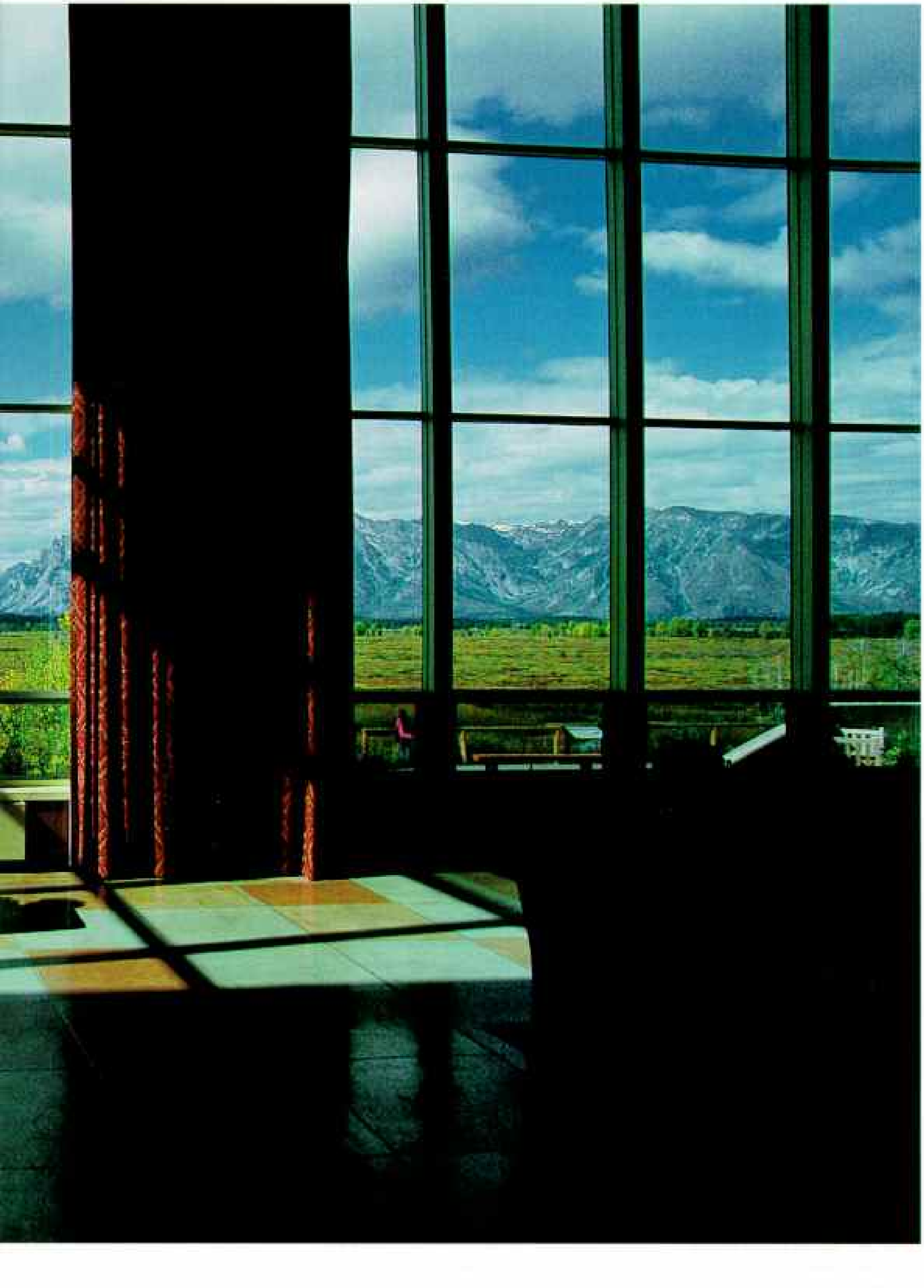
SEASONAL EMPLOYEES provide most of the park's man- and woman-power between June and September. Many of them are educators like Bill Miller, a retired California school principal, who has been a part-time ranger and full-time lover of the park for 29 years. "It changed my life," he says. "I used to have chronic ulcers. They went away my first season here and never came back."

Today Miller helps supervise the activities of the most temporary employees of all: a few thousand licensed hunters who each fall are appointed deputy rangers to help reduce a growing elk population, estimated at 16,000 animals in the park and surrounding areas.

Man has replaced wolves and grizzly bears as predator in chief. Ironically he has at the same time assumed the role of protector. In 1912,



Room with a view, the lounge of Jackson Lake Lodge overlooks peaks that pioneer photographer W. H. Jackson called "one of the most stupendous panoramas in all America." One of our most visited national parks, Grand Teton must cope with its own popularity.



fearing starvation of herds displaced by homesteaders, the federal government created the National Elk Refuge. Every winter thousands of animals that summer in Grand Teton and Yellowstone and adjacent national forests gather on its 25,000 acres for free room and board.

"We supplement the elk's diet from mid-January to late March," says assistant refuge manager Jim Griffin. "The state has 22 other feeding areas. Basically they're set up to keep elk off ranches."

Once the elk consumed as many as 1,200 80-pound bales of hay a day. Today Roger Pape distributes alfalfa pellets from a 25-foot dump trailer hauled by a big D-8 Caterpillar tractor. "I give them between seven and nine pounds per animal—enough for breakfast with a little left over for the rest of the day," he says.

Pape has witnessed tremendous changes since coming to Jackson from Iowa 27 years ago: "In those days they hardly plowed the snow on the streets in the wintertime. Gas stations would trade off staying open on weekends. Most of the business people would go south."

Today winter is big business. At the Jackson Hole Ski Resort at Teton Village, the region's largest, 2,300 skiers a day ride the tram to the top of Rendezvous Mountain for the breathtaking 4,139-foot downhill run. To escape the crowds, more and more skiers head for the backcountry, breaking trail through woods and delighting in vistas of new snow.

Many of them may be skiing for a fall unless they take the trouble to study snow, according to Rod Newcomb, who founded the American Avalanche Institute in Wilson 20 years ago. "Most skiers are trapped by small avalanches, on slopes about 150 feet high," he says. "Cross-country skiers need to know how snow behaves. Snowmobilers need to study too. They have a trick called highmarking—seeing how high up a slope they can get before curving down again. Three years ago a snowmobile set off a 2,000-foot avalanche in Targhee National Forest, and it took more than a week to find the victim."

To diagnose danger, Newcomb advises digging a snow pit to learn how weather conditions have affected previous snowfalls. Surface snow that has been packed hard by wind can mask unstable layers, such as sugar snow—loose, granular crystals that do not bond well. And new-fallen snow on crusts formed by melt and refreezing can cause an avalanche even on moderate, 30-degree slopes.

"If you want to be safe, make snow your hobby," says Newcomb.

There are more comfortable ways to study snow, such as watching fat white flakes swirling outside the picture windows of Dornan's Spur Ranch Bar, one of Jackson Hole's oldest roadhouses, located near park headquarters at Moose. Three-foot logs crackle in the great stone fireplace as customers drift in, stamping boots and emerging from heavy coats. They are coming to attend Dornan's traditional weekly hootenanny, where local musicians, singers, and poets perform before an audience of their peers.

As old rhymes and rhythms settle comfortably over the room, people with strong and often contrary views about development and the environment relax and greet one another with apparent goodwill. Bob Dornan isn't surprised. His family stems from two sets of homesteaders, one opposed and one strongly in favor of establishing the park.

"One of the great things about the valley in the old days was diversity," he says. "Nobody had total control. We always had some outsiders, eastern people who came to the dude ranches and hunting camps, so there was a mix of cultures. Before the park, this was just a neighborhood. Whatever happens, I hope we're not losing that." □

FORD DESIGNERS FROM LEFT TO RIGHT:
SUSAN K. WESTFALL, DAVID HILTON, GARY BRADDOCK, SOO KANG, PAUL ARNONE, AARON WALKER

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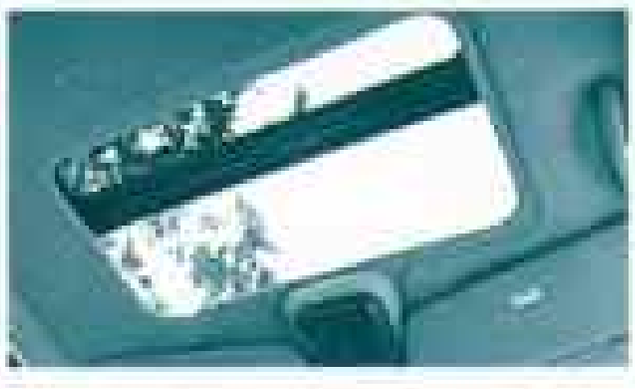

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HOWARD W. WHALEN COLLECTION

Fifty Years Later, Rare Photograph of Iwo Jima

Shells crashed and enemy fire rained down as landing craft unloaded U. S. Marines at Iwo Jima during a key amphibious assault in the final months of World War II in the Pacific.

Amid the chaos and terror of February 19, 1945, Lt. Howard W. Whalen, a 34-year-old boat group commander from the U.S.S. *Sanborn*, photographed the action at Blue Beach—including the disabled landing craft at center in this view published for the first time (above). Guiding the landing from his launch, Whalen made 80 color photographs over a ten-day period. Since he was not authorized to take pictures, he held the film undeveloped until the end of the war.

A seven-and-a-half-square-mile volcanic speck, Iwo Jima gained strategic value from its location 760 miles south of Tokyo, midway between Japan and U. S. bases in the Mariana Islands. American planners intended to use the islet as a forward air base and an emergency landing field for bombers attacking Japan.

The monthlong battle took a frightful toll: It wiped out nearly all 22,000 entrenched Japanese and left some 23,000 Marine casualties, including about 6,000 dead. After the war, Whalen returned to a teaching job in Bakersfield, California. He died in 1989. Last summer, his wife, Nadine, retrieved the photographs from a shoe box and offered them to NATIONAL GEOGRAPHIC.

RICHARD THOMPSON

Be My Valentine: "How Do I Love Thee?"

"Let me count the ways," wrote poet Elizabeth Barrett Browning.

Through the ages the ways people have loved have been many: calmly or hysterically, monogamously or polygamously, impetuously or pragmatically. Now psychologists are entering the realm of romance and applying scientific measurements to styles of love. The findings: Romantic attitudes are rooted almost exclusively in environment and not in heredity. Genes play virtually no role, as they do in attitudes toward vocations, hobbies, even religiousness. "This flies in the face of what we expected," says Niels Waller of the University of California, Davis.

Waller and Phillip R. Shaver led a study involving lengthy questionnaires of 338 female and 107 male adult twin pairs. They found it made no difference whether twins were identical—with exactly the same genes—or fraternal: How they approached love depended on environment and life experiences.

National Geographic, February 1995

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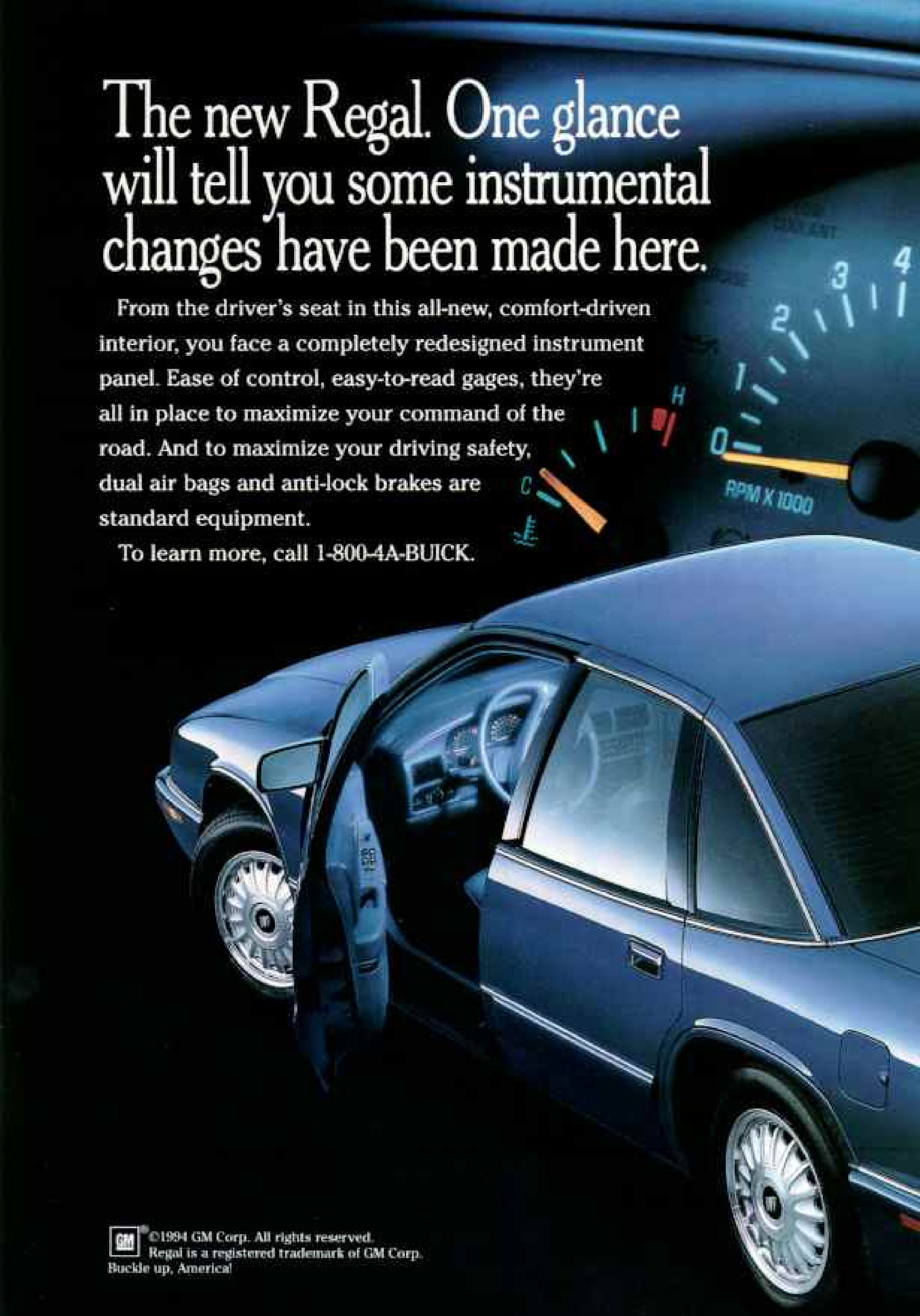


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Fleeing Fishy Predators by Crawling Ashore

In Devonian seas filled with "a bunch of ferocious fish," says University of Pennsylvania paleontologist Neil Shubin, the options for survival were "get big, get armor, or get out of the way." One animal took the third path: It developed legs that enabled it to move to the shallows and then to land.

Ted Daeschler of Philadelphia's Academy of Natural Sciences—a student of Shubin's—found a fossilized shoulder bone and skull fragments of the oldest known North American amphibian near Hyner, Pennsylvania. At least 363 million years old, the three-foot-long creature is the second oldest amphibian ever discovered. The oldest—by some five million years—was found in Scotland, which then shared the same landmass with Pennsylvania.

KENSETH BARRETT, DOUGLAS HENDERSON

The Hyner amphibian had strong limbs that enabled it to lift its body and walk. The shoulder structure indicates that it breathed with lungs, not gills. "It's a close relative of the ancestor of every vertebrate ever to walk on land," Daeschler says.

SARAH LEEN

White Buffalo Birth Lures Native Americans

Last August, Native Americans began arriving at Dave and Valerie Heider's farm near Janesville, Wisconsin. They came from as far away as Alaska to pray, leave offerings, and give thanks for Miracle—the female white buffalo calf born on the farm August 20.

Unbeknownst to the Heiders, the white buffalo—a genetic rarity—holds an honored place among Native American tribes that once depended on bison (GEOGRAPHIC, November 1994).

Arthur Amiotte, a native-studies professor and a Lakota, says his people believe that a mythic woman was transformed into a white buffalo after aiding them during a famine, and that she will reappear as a sign of great change. An elder still keeps her sacred gift, a ceremonial pipe.

After Miracle is weaned this spring, the American Bison Association will conduct genetic tests to learn whether she is pure buffalo or part cow. A white buffalo, according to zoologist Tracy Walker of Oklahoma State University, is "exceedingly, exceedingly rare."

Slave-Ship Relics Inspire a Memorial

The *Henrietta Marie*, a slave ship that sank off the Florida Keys nearly 300 years ago, has yielded chilling hints of its human cargo: iron shackles for both adults and children. "It is unfathomable that somebody would put these on some little kid and drag him halfway around the world," says Albert José Jones, a founder of the National Association of Black Scuba Divers. NABS members, resolving to honor all Africans who came in chains to the New World, have placed a brass plaque at the wreck site, located in 30 feet of water at a shoal called New Ground.

Salvager Mel Fisher found the *Henrietta Marie* in 1972; in the early 1980s, David Moore led its excavation, bringing up muskets, ivory tusks, trade beads—and scores of shackles. The ship's bell inscribed with her name led Moore to her historic records.

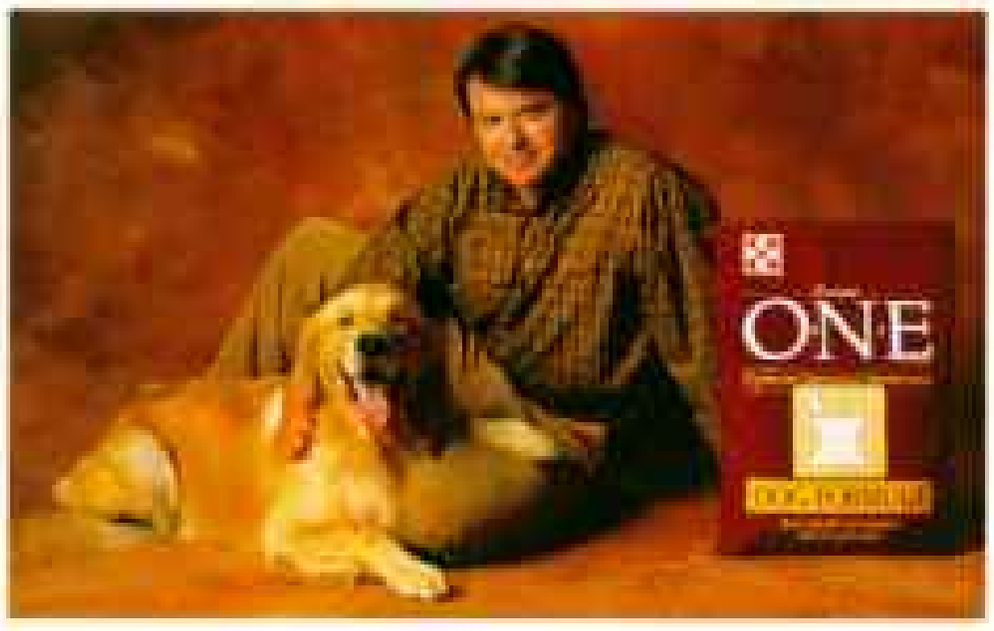
The English ship sailed from London to West Africa with trade goods, picked up her cargo of slaves, and took them to Jamaica. The hull was then filled with sugar and cotton for the trip home, which ended in a storm in 1700. "This is the earliest and the only slaver to be identified and properly excavated," says Moore.

JONATHAN BLAIR AT THE MEL FISHER MARITIME HERITAGE SOCIETY, KEY WEST, FLORIDA

—BORIS WEINTRAUB

"He Can Sit,

Roll Over, Beg, Play Dead and Even Sing.



But He Couldn't Read An Ingredient Label If His Life Depended On It"

—*Robert Urich*

Do your dog a favor and read a few dog food labels. What you'll find out is that they're not all the same.

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Forum

Our National Parks

I have just returned from a three-week camping vacation that included Yellowstone, Grand Teton, and Yosemite. Your article (October 1994) brought back memories of traffic jams, overcrowded campsites, facilities in disrepair, and a few unenthusiastic rangers. These parks are in grave danger of losing their appeal if something constructive is not done soon.

JOHNNY VAN TOL
Delta, British Columbia

I just returned from a perfect family vacation to Yellowstone and Grand Teton; we found both parks alive with wildlife and splendid beauty. The air and water were clean and fresh; we saw no trash; the fellow vacationers, rangers, and concessionaires were all helpful and courteous. I have read other alarmist articles about our abused parks. Some changes are needed. However, we must not overreact and stop future families from enjoying affordable journeys through their national parks.

JOHN R. CLARK
Bryan, Texas

As a frequent four-wheel-drive traveler in the Southwest, I rarely encounter other people or damaged landscapes in the scenic backcountry—except in protected areas. I believe the worst fate a scenic area can experience is to become protected, which inevitably attracts crowds. To conserve the scenery, the myriad of proposed parks and park expansions should be rejected.

NORMAN MEEK
Assistant Professor of Geography
California State University
San Bernardino, California

I was alarmed to learn that entrance fees do not go back into the park system but rather into the U. S. Treasury. Wouldn't it be more practical to have the park system begin to support itself through a fee system? I'm told that the fees earned at Hearst Castle, a California state monument at San Simeon, support not only that facility but also some of the others within the state.

ALFRED C. SCHWEGLER
San Jose, California

Has a suggestion been made to privatize the parks to make them self-sustaining? If a board of trustees was appointed to manage each park as a going concern and was responsible to a national board, you would probably find a lot of well-run, wealthy parks. For advice, call on the New Zealand government, as it has privatized everything here but the kitchen sink. The end result is a country that is finally starting to pay its way with hard cash.

GREG EDWARDS
Dunedin, New Zealand

I want to protest your comment on the "un-natural attraction" of Dollywood at Pigeon Forge (page 25). While Dollywood has some commercial attractions, it offers the best family entertainment in this whole area. It is a spotlessly clean place where children are safe, the food and souvenirs are reasonably priced, and craftspeople make wagons, glass pitchers, and other things.

MARTIN G. GALLUP
Franklin, North Carolina

A lottery system should be set up to control how many humans pass through national parks. Such a system would mean that I may never have the privilege of returning to Yellowstone, while I still have the privilege of paying taxes for maintenance. But if I do return, I will be admiring natural beauty and not picking up the debris of people who came before me.

DENISE M. PECK
Redondo Beach, California

It is easy to get caught up in the elitist euphoria that deludes one into thinking that the national parks are our own special sanctuaries, but the fact is that all the parks exist by democratic decree. If we take steps to limit democratic access, we create the danger that the majority will be alienated. When a time comes to solicit support for wilderness from the voting public, the support will not be there.

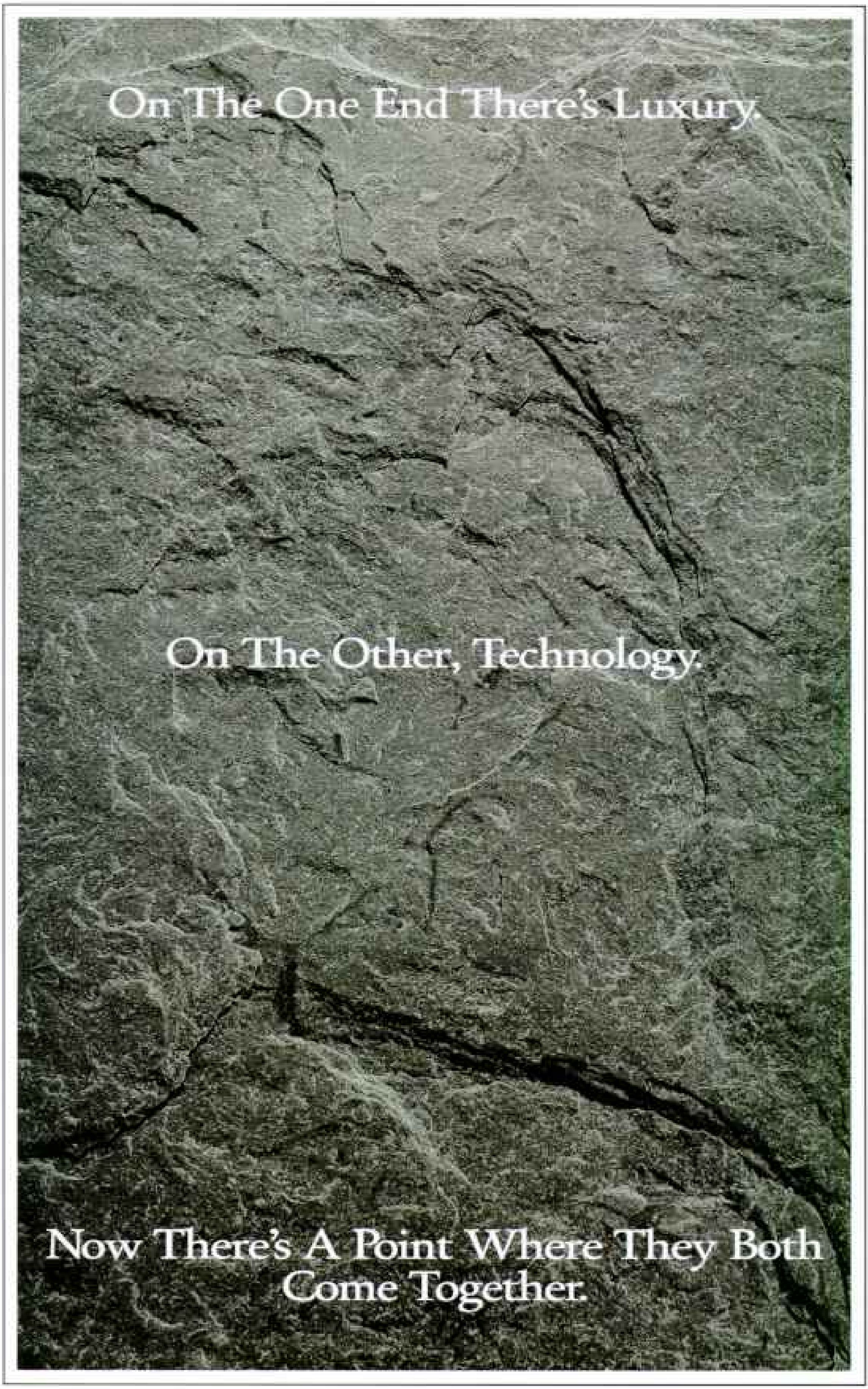
JEFF V. MIDDLEBROOK
Pacific Grove, California

The reestablishment of the Civilian Conservation Corps should be seriously considered to maintain the parks. If that option is unpalatable, then I suggest the Boy Scouts of America. They could practice the skills they've been learning by clearing undergrowth, rebuilding trails, and repairing facilities. They would bring their own shelter; the Park Service would provide materials and food.

WILLIAM C. VODA
Aurora, Illinois

I grew up in Utah and have a deep appreciation of our parks. With our four children we were able to spend many summer vacations in southern Utah's magnificent wonderlands. We are willing to do whatever it takes to protect these treasures. Tax me more! Charge me higher fees! Limit my seasonal usage! Let's do something now.

GERALD I. THOMPSON
Omaha, Nebraska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3. Have you ever owned a luxury vehicle? 1 ☐ Yes 2 ☐ No

4. When do you plan to acquire your next new vehicle?
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2 ☐ 4-6 months
3 ☐ 7-12 months
4 ☐ 1-2 years
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5. How do you plan to pay for this vehicle?
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3 ☐ Lease

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3 ☐ General Motors
4 ☐ European imports
5 ☐ Japanese imports

7. Which of the following is most important in your decision to purchase a new vehicle? Please choose one.
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5 ☐ Technologically-advanced features
6 ☐ Value for the money

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E ☐ 35-39
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H ☐ 50-54
I ☐ 55-59
J ☐ 60-64
K ☐ 65 or over

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Hanseatic League

Edward Von der Porten's informative portrayal of the Hanseatic League might have differentiated between the Low German of the Hansa and the southern language known as High, or standard, German. Low German, which descends from Old Saxon as does English, was used at league trading posts, from Bruges to Bergen and Novgorod, including the Steelyard of London. The collapse of the Hansa plunged the langunge into a decline, which opened doors to worldwide recognition for its English sibling.

REUBEN EPP
Kelowna, British Columbia

The article mentions that some towns and organizations today include *Hansa* [trading association] in their names. You might have included Germany's airline Lufthansa.

KEN MITCHELL
Newburgh, New York

It was true that for most of World War II Lüneburg was ignored by Allied bombers (page 72), but on April 7, 1945, my B-17 crew of the 351st Bomb Group attacked Lüneburg, targeting railroad marshaling yards in advance of our armies.

LEE GINGERY
Shenandoah, Iowa

During their long march to the east (the famous *Drang nach Osten*) along the Baltic coast, the Germans tried to push Poland and Russia away from the Baltic Sea. Hanseatic ports kept rich profits from the sale of Polish and Russian grain, wood, meat, and other products. In case of war, they instantly cut any supply from Poland or Russia to other trade partners. This was the Hansa's dark side. I think nobody wants to enjoy again the bloody Teutonic order in this part of Europe.

MIROSLAW SURMA
Nepean, Ontario

The Improbable Seahorse

I wanted you to know that your article on the seahorse moved me to write for the first time to your magazine and say thank you for making my day a little more cheerful. My wish is to save the seahorse in any way possible.

MARY G. AIVEY
Green Forest, Arkansas

St. Lawrence River

Looking at the beautiful pictures made me realize how lucky I am to live on the shore of this majestic river. Going whale-watching, walking on the beach, or fishing becomes a way of life here. After almost five years of looking at the ships from my kitchen window, smelling the salt air, and sleeping to the rocking sound of the waves, I had gotten less receptive to all this beauty. Thank you for reminding me not to take it for granted.

LILY MURPHY
Sept-Îles, Quebec

Jacques Parizeau (page 112) has won the election in Quebec. This in no way means Quebec will vote to separate. He will hold a referendum in 1995, and I am confident the people of Quebec will remain part of the greatest country in the world.

CASSIE ROSS
Halifax, Nova Scotia

Author Thomas Abercrombie offers only half a page on the Ontario and Thousand Islands portion of the river. One gets the impression that Quebec has a monopoly on the river and its history.

A. W. MERKLEY
Rockport, Ontario

Siberian Mummy Unearthed

The article on the Siberian tomb was immensely moving; it had the quality of well-wrought fiction. I especially liked author Natalya Polosmak's presence and point of view, the way she honored the dead, and her humility. So much writing in the social sciences aims to inform and instruct but not to bring pleasure.

DEENA LINETT
Montclair, New Jersey

It seemed clear that the lady's Pazyryk culture expected that her rest would be for eternity. That also seemed to have been apparent to the archaeologists once they cut through the undamaged lid. I believe this was scientific grave robbing as was the case with Tutankhamun's tomb and many others.

RONALD E. SMITH
Bishop, California

The author encourages a wonderful sense of connection to the people whose remains she encountered. I studied anthropology at McGill University in the late 1970s. I am glad now to count these two women, from thousands of years apart, as two more of my teachers.

SUE DOW
Owen Sound, Ontario

The tattoo design referred to as a "mythical creature" and "a magnificent griffin-like creature" looks to me like a stylized stag (page 84). The head, strong neck and shoulders, graceful front legs, and sharp hoofs are those of a stag deer. The curling flourish in front of the hindquarters could symbolize a ritual knife or male genitalia. Other deer motifs are present in the burial. Perhaps the lady was the shaman and guardian of her people's spirituality, health, and welfare. Perhaps she was protectress of the hunt.

LINDSAY J. MILLER
Richland, Missouri

Letters for FORUM should be sent to National Geographic Magazine, Box 37448, Washington, D. C. 20013-7448, or by fax to 202-828-5460, or via the America Online computer network to ngsforum@aol.com. Include full name, address, and daytime telephone. Letters selected may be edited for clarity and space.

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Olive Ridley *(Lepidochelys olivacea)* **Size:** Carapace length, 76cm **Weight:** Approx. 40kg **Habitat:** Tropical regions of the Pacific, Indian and South Atlantic Oceans **Surviving number:** Unknown, population declining

Photographed by Bill Curtsinger

WILDLIFE AS CANON SEES IT

An olive ridley emerges from the sea during an *arribada*, a mass nesting when thousands of these graceful swimmers come ashore and deposit their eggs in the sand. Each turtle leaves behind over 100 potential hatchlings, but only a few will survive to carry on the mysterious life cycle of the species. Once the most abundant of sea turtles, olive ridleys are returning to their nesting beaches in decreasing numbers. To save endangered species, it is vital to protect their habitats and understand the role of each species within the earth's ecosystems. As a global corporation committed to social and environmental concerns, we hope to foster a greater awareness of our common obligation to ensure that the earth's life-sustaining ecology survives intact for future generations.

NATIONAL GEOGRAPHIC MAGAZINE

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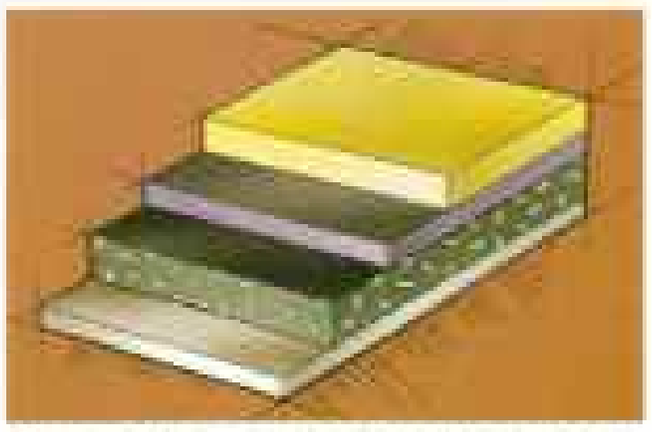

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Through "Project Norway," the students of both countries are learning that teenagers are alike regardless of ethnic heritage, cultural background, or where they live. And, learning to concentrate on similarities instead of differences is, after all, a very valuable lesson.

Last October, Barbara's students turned miles into smiles when they welcomed 46 of the Norwegian students and their teacher, Anne-Marie Hagen, for a 10-day visit to Swiftwater.

For turning distance into closeness, State Farm is proud to present Barbara with our Good Neighbor Award, and a $5,000 donation in her name to Pocono Mountain Intermediate School.

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On Television

The Blues: Traveling On Down the Road

LIBRARY OF CONGRESS

Along the routes out of the Deep South, like Highway 61 and the Illinois Central railroad line, came a swelling of sound—sensual, bittersweet, moody. It was "the blues." American youth and much of the world were soon up and moving to the beat of the blues and its kin—jazz, country, rock-and-roll. The center was Chicago, "sweet home, Chicago," in the words of the influential bluesman Robert Johnson, whose song forms the refrain in National Geographic's EXPLORER feature "Blues Highway."

The journey north to industrial cities such as Chicago from the rural South has become part of the history of millions of families. In the largest and most rapid of our internal migrations, five million blacks came north between 1940 and 1970, traveling on to escape racial segregation and poverty.

As the Second World War effort opened up salaried jobs in the North and mechanization closed out sharecroppers in the South, families—like this one in 1940 (above right)—packed up their belongings and moved. They brought with them two strong traditions—their faith and their music.

Airing at the end of Black History Month, "Blues Highway" takes viewers along on those memorable journeys by combining period still photographs and moving pictures, eyewitness accounts, and, above all, music. "Blues Highway" plays the sounds that blacks brought with them and gave to the world, the music that underpins American popular musical culture.

The film goes back home to the birth of the blues, showing where and why it flowered. For filmmakers Vince DiPersio and Bill Guttentag its sounds embody the themes of the great black migration.

The blues grew from roots in the deep, alluvial soil of the Mississippi Delta, cleared of forest and drained of swamp by black labor after the Civil War. Enriched with remembered rhythms of West African music, the blues at the local juke joint on Saturday night gave a lift to sharecroppers beaten down by the grind and sweat of daily work.

The blues: Plaintive lyrics sing of faithless women, bad whiskey, hard-driving bosses, good love gone bad, and—sometimes—a sigh of joy.

What makes the blues the blues is not only the musical form—usually a three-line verse of 12-bar phrases in 4/4 rhythm, with a rhyming word pattern—but the emotional intensity of the singer. As Riler "Iceman" Robinson (left) says, "I work out my anger. Happiness, love, and sorrow—I shoot all of it right through that guitar."

BOB SACHA

EXPLORER's "Blues Highway" airs Sunday, February 26, at 9 p.m. ET on TBS Superstation.

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Earth Almanac

Freeloading Sea Lions Face Drastic Controls

PETER LIDDELL, *SEATTLE TIMES*

Two sportfishermen of Washington State, this California sea lion feasting on a steelhead salmon is a most unwelcome visitor. Eleven years ago a small but feisty band of the marine mammals began arriving from California waters every fall to gorge on steelhead and other salmon species at Chittenden Locks in Seattle. Repeated efforts to repel or relocate the hungry invaders have met with little success. Now their appetites may cost some sea lions their lives.

"The sea lions could mean the end of this steelhead run," says Joe Scordino of the National Marine Fisheries Service. "Since 1983 the run has fallen from 2,575 steelhead to just 70 last year. In past years sea lions have taken as much as 65 percent of the returning fish. At this point every fish they remove is one too many."

Thirty to sixty sea lions cruise the area. About six at a time stake out the locks' fish ladders and waylay steelhead en route to Lake Washington, where they spawn in its tributaries. The run starts in December and peaks in February and March.

Under an amendment to the Marine Mammal Protection Act, Washington State officials are seeking control measures that include killing 10 to 15 sea lions during the next three years. Scordino says no West Coast aquarium will accept the animals; all are males that weigh 600 to 900 pounds.

"The sea lions are only a tiny part of the problem," says Cristina Mormorunni of Greenpeace, citing degradation of the watershed from urbanization, logging, and a dam as steelhead threats.

Sneakers' Environmental Flaw Sparks Correction

Kids think they're awesome, these high-tech sneakers with colored lights that flash when the heels hit the ground. But when Minnesota pollution-control agents discovered mercury in the shoes' heels, they put their official foot down. Wearing the shoes was not a health hazard, but they did pose a disposal problem, since the mercury could leach from landfills into the state's streams and lakes.

The California company L.A. Gear began making light-up sneakers for children in 1992. The flash was generated when the movement of a child's foot caused a piece of mercury the size of a BB to roll and strike the two copper wires of a switch.

After Minnesota officials took legal action, the company stopped using mercury last June and devised a ball-bearing switch. The sneakers with mercury, such as these (left), are still being sold, and they look the same as the new models.

STEVE BRONSTEIN

Wendy Strickman of L.A. Gear says that even though consumers can't tell which version they have, when the time comes to dispose of the shoes, they can call the company at 1-800-786-7820. "We will send them a prepaid envelope, and they can send the shoes to a federal recycling facility in Texas."

National Geographic, February 1995

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–Automobile Magazine, January '93

"Best Bets, 1993, 1994"
–The Car Book

"Ten Best Cars, 1993, 1994"
–Car and Driver

"We emerged with a sense that this car represents an important milestone, not only for Dodge, but for the art of the American sedan in general."
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Earth Almanac

A Forest Where Frogs Rain

They leap at dawn, little frogs that sail from trees in Puerto Rico as far as 45 feet to the ground. At dusk they climb back up. The timing of the two-inch-long *coquíes'* feeding cycle also lets them outwit predators.

Coquí frogs spend the night in the rain forest canopy, eating insects. But the wind dries their skin. So before dawn —when birds begin to feed—they jump to the forest floor, where they soak up moisture through a special skin patch.

At night tarantulas and other predators lurk on tree trunks but don't become active until after 7:30 p.m., researcher Margaret M. Stewart found. By then most coquíes have returned to the canopy. No wonder these forests teem with as many as 10,000 coquíes an acre—"the highest density measured anywhere for frogs," says Stewart.

MARK MOFFETT

Adapted to the Desert, This Fox Is All Ears

All seems still in the desert night—but not to the diminutive fox called the fennec. Native to Algeria, Libya, Morocco, and Tunisia, it is equipped with huge, six-inch-long ears. Unlike foxes that are active hunters, the fennec often just lurks and listens. Like radar, its ears pick up furtive scurryings of prey: lizards, small rodents, and insects.

By day, when the foxes stay near their burrows, like this adult and its cubs in Algeria, those oversize ears help dissipate the desert's ferocious heat. Other adaptations include dense fur on the animals' feet that covers the footpads, thus preventing hotfoot. The fennec's cuddly looks attract unwanted attention from Bedouin, who sometimes trap them for sale as pets, in spite of restrictions under the Convention on International Trade in Endangered Species.

HANS REINHARD LAUBER

Birder's Dream: Return of the Aplomado Falcon

A slim, swift raptor sporting a cinnamon breast is returning to south Texas skies, thanks to far-reaching cooperation.

This young northern aplomado falcon—a species rarely seen in the U. S. since the 1940s—was among a dozen released last year in Laguna Atascosa National Wildlife Refuge near Brownsville. Raised by the Peregrine Fund at its World Center for Birds of Prey in Boise, Idaho, they descend from several pairs of Mexican birds. Since 1985 more than 60 falcons have been freed in the refuge.

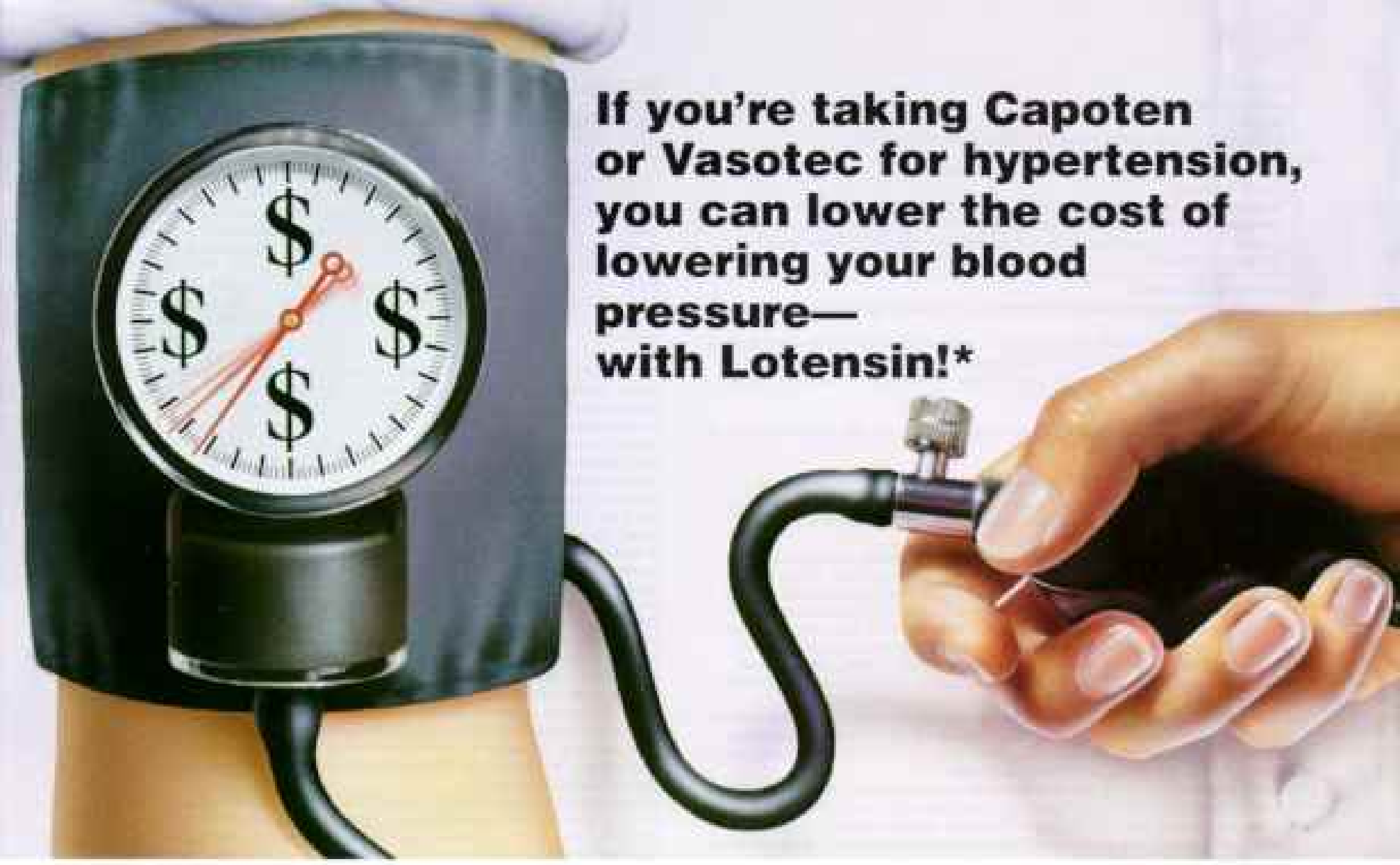
JAY DICKMAN

Pesticides and loss of habitat contributed to the species' decline. Now cooperation by cotton farmers should safeguard the falcon's recovery. "They're using alternative pesticides that are much safer," says refuge manager Steve Thompson. He adds that birders, who prize the aplomado falcon as one of the top ten birds to see, may bring $100,000 a year to area businesses.

The falcons have plenty to eat. Besides dragonflies and other large insects, their diet includes grackles, a noisome pest in the area.

—JOHN L. ELIOT

National Geographic, February 1995



If you're taking Capoten or Vasotec for hypertension, you can lower the cost of lowering your blood pressure— with Lotensin!*

Ask your doctor if Lotensin is right for you . . .

Although Lotensin, Capoten, and Vasotec all belong to a family of drugs called ACE inhibitors, Lotensin may cost 47%-67% less than Capoten and 20%-45% less than Vasotec! This can represent savings of $19.00 to $45.00 compared with Capoten, and $5.00 to $18.00 compared with Vasotec, each month.*

With Lotensin you also get a Lifetime Price Guarantee, which means that once you enroll, if you ever pay more than your low Guarantee Price, we'll send you the difference.† That's our promise for as long as you need to take Lotensin.

Like Capoten and Vasotec, Lotensin should be discontinued as soon as pregnancy is detected because of concerns about its effects on the unborn child.
As with other ACE inhibitors, Lotensin has also caused headache, dizziness, and cough, and in rare cases, a potentially dangerous swelling of the mouth and throat. Talk to your doctor about the potential risks and benefits of these medications.

Remember, only your doctor can decide if Lotensin is right for you. If it is, fill your Lotensin prescription and give us a call—toll-free—for more information about the Lotensin Lifetime Price Guarantee. The number is:

1-800-955-9100, ext. 950.

- Price comparisons are not intended to imply similar levels of effectiveness of these products.
- The cost of these products may vary depending on where you live, your pharmacy's pricing policy, and the prescribed dosage strength and dosing regimen.
- When switching brands of drugs, additional costs may be incurred for office visits or monitoring. In addition, dosing regimens may need to be adjusted in order to control blood pressure effectively.

*Cost data based on average retail prices as compiled by *Walsh America*, August 1994. Price comparisons are based on Capoten 25 mg or 50 mg twice daily; Vasotec 5 mg, 10 mg, or 20 mg once daily; and Lotensin 10 mg, 20 mg, or 40 mg once daily (other dosage strengths and dosing regimens are available).

†Ciba establishes the Guarantee Price. To receive your Guarantee Price, you must enroll in the Lotensin Lifetime Price Guarantee on or before 12/31/97. Because retail prices may vary, a maximum refund has been established.

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Lotensin®
benazepril HCl tablets

Lifetime Price Guarantee

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See important information on next pages.

Lotensin®
benazepril hydrochloride
Tablets

BRIEF SUMMARY (FOR COMPLETE PRESCRIBING INFORMATION, SEE PACKAGE INSERT)

Use in Pregnancy
When used in pregnancy during the second and third trimesters, ACE inhibitors can cause injury and even death to the developing fetus. When pregnancy is detected, Lotensin should be discontinued as soon as possible. See WARNINGS, Fetal/Neonatal Morbidity and Mortality

INDICATIONS AND USAGE
Lotensin is indicated for the treatment of hypertension. It may be used alone or in combination with thiazide diuretics.
In using Lotensin, consideration should be given to the fact that another angiotensin-converting enzyme inhibitor, captopril, has caused agranulocytosis, particularly in patients with renal impairment or collagen-vascular disease. Available data are insufficient to show that Lotensin does not have a similar risk (see WARNINGS).

CONTRAINDICATIONS
Lotensin is contraindicated in patients who are hypersensitive to this product or to any other ACE inhibitor.

WARNINGS
Anaphylactoid and Possibly Related Reactions: Presumably because angiotensin-converting enzyme inhibitors affect the metabolism of eicosanoids and polypeptides, including endogenous bradykinin, patients receiving ACE inhibitors (including Lotensin) may be subject to a variety of adverse reactions, some of them serious.
Angioedema: Angioedema of the face, extremities, lips, tongue, glottis, and larynx has been reported in patients treated with angiotensin-converting enzyme inhibitors. In U.S. clinical trials, symptoms consistent with angioedema were seen in none of the subjects who received placebo and in about 0.5% of the subjects who received Lotensin. Angioedema associated with laryngeal edema can be fatal. If laryngeal stridor or angioedema of the face, tongue, or glottis occurs, treatment with Lotensin should be discontinued and appropriate therapy instituted immediately. **Where there is involvement of the tongue, glottis, or larynx, likely to cause airway obstruction, appropriate therapy, e.g., subcutaneous epinephrine injection 1:1000 (0.3 mL to 0.5 mL) should be promptly administered (see ADVERSE REACTIONS).**
Anaphylactoid Reactions During Desensitization: Two patients undergoing desensitizing treatment with hymenoptera venom while receiving ACE inhibitors sustained life-threatening anaphylactoid reactions. In the same patients, these reactions were avoided when ACE inhibitors were temporarily withheld, but they reappeared upon inadvertent rechallenge.
Anaphylactoid Reactions During Membrane Exposure: Anaphylactoid reactions have been reported in patients dialyzed with high-flux membranes and treated concomitantly with an ACE inhibitor. Anaphylactoid reactions have also been reported in patients undergoing low-density lipoprotein apheresis with dextran sulfate absorption (a procedure dependent upon devices not approved in the United States).
Hypotension: Lotensin can cause symptomatic hypotension. Like other ACE inhibitors, benazepril has been only rarely associated with hypotension in uncomplicated hypertensive patients. Symptomatic hypotension is most likely to occur in patients who have been volume- and/or salt-depleted as a result of prolonged diuretic therapy, dietary salt restriction, dialysis, diarrhea, or vomiting. Volume- and/or salt-depletion should be corrected before initiating therapy with Lotensin.
In patients with congestive heart failure, with or without associated renal insufficiency, ACE inhibitor therapy may cause excessive hypotension, which may be associated with oliguria or azotemia and, rarely, with acute renal failure and death. In such patients, Lotensin therapy should be started under close medical supervision, they should be followed closely for the first 2 weeks of treatment and whenever the dose of benazepril or diuretic is increased.
If hypotension occurs, the patient should be placed in a supine position, and, if necessary, treated with intravenous infusion of physiological saline. Lotensin treatment usually can be continued following restoration of blood pressure and volume.
Neutropenia/Agranulocytosis: Another angiotensin-converting enzyme inhibitor, captopril, has been shown to cause agranulocytosis and bone marrow depression, rarely in uncomplicated patients, but more frequently in patients with renal impairment, especially if they also have a collagen-vascular disease such as systemic lupus erythematosus or scleroderma. Available data from clinical trials of benazepril are insufficient to show that benazepril does not cause agranulocytosis at similar rates. Monitoring of white blood cell counts should be considered in patients with collagen-vascular disease, especially if the disease is associated with impaired renal function.
Fetal/Neonatal Morbidity and Mortality: ACE inhibitors can cause fetal and neonatal morbidity and death when administered to pregnant women. Several dozen cases have been reported in the world literature. When pregnancy is detected, ACE inhibitors should be discontinued as soon as possible.
The use of ACE inhibitors during the second and third trimesters of pregnancy has been associated with fetal and neonatal injury, including hypotension, neonatal skull hypoplasia, anuria, reversible or irreversible renal failure, and death. Oligohydramnios has also been reported, presumably resulting from decreased fetal renal function; oligohydramnios in this setting has been associated with fetal limb contractures, craniofacial deformation, and hypoplastic lung development. Prematurity, intrauterine growth retardation, and patent ductus arteriosus have also been reported, although it is not clear whether these occurrences were due to the ACE inhibitor exposure.
These adverse effects do not appear to have resulted from intrauterine ACE inhibitor exposure that has been limited to the first trimester. Mothers whose embryos and fetuses are exposed to ACE inhibitors only during the first trimester should be so informed. Nonetheless, when patients become pregnant, physicians should make every effort to discontinue the use of benazepril as soon as possible.
Rarely (probably less often than once in every thousand pregnancies), no alternative to ACE inhibitors will be found. In these rare cases, the mothers should be apprised of the potential hazards to their fetuses, and serial ultrasound examinations should be performed to assess the intraamniotic environment.
If oligohydramnios is observed, benazepril should be discontinued unless it is considered life-saving for the mother. Contraction stress testing (CST), a nonstress test (NST), or biophysical profiling (BPP) may be appropriate, depending upon the week of pregnancy. Patients and physicians should be aware, however, that oligohydramnios may not appear until after the fetus has sustained irreversible injury.
Infants with histories of in utero exposure to ACE inhibitors should be closely observed for hypotension, oliguria, and hyperkalemia. If oliguria occurs, attention should be directed toward support of blood pressure and renal perfusion. Exchange transfusion or dialysis may be required as means of reversing hypotension and/or substituting for disordered renal function. Benazepril, which crosses the placenta, can theoretically be removed from the neonatal circulation by these means; there are occasional reports of benefit from these maneuvers with another ACE inhibitor, but experience is limited.
No teratogenic effects of Lotensin were seen in studies of pregnant rats, mice, and rabbits. On a mg/m² basis, the doses used in these studies were 65 times (in rats), 9 times (in mice), and more than 0.8 times (in rabbits) the maximum recommended human dose (assuming a 50 kg woman). On a mg/kg basis these multiples are 336 times (in rats), 90 times (in mice) and more than 3 times (in rabbits) the maximum recommended human dose.
Hepatic Failure: Rarely, ACE inhibitors have been associated with a syndrome that starts with cholestatic jaundice and progresses to fulminant hepatic necrosis and (sometimes) death. The mechanism of this syndrome is not understood. Patients receiving ACE inhibitors who develop jaundice or marked elevations of hepatic enzymes should discontinue the ACE inhibitor and receive appropriate medical follow-up.

PRECAUTIONS
General
Impaired Renal Function: As a consequence of inhibiting the renin-angiotensin-aldosterone system, changes in renal function may be anticipated in susceptible individuals. In patients with severe congestive heart failure whose renal function may depend on the activity of the renin-angiotensin-aldosterone system, treatment with angiotensin-converting enzyme inhibitors, including Lotensin, may be associated with oliguria and/or progressive azotemia and (rarely) with acute renal failure and/or death. In a small study of hypertensive patients with renal artery stenosis in a solitary kidney or bilateral renal artery stenosis, treatment with Lotensin was associated with increases in blood urea nitrogen and serum creatinine; these increases were reversible upon discontinuation of Lotensin or diuretic therapy, or both. When such patients are treated with ACE inhibitors, renal function should be monitored during the first few weeks of therapy. Some hypertensive patients with no apparent preexisting renal vascular disease have developed increases in blood urea nitrogen and serum creatinine, usually minor and transient, especially when Lotensin has been given concomitantly with a diuretic. This is more likely to occur in patients with preexisting renal impairment. Dosage reduction of Lotensin and/or discontinuation of the diuretic may be required. **Evaluation of the hypertensive patient should always include assessment of renal function (see DOSAGE AND ADMINISTRATION).**
Hyperkalemia: In clinical trials, hyperkalemia (serum potassium at least 0.5 mEq/L greater than the upper limit of normal) occurred in approximately 1% of hypertensive patients receiving Lotensin. In most cases, these were isolated values which resolved despite continued therapy. Risk factors for the development of hyperkalemia include renal insufficiency, diabetes mellitus, and the concomitant use of potassium-sparing diuretics, potassium supplements, and/or potassium-containing salt substitutes, which should be used cautiously, if at all, with Lotensin (see Drug Interactions).
Cough: Presumably due to the inhibition of the degradation of endogenous bradykinin, persistent nonproductive cough has been reported with all ACE inhibitors, always resolving after discontinuation of therapy. ACE inhibitor-induced cough should be considered in the differential diagnosis of cough.
Impaired Liver Function: In patients with hepatic dysfunction due to cirrhosis, levels of benazeprilat are essentially unaltered (see WARNINGS, Hepatic Failure).
Surgery/Anesthesia: In patients undergoing surgery or during anesthesia with agents that produce hypotension, benazepril will block the angiotensin II formation that could otherwise occur secondary to compensatory renin release. Hypotension that occurs as a result of this mechanism can be corrected by volume expansion.
Information for Patients
Pregnancy: Female patients of childbearing age should be told about the consequences of second- and third-trimester exposure to ACE inhibitors, and they should also be told that these consequences do not appear to have resulted from intrauterine ACE inhibitor exposure that has been limited to the first trimester. These patients should be asked to report pregnancies to their physicians as soon as possible.
Angioedema: Angioedema, including laryngeal edema, can occur with treatment with ACE inhibitors, especially following the first dose. Patients should be so advised and told to report immediately any signs or symptoms suggesting angioedema (swelling of face, eyes, lips, or tongue, or difficulty in breathing) and to take no more drug until they have consulted with the prescribing physician.
Symptomatic Hypotension: Patients should be cautioned that lightheadedness can occur, especially during the first days of therapy, and it should be reported to the prescribing physician. Patients should be told that if syncope occurs, Lotensin should be discontinued until the prescribing physician has been consulted.
All patients should be cautioned that inadequate fluid intake or excessive perspiration, diarrhea, or vomiting can lead to an excessive fall in blood pressure, with the same consequences of lightheadedness and possible syncope.
Hyperkalemia: Patients should be told not to use potassium supplements or salt substitutes containing potassium without consulting the prescribing physician.
Neutropenia: Patients should be told to promptly report any indication of infection (e.g., sore throat, fever), which could be a sign of neutropenia.
Drug Interactions
Diuretics: Patients on diuretics, especially those in whom diuretic therapy was recently instituted, may occasionally experience an excessive reduction of blood pressure after initiation of therapy with Lotensin. The possibility of hypotensive effects with Lotensin can be minimized by either discontinuing the diuretic or increasing the salt intake prior to initiation of treatment with Lotensin. If this is not possible, the starting dose should be reduced (see DOSAGE AND ADMINISTRATION).
Potassium Supplements and Potassium-Sparing Diuretics: Lotensin can attenuate potassium loss caused by thiazide diuretics. Potassium-sparing diuretics (spironolactone, amiloride, triamterene, and others), or potassium supplements can increase the risk of hyperkalemia. Therefore, if concomitant use of such agents is indicated, they should be given with caution, and the patient's serum potassium should be monitored frequently.
Oral Anticoagulants: Interaction studies with warfarin and acenocoumarol failed to identify any clinically important effects on the serum concentrations or clinical effects of these anticoagulants.
Lithium: Increased serum lithium levels and symptoms of lithium toxicity have been reported in patients receiving ACE inhibitors during therapy with lithium. These drugs should be coadministered with caution, and frequent monitoring of serum lithium levels is recommended. If a diuretic is also used, the risk of lithium toxicity may be increased.
Other: No clinically important pharmacokinetic interactions occurred when Lotensin was administered concomitantly with hydrochlorothiazide, chlorthalidone, furosemide, digoxin, propranolol, atenolol, naproxen, or cimetidine.
Lotensin has been used concomitantly with beta-adrenergic-blocking agents, calcium-channel-blocking agents, diuretics, digoxin, and hydralazine, without evidence of clinically important adverse interactions. Benazepril, like other ACE inhibitors, has had less than additive effects with beta-adrenergic blockers, presumably because both drugs lower blood pressure by inhibiting parts of the renin-angiotensin system.
Carcinogenesis, Mutagenesis, Impairment of Fertility: No evidence of carcinogenicity was found when benazepril was administered to rats and mice for up to two years at doses of up to 150 mg/kg/day. When compared on the basis of body weights, this dose is 110 times the maximum recommended human dose. When compared on the basis of body surface areas, this dose is 18 and 9 times (rats and mice, respectively) the maximum recommended human dose (calculations assume a patient weight of 60 kg). No mutagenic activity was detected in the Ames test in bacteria (with or without metabolic activation), in an in vitro test for forward mutations in cultured mammalian cells, or in a nucleus anomaly test. In doses of 50-500 mg/kg/day (8-80 times the maximum recommended human dose based on mg/m² comparison and 37-375 times the maximum recommended human dose based on a mg/kg comparison), Lotensin had no adverse effect on the reproductive performance of male and female rats.
Pregnancy Categories C (first trimester) and D (second and third trimesters)
See WARNINGS, Fetal/Neonatal Morbidity and Mortality.
Nursing Mothers: Minimal amounts of unchanged benazepril and of benazeprilat are excreted into the breast milk of lactating women treated with benazepril. A newborn child ingesting entirely breast milk would receive less than 0.1% of the mg/kg maternal dose of benazepril and benazeprilat.
Geriatric Use: Of the total number of patients who received benazepril in U.S. clinical studies of Lotensin, 18% were 65 or older while 3% were 75 or older. No overall differences in effectiveness or safety were observed between these patients and younger patients, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.
Pediatric Use: Safety and effectiveness in children have not been established.

ADVERSE REACTIONS
Lotensin has been evaluated for safety in over 6000 patients with hypertension; over 700 of these patients were treated for at least one year. The overall incidence of reported adverse events was comparable in Lotensin and placebo patients.

The reported side effects were generally mild and transient, and there was no relation between side effects and age, duration of therapy, or total dosage within the range of 2 to 80 mg. Discontinuation of therapy because of a side effect was required in approximately 3% of U.S. patients treated with Lotensin and in 3% of patients treated with placebo.

The most common reasons for discontinuation were headache (0.6%) and cough (0.5%) (see PRECAUTIONS, Cough).

The side effects considered possibly or probably related to study drug that occurred in U.S. placebo-controlled trials in more than 1% of patients treated with Lotensin are shown below:

PATIENTS IN U.S. PLACEBO-CONTROLLED STUDIES

	LOTENSIN (N=964)		PLACEBO (N=486)	
	N	%	N	%
Headache	60	6.2	21	4.2
Dizziness	35	3.6	12	2.4
Fatigue	23	2.4	11	2.2
Somnolence	15	1.6	2	0.4
Postural Dizziness	14	1.5	1	0.2
Nausea	13	1.3	5	1.0
Cough	12	1.2	5	1.0

Other adverse experiences reported in controlled clinical trials (in less than 1% of benazepril patients), and rarer events seen in postmarketing experience, include the following (in some, a causal relationship to drug use is uncertain):

Cardiovascular: Symptomatic hypotension was seen in 0.3% of patients, postural hypotension in 0.4%, and syncope in 0.1%; these reactions led to discontinuation of therapy in 4 patients who had received benazepril monotherapy and in 9 patients who had received benazepril with hydrochlorothiazide (see PRECAUTIONS and WARNINGS). Other reports included angina pectoris, palpitations, and peripheral edema.

Renal: Of hypertensive patients with no apparent preexisting renal disease, about 2% have sustained increases in serum creatinine to at least 150% of their baseline values while receiving Lotensin, but most of these increases have disappeared despite continuing treatment. A much smaller fraction of these patients (less than 0.1%) developed simultaneous (usually transient) increases in blood urea nitrogen and serum creatinine.

Fetal/Neonatal Morbidity and Mortality: See WARNINGS, Fetal/Neonatal Morbidity and Mortality.

Angioedema: Angioedema has been reported in patients receiving ACE inhibitors. During clinical trials in hypertensive patients with benazepril, 0.5% of patients experienced edema of the lips or face without other manifestations of angioedema. Angioedema associated with laryngeal edema and/or shock may be fatal. If angioedema of the face, extremities, lips, tongue, or glottis and/or larynx occurs, treatment with Lotensin should be discontinued and appropriate therapy instituted immediately (see WARNINGS).

Gastrointestinal: Constipation, gastritis, vomiting, and melena.

Dermatologic: Apparent hypersensitivity reactions (manifested by dermatitis, pruritus, or rash), photosensitivity, and flushing.

Neurologic and Psychiatric: Anxiety, decreased libido, hypertonia, insomnia, nervousness, and paresthesia.

Other: Arthralgia, arthritis, asthenia, asthma, bronchitis, dyspnea, impotence, infection, myalgia, sinusitis, sweating, and urinary tract infection.

Clinical Laboratory Test Findings

Creatinine and Blood Urea Nitrogen: Of hypertensive patients with no apparent preexisting renal disease, about 2% have sustained increases in serum creatinine to at least 150% of their baseline values while receiving Lotensin, but most of these increases have disappeared despite continuing treatment. A much smaller fraction of these patients (less than 0.1%) developed simultaneous (usually transient) increases in blood urea nitrogen and serum creatinine. None of these increases required discontinuation of treatment. Increases in these laboratory values are more likely to occur in patients with renal insufficiency or those pretreated with a diuretic and, based on experience with other ACE inhibitors, would be expected to be especially likely in patients with renal artery stenosis (see PRECAUTIONS, General).

Potassium: Since benazepril decreases aldosterone secretion, elevation of serum potassium can occur. Potassium supplements and potassium-sparing diuretics should be given with caution, and the patient's serum potassium should be monitored frequently (see PRECAUTIONS).

Hemoglobin: Decreases in hemoglobin (a low value and a decrease of 5 g/dL) were rare, occurring in only 1 of 2214 patients receiving Lotensin alone and in 1 of 1357 patients receiving Lotensin plus a diuretic. No U.S. patients discontinued treatment because of decreases in hemoglobin.

Other (cause/relationship unknown): Clinically important changes in standard laboratory tests were rarely associated with Lotensin administration. Elevations of uric acid, blood glucose, serum bilirubin, and liver enzymes (see WARNINGS) have been reported, as have scattered incidents of hyponatremia, electrocardiographic changes, leukopenia, eosinophilia, and proteinuria. In U.S. trials, less than 0.3% of patients discontinued treatment because of laboratory abnormalities.

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On Assignment

"There's something about Venice," insists Assistant Editor ERLA ZWINGLE, "that makes you feel like you could be somebody else." Masked in silk flowers, Erla attained that transformation at a palace ball during Venice's famous Carnival, while working on the article in this issue. "Of course," she says, "the Venetians are only interested in being themselves. What could be better? They're used to the beauty of the place; they grow up kicking soccer balls against 14th-century buildings."

Erla grew up the daughter of English teachers. "In our home it was always literature, not journalism," she says. "It never occurred to me that writing could be someone's profession." After attending four colleges, "every year a different major," Erla earned an art history degree from the State University of New York at Albany. Following stints as a secretary and travel agent, she finally chose journalism. "I'm incorrigibly curious about everything," she says. She worked

IAN ABELL, NGS

her way up to managing editor of *American Photographer*, later freelancing for and then joining the staff of NATIONAL GEOGRAPHIC.

"You don't want to bang into these walls," cautions freelance photographer ENRICO FERORELLI (below), shooting the precious Bonampak murals at close quarters for this issue.

"The place is magic, but it's so isolated; we had to fly in supplies from the States, a gas generator, everything." Horses grazed on the tree-studded runway near the photographer's camp; before landing, incoming planes had to make a low pass to scare them off. "I'm a pilot myself," says Enrico. "I was concerned about ever getting home."

Raised in Rome, Enrico graduated from the University of Naples Law School and passed the bar exam but had already decided to pursue photography. Fluent in five languages, he worked in Time, Inc.'s Rome bureau as a photographer's assistant, then began his own globe-trotting freelance career. "My parents were always supportive of my photography," says the New York-based photographer, "but now, when I complain to my mother about money, she tells me, 'You should have been a lawyer!'"

JOHN ECHAVE, NGS

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Geoguide

A BOY DARTS IN FRONT OF A FEARSOME BUT FUN SERPENT (LEFT) CARRIED IN A STREET PARADE AT A FESTIVAL IN IQUITOS, PERU, A CITY ON THE UPPER REACHES OF THE AMAZON. DOWNSTREAM, DARING YOUNG DIVERS (BELOW) COOL OFF FROM OPPRESSIVE HEAT AND HUMIDITY WHERE THE RIVER LEAVES PERU AND COLOMBIA TO START ITS LONG JOURNEY THROUGH BRAZIL.

AMAZON

• The 4,000-mile-long Amazon River winds its way across South America from the snowcapped Andes to the Atlantic Ocean. It averages about three miles an hour on its journey. Judging from the graph on page 13, after how many miles does it become less steep? Why does much of it have a chocolate brown color?

• Many people regularly use the Amazon as a river road to travel from place to place. For what other purposes is it used?

• Children can make a topographical map of South America using common household items. With an atlas or a globe as a guide, draw the continent on a large sheet of paper. To create the Andes, paste on crumpled construction paper or conical chocolate candies. Ribbon can represent the main stem of the river; blue thread can be taped down to show tributaries. Referring to the map on pages 12-13, cut out squares, circles, diamonds, and triangles to represent the natural resources of the Amazon Basin; make a map legend to explain the symbols. Then add the Equator and compass directions.

• The Amazon and its tributaries make up the world's largest river system. This watershed is outlined on the smaller map on page 12. Just how vast it is becomes clear in a comparison with the 48 conterminous U. S. states. With the map on page 12 as a guide for approximating, use string to outline the boundary of the Amazon Basin on a world map or globe. Take the length of string from South America and lay it in a rough circle over the 48 U. S. states. About what percentage of the land is enclosed?

• The mouth of the Amazon River is about a hundred miles across. Discounting islands and the strong current, how long would it take to cross it by boat traveling at five miles an hour?

BOTH BY ALEX WEBB

USE THE GEOGUIDE PAGE ALONG WITH THE ARTICLE "AMAZON: SOUTH AMERICA'S RIVER ROAD" IN THIS ISSUE TO HELP CAPTURE THE INTEREST OF YOUNG READERS AND STIMULATE DISCUSSION WITH THEM. GEOGUIDE IS FEATURED FOUR TIMES A YEAR.

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Technology changes so quickly, it's only natural to wonder whether the computer you buy today will be obsolete tomorrow.

That's why Apple designed the Macintosh® Performa® to work every bit as well tomorrow as it does today.

You grow with your Performa.

Macintosh Performa comes with all the software you're ever likely to need—enough to write letters, do a household budget, bring work home from the office and more.

Because it's a Macintosh, you'll find that Performa is easy to use. Learning games, a dictionary and a multimedia encyclopedia can help your kids from the first day of kindergarten through the last day of college.

If your interests grow or change, thousands of different programs are available to meet your needs.

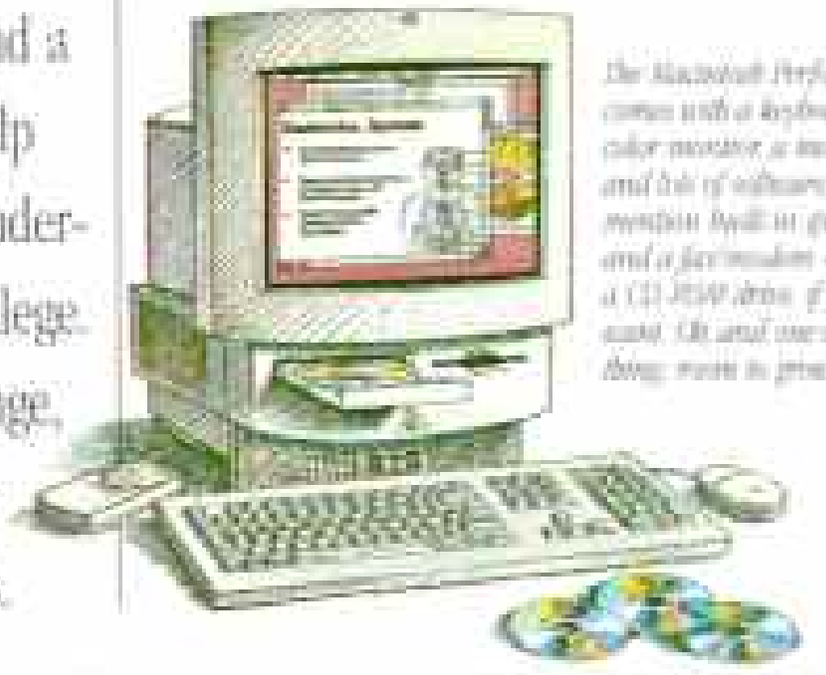
Plus, since more homes and schools use Apple® computers than any other brand, you have access to the newest, most exciting software.

Performa grows with you.

Apple has a unique plug-and-play philosophy that makes it easy to add capabilities to your Performa—today, tomorrow, even years down the road.

What does plug-and-play mean? Exactly what it sounds like. When you want to add a printer, just plug it in. If you need more storage space, just plug in a hard drive. And so on.

There are no cards to fool with.



The Macintosh Performa comes with a keyboard, a color monitor, a mouse and lots of software, and its monitor built in (modem and a fax modem—even a CD-ROM drive, if you want. Oh and one other thing: room to grow.

There are no complex CONFIG.SYS or AUTOEXEC.BAT files to modify. No other computer makes it this simple to add what you need.

You can also add extra memory, if you need it. You may even want to upgrade your Performa to the sizzling new PowerPC™ chip (making it virtually impossible to outgrow).

And every Performa comes with a year of in-home service and a lifetime of toll-free telephone support (making your future virtually worry-free).

All of which means that year after year, your family can enjoy the kind of power you buy a computer for in the first place. The power to be your best.®

Performa®

The Family Macintosh