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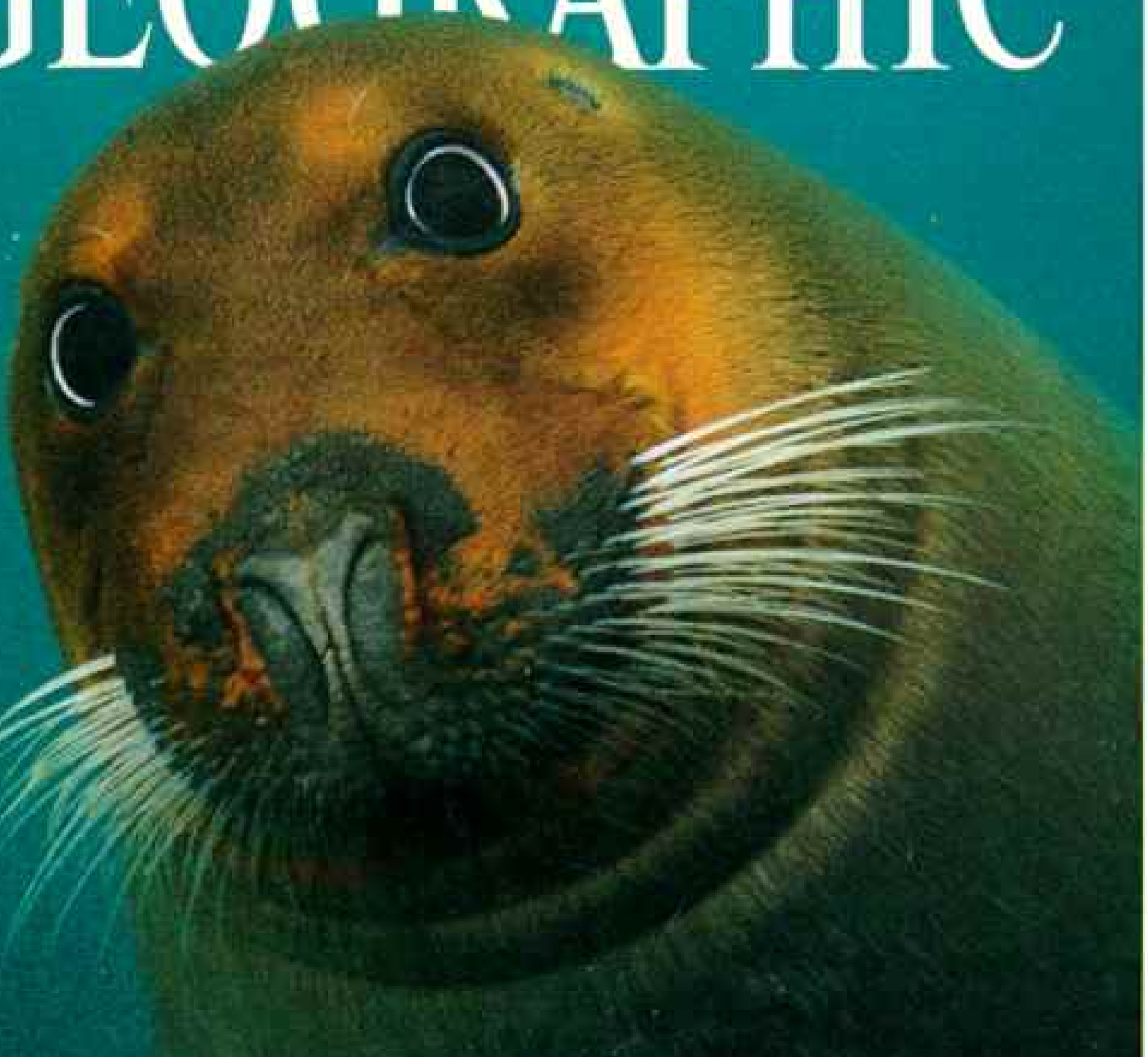
# NATIONAL GEOGRAPHIC



## BEARDED SEALS



OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

# NATIONAL GEOGRAPHIC MAGAZINE

# Boom Times on the Gold Coast of China

A riotous growth of skyscrapers sprouts in the hothouse city of Shenzhen, the gaudiest fruit yet of China's experiment with an open economy. Hong Kong, the model for all the upstart towns on the Pearl River Delta in southern China, lies just across fishponds, at middle right. As the world braces for China's take-over of the wealthy British colony on July 1, both sides find that their economic fates are already tightly entwined.

Places to go, things to buy: Nowadays the Chinese have money to flaunt. They pay to visit Window of the World, a theme park in Shenzhen that features miniaturized tourist sights, like Moscow's St. Basil's Cathedral (left). Or they rush around with cellular phones (right), a must for new capitalists.

By MIKE EDWARDS ASSISTANT EDITOR

Photographs by MICHAEL S. YAMASHITA

"TRY THE COBRA," Chin Lung Fei urged, reaching with his chopsticks to serve me a chunk of flesh baked the color of honey. I had just tried the five-step snake, a Chinese kin of the rattler. The name means that after it bites, you take five steps and die.

I had already finished a serving of snakeskin with peppers, and even managed to down a small glass of snake semen liqueur. This is an elixir of which Chin Lung Fei, a tall and well-built man, is especially proud. "It is good for a person with a weak body," he said. Regarding my physique with a sniff, he refilled my glass.


When I met Chin Lung Fei in the Pearl River Delta of southeastern China's Guangdong Province, he introduced himself as the "King of Snakes." Part herpetologist and part Barnum, the king is proprietor of a Medusa-headed theme park, complete with a stage show in which a brave fellow pats cobras on their hooded heads. His restaurant is packed, for snake is a delicacy to Chinese, and many believe that snake parts and tonics will restore vigor and even cure various diseases. Some check into his sanatorium for extended snake-diet therapy.

The king expects to become rich, and most likely he will. Thousands of

entrepreneurs are flourishing on the Chinese side of the Pearl Delta.

In the People's Republic of China that I remember from my first visits nearly two decades ago, life was guided by sternly anticapitalist shibboleths. But as China's leader, Deng Xiaoping, sought to stimulate the economy, he sanctioned a development strategy called "socialism with Chinese characteristics." Would-be entrepreneurs soon divined what that meant: capitalism. Indeed, capitalism spread rapidly in coastal China, conjuring visions of a vibrant "gold coast" stretching from North Korea to the Gulf of Tonkin.

With cash and managerial skill pouring in, especially from Hong Kong, the Chinese side of the delta has exploded into China's biggest export producer, turning out goods worth 36 billion dollars a year. Nearly one-third of all the goods that China ships abroad come from factories humming in this modest wedge of land extending upriver some 60 miles to the provincial capital, Guangzhou, or Canton, as foreigners long called it (map, pages 12-13).

Things right around you were probably made in those factories: the shirt on your back, perhaps, or your children's toys. Barbie is a delta product, as are Mickey Mouse and the Ninja Turtles. The computer on your desk may contain parts assembled by young women in a dust-free delta room.

With the return of British Hong Kong to China scheduled for midnight on June 30 (article, page 32) and the handover of Portuguese Macau to follow in 1999 (pages 30-31), I took a long look at the gold coast that the delta has become. I began in Hong Kong, the principal engine that drives the delta's development. Every corner in Central, the main business district, seems to hold a bank, and every hotel lobby seems to harbor deal makers who punch calculators and speak into cellular phones while examining goods—shirts, perhaps, or plastic toys—offered by hustling factory owners. Though some Hong Kongers fear that the handover will usher in restrictions on freedoms and crimp their laissez-faire economic system, others said they were not concerned about the future or declared that unity will create an even mightier Pearl Delta powerhouse.

And still others know that the handover means it's time to go. Jimmy McGregor, a trim, white-haired man of 73 years, is one of those. He invited me to meet him in the Hong Kong Club, the most genteel bastion of British wealth and influence. Once housed in a building lavished with arcades and turrets, the club now occupies four floors in a glass skyscraper.

When I got to the club's restaurant, McGregor was thumbing a magazine with photographs of houses for sale in Scotland. "I've been here 46 years—I hardly know my relatives in Scotland now," he said. As deputy head of the Department of Commerce and Industry, McGregor played a role in Hong Kong's growth. He still serves the territory as a member of Governor Chris Patten's Executive Council, an advisory body that will vanish, with the governorship, at midnight June 30. "And whatever influence I have stops dead," he said. "It's like a door closes. The Chinese don't want colonial dinosaurs."

Jimmy McGregor knows it's time, but. . . .

"My life has run like a thread through this place," he went on. "I fought for what's best. Look at this huge modern city with more than six million people and a lifestyle better than some of the developed countries." He gazed through the club's windows. Central's towers seemed to push against the glass. "I feel a part of it all," Jimmy McGregor said. "And now am I to go to some other place and watch the grass grow?" He answered his own question. "I know—it has to be done."

AS A REAL ESTATE DEVELOPER, Lee Shau Kee was also involved in Hong Kong's spectacular growth, but he has no plans to go anywhere except, literally, up—higher into the Hong Kong skyline than any developer has yet reached. When I met him, in a wood-paneled office, he had recently announced that he would become a partner in a huge real estate project that will include a

Frequent contributor MICHAEL S. YAMASHITA teamed up with author MIKE EDWARDS for "Joseph Rock—Our Man in China," in the January 1997 issue.

**THE GREAT INDOORS** While parents shop, future consumers play at the glittery Qian Cun department store in Guangzhou, capital of Guangdong Province. Toys are us, China can rightly say; led by Guangdong's factories, China supplies 40 percent of playthings sold in the U.S.

**NEON NIGHT**
A bright darkness falls over Shenzhen, which since 1980 has gone from a farm town to a clamorous 24-hour city of three million people. The army of newcomers includes large numbers of workers from the interior. The rural folk make city driving a hair-raising trial with their panicked attempts to cross the high-speed roads.

On the road to Guangzhou a horizon of new housing springs up as fast as the crops tended by Hong Jiang Zhong (bottom). He rents the plot from landowners now too rich to work their fields.

90-story tower—a five-billion-dollar vote of confidence in the territory's future.

What about the handover? "I don't see it as an issue," he said. "Hong Kong is going to be the same as now or even more prosperous."

Lee, who is 68, never asked to join the Hong Kong Club (it has had Chinese members since about 1950). He made his fortune outside its old-boy network and without fluency in English. He spoke through an interpreter and seemed shy, especially when I asked if, as the newspapers sometimes say, he is the richest taipan in Hong Kong. "Oh no, several are richer than I am," he replied. Financial experts, however, say that among Hong Kong's 20 billionaires, Lee stands first with holdings worth more than 12.5 billion dollars.

Lee explains his success simply: "Buying at the bottom and selling at the top was very important." And with Hong Kong property values ascending for 40 years, the top kept rising. Today Lee's companies own much of Hong Kong's choicest real estate as well as utilities and ferry lines.

Economic power in Hong Kong long ago began to pass from British traders and bankers to rising Chinese taipans such as Lee. Some of these businessmen have invested in China out of sentiment, but many more have done so because they saw the gleam of profit.

And on the Chinese side of the delta they feel at home. Most of Hong Kong's investors and industrialists have roots in Guangdong Province and speak its language, Cantonese. Lee Shau Kee came to Hong Kong from Guangdong at age 20.

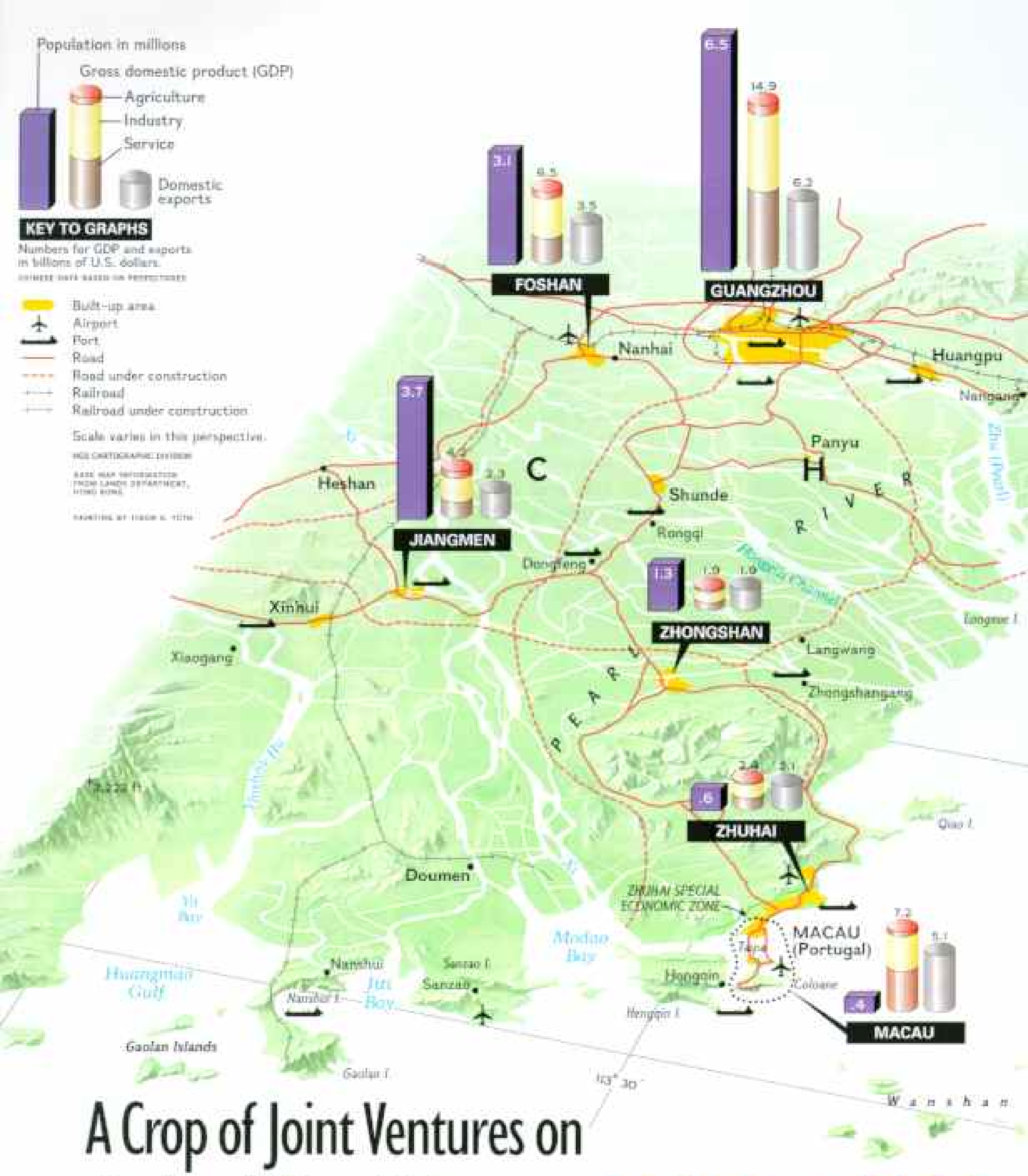
Another transplanted mainlander is Horace Nip. I met Nip one day while he was busy raising capital for new ventures in China. "Going back to China, we stand in a quite favorable position compared with foreigners," he said. "We understand the culture." Nip's company, Wai Kee Holdings, has funneled 240 million dollars into the delta, some of it provided by U.S. investors, to construct 200 miles of highway. Until now, few roads joined the villages that had burgeoned into manufacturing centers. Wai Kee expects to make a profit from the collection of tolls.

Nip says Guangdong officials are more amenable than the bureaucrats of Beijing when it comes to signing deals that guarantee a handsome return to investors. "They don't like an investor to make excessive profits," he explained, "but a 20 percent return every year is acceptable to them."

Though companies from the United States, Taiwan, Japan, South Korea, and Britain, among many others, have joined the rush to the delta, Nip believes Hong Kongers will stay in the driver's seat long after the handover.

ONE DAY I stood in a police tower high over the Man Kam To border crossing, where Hong Kong and China meet. The traffic looked like two thick ropes with a huge knot in the middle. Backed up for miles, more than 10,000 trucks wait to cross daily.

Then I went to the checkpoint below, where Officer Tony Yeung of the Royal Hong Kong Police was lying on a pad, peering under the trucks, looking for "II's"—illegal immigrants. Every day the police pull out several illegals trying to reach Hong Kong to find work or perhaps to engage in crime.




# A Crop of Joint Ventures on the Pearl River Delta

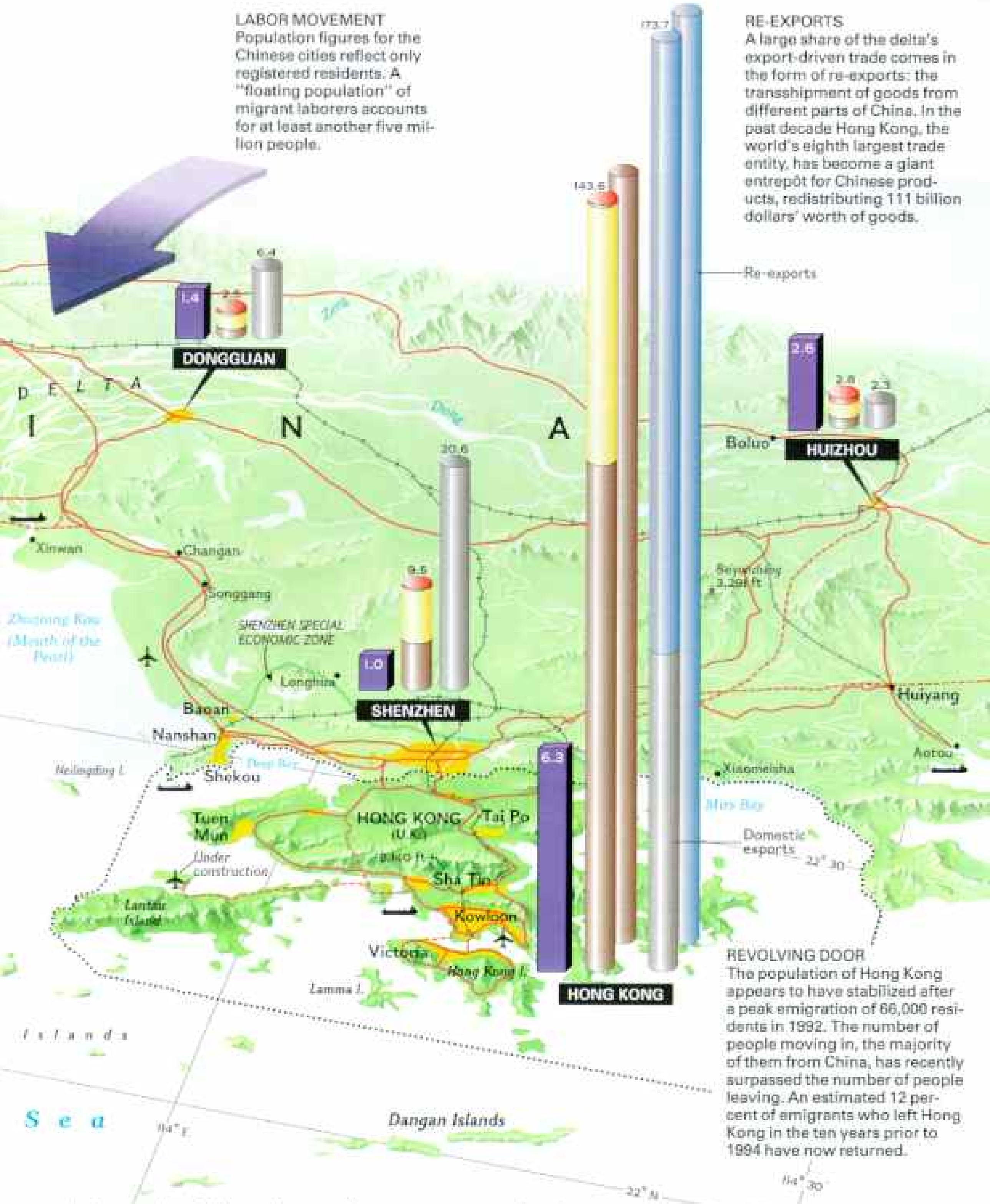
South China

"To get rich is glorious," proclaimed Deng Xiaoping, and no area of China has taken the senior leader's exhortation more to heart than the Pearl River Delta, the most recent center of Asia's industrial revolution. Since Deng announced plans to import capitalism and create in 1980 the Special Economic Zones of Shenzhen and Zhuhai, Guangdong Province (whose capital, Guangzhou, was long known in the West as Canton) has mushroomed into a world export center. Its labor-intensive factories manufacture everything from computer keyboards and dishwashers to leather coats and Mighty Morphin Power Rangers.

Foreign investment from neighboring Hong Kong has driven the explosive growth

LABOR MOVEMENT
Population figures for the Chinese cities reflect only registered residents. A "floating population" of migrant laborers accounts for at least another five million people.

RE-EXPORTS
A large share of the delta's export-driven trade comes in the form of re-exports: the transshipment of goods from different parts of China. In the past decade Hong Kong, the world's eighth largest trade entity, has become a giant entrepôt for Chinese products, redistributing 111 billion dollars' worth of goods.




in the region. Taking advantage of cheap land and labor in China, Hong Kong has moved most of its manufacturing capacity into Guangdong. More than 80,000 Hong Kong-related enterprises operate in the delta region. The Hong Kong ventures employ three million people.

Money flows the other way too. Some 1,800 mainland Chinese companies have set up shop across the border, giving China, still ruled by the Communist Party, major stakes in the construction, shipping, and trade industries of capitalist Hong Kong. Pragmatism and profits overcome ideology in this powerful economic alliance. As an old saying goes, "Hong Kong and Canton are as close as lips are to teeth."

REVOLVING DOOR
The population of Hong Kong appears to have stabilized after a peak emigration of 66,000 residents in 1992. The number of people moving in, the majority of them from China, has recently surpassed the number of people leaving. An estimated 12 percent of emigrants who left Hong Kong in the ten years prior to 1994 have now returned.

**VEGETARIANS BEWARE** For all the French and Italian eateries debuting in southern China, barbecued rat and dog still hang in prominent display at a Guangzhou restaurant. Among photographer Mike Yamashita's memorable Cantonese meals was a feast of silkworms, black beetles, and rats.

China has told the police that it wants border checks to continue after the handover, so Hong Kong isn't overrun by job seekers. This underscores a grim fact: Though five million jobs have been created in the delta, China's legions of unemployed have by no means been blotted up. Some travel from poor provinces a thousand miles away to find work.

On its side of the border, China bars uninvited job seekers from entering the Shenzhen Special Economic Zone, fearing that this highly successful industrial district could also be swamped. Only workers with government-granted permits—issued because they have needed skills or perhaps because they have connections—may live in the zone, which was created in 1980 to lure manufacturers with tax concessions and cheap land leases.

It was hard for me to believe that Shenzhen had been a dreary farm town before the special zone was established. Today it is a city of three million people. Not only is the city brimming with factories, but, copying Hong Kong, it also sends up office and apartment buildings in bold configurations: sloped, stair-stepped, beveled, barreled, double-barreled. One tower soars to 68 floors.

A billboard declares, "Love Shenzhen as Your Home," an acknowledgment that almost all the residents came from somewhere else. In Shenzhen you never see an older person sweeping the sidewalk, a common sight in traditional China. Shenzhen is a place for the young—the average age is probably 25.

"This is almost a dream come true," a woman said of her job as assistant to a salesman with international customers. "In the factory where I used to work, the bosses had nothing to do all day except smoke cigarettes and read newspapers."

**NEW ORDER** Fast learners at fast food, diners dig into noodles and burgers and watch Hong Kong TV at a Shenzhen food court. Shenzhen is not yet Hong Kong's double, says a frequent visitor. "There's a big drop-off in the quality of food, construction, architecture. It's the good, the bad, and the ugly."

The boring routine of state factories has driven many ambitious workers to Shenzhen. But money is the main attraction. I met workers earning as much as 1,500 yuan a month, about $200—not a lot by U.S. standards but more than a professor's pay at Beijing University. A middle-level manager's pay might be $400 a month, plus a comfortable apartment for only token rent.

Just off Changan Street a parts factory belonging to Compaq, a U.S. computer company, sits next to Konka, a Chinese electronics giant, whose 2,300 workers assemble 500,000 TV sets a year, some for China, others destined for the United States, Europe, and Brazil. Like most companies in the zone, Konka is a joint venture. A Hong Kong firm helped start it and owns 36 percent of the stock.

In an assembly room the size of a football field, television cabinets, picture tubes, and other parts passed before blue-smocked workers who fitted, tightened, and soldered. At the final testing bench I watched Yang Yu Hui turn on a set and swing a soft mallet against it several times, as if banging a drum. "To see if the connections are solid," he explained, sending another survivor of his drumroll trundling on its way.

"Manpower costs are very high in Shenzhen," a manager said. And price competition in the Chinese TV market is fierce. Konka plans to move its factory from the zone farther into China, where workers can be hired for $60 to $70 a month.

While lowering production costs, Konka will implement national policy; China wants labor-intensive companies to create jobs in interior provinces while the coastal regions seek to attract more sophisticated enterprises.

Enterprises like Analogic Scientific, Inc.,

situated at the zone's western edge where a fishing village once stood. Analogic's assembly room is a quiet place with only a handful of workers. They thread bundles of electric wires into tall metal cabinets, the brains of $500,000 magnetic resonance imaging machines, or MRIs, that are used in medical diagnoses.

Analogic's manager, Tao DuChun, had been a research physicist in Beijing. "I was just writing research papers," he told me. "I didn't think that was very useful. Here I can make a real contribution to China."

Tax incentives—no tax at all in the first three years and then rates substantially lower than China's 33 percent maximum—attracted the company. But taxes weren't the only factor. "If we had chosen Beijing as our site," Tao said, "we would have spent years obtaining the necessary bureaucratic approvals. The people here got this factory ready for us in one year."

No doubt freedom from bureaucratic interference also explains why a shop dealing in pirated music tapes and compact discs flourished for a time in a highly public place in Shenzhen—above the McDonald's on busy Changan Street.

"You could buy a Michael Jackson disc for about one dollar," a young woman told me.

"A legitimate disc would cost about $20." After piracy became a hot trade issue between the United States and China last year, authorities finally closed the shop, along with a dozen or so Guangdong factories that produced illegal tapes, discs, and software.

FREE ENTERPRISE takes another guise as night brings crowds to restaurants and nightclubs. Touts hand out cards advertising "massage parlors." But prostitution isn't the most serious offense that has followed the flow of cash to Shenzhen: Several entrepreneurs have been kidnapped for ransom.

"To be a businessman here involves some risks," acknowledged Xia Chunsheng. "In the evening I don't go to a public place alone." Xia travels in an expensive German car with bulletproof glass and a chauffeur who discreetly doubles as a bodyguard.

Xia and his three brothers transformed their small lighting-fixtures business into a major company, Gold Lighting. The name could refer to the luster of profits, if I judge by such Gold undertakings as providing lights for Shanghai's airport terminal and selling $5,000 crystal chandeliers from France to Shenzhen's tycoons.

Xia wears tailored suits and enjoys expensive restaurants. In one of them we worked through a lunch of eight dishes, including slivers of lobster heaped in a boat-shaped bowl of ice. Afterward I asked him what the relationship of Shenzhen and Hong Kong would become after the handover.

"Shenzhen will catch up economically," he said. "These two are like one reservoir, and the border is a dam between them. The water on the other side is high, and here it is shallow. Once we break the dam—the border—the water will be at the same level on both sides. There will be even more development in China because land costs are still four times higher in Hong Kong."

This assumes that hard-liners won't take control of China and restrict capitalism after Deng Xiaoping, who is 92, passes from the

**MADE IN CHINA**
Scoring points for China's 40-billion-dollar export market to the United States, an assembly line of women in Zhongshan glue sole after sole onto Reebok basketball shoes.

With the real comes the fake. In a gesture to appease American trade officials, heavy machinery crushes pirated copies of mostly U.S.-made videos, software, and CDs (right), all confiscated from vendors in Shenzhen. Says Robert Holleyman, of the Business Software Alliance, an antipiracy group, "Sadly, it's just the tip of an iceberg."

**COMPANY MEN**
Under flags of drying laundry, new employees of the China Bicycle Company shout out a worker's anthem during morale training. Living six to a room in Longhua, they earn a hundred dollars a month, three times the rural mean wage.

**LEARNING FACTORY**
With assembly-line precision, students at the exclusive Guangdong Country Garden School file back to classrooms after morning exercise. About 2,500 students, some young enough to need naps (below), attend the private boarding school, established in 1994 as one of the first of its kind in China. Tuition is a onetime payment of $40,000, ideally to be reimbursed upon graduation. The school invests the money. The economics are textbook simple: No profits, no reimbursements.

scene. Another possibility that can't be ignored is that Shanghai, long the capital of heavy industry, could emerge as China's major financial center, to Hong Kong's distinct disadvantage.*

BEYOND SHENZHEN, I took a Hong Kong-financed toll road—six lanes of concrete—into Dongguan township, which, at nearly a thousand square miles, is more like a county. Factories and apartment buildings rose out of earth scraped bare and littered with construction debris, but plots of rice and onions reminded me that this had recently been farm country.

Some of Dongguan's former villages, swollen by explosive growth, are beginning to look as Shenzhen must have 15 years ago. But in this part of the delta there are no keep-out signs posted against migrants looking for work. In fact, Dongguan depends on the labor of 1.5 million migrants from interior China. These *wailai gongren*—literally, external coming workers—outnumber the Dongguan population, with more arriving all the time. "When I need workers," a sweater factory manager said, "I just put a sign outside the gate."

Collective farms, one of the foundations of the communist system, have been abandoned, and many people who had spent their lives bent over rice fields have become businessmen. "I worked in the fields until 1985," a graying man named Chen Kuan told me in Changan. A dirt-road village 15 years ago, today it's crowded with the brick buildings of hundreds of manufacturers. Chen's life changed when a relative in Hong Kong gave him cash to buy a small truck. "I made money hauling goods," he said, "and with that I bought a bigger truck." That grew into five trucks that stay busy hauling materials for more construction.

"You see my new house?" he asked. I was invited into one of the several dozen two-story homes occupying land that Chen's farm brigade once tended. "When I was a farmer," he added, "I lived in a house about the size of the dining room here." In other words, an entire house measuring about 10 by 15 feet.

The local government leased the land to industrialists, using the cash to build roads, schools, and power plants. Officials concede that the loss of large chunks of agricultural land is worrisome; China is always concerned about its food supply. But industrial development goes right on.

Some officials claim to be concerned about the environment too. "We rejected a metal-plating company because it would be a serious polluter," one official said. Authorities worry, however, that with hordes of migrant workers swelling the population, sewage treatment is inadequate.

The government gives former farmers a share of the proceeds from factory leases, in Chen's case an annual payment of about $335. In China that's more than the average working farmer earns in a year.

"It's just pocket money," was the contemptuous reaction of Li Chin Di, who has also given up farming. Li lives in a four-story house and drives a luxury car. He builds factories and manages one that makes plastic toys and

*See "Shanghai, Where China's Past and Future Meet," by William S. Ellis, March 1994 issue.

**ANY VOLUNTEERS?** Imagine hundreds of snakes, some poisonous, winding themselves around your body. That's entertainment at the wildly popular Flying Dragon snake farm in Panyu. The operation sells snake-based meals and traditional medicines. Says owner, Chin Lung Fei, "We treat snakes as friends."

souvenirs. "My profit is about $100,000 a year," he boasted casually.

I was beginning to wonder if any communists were left. But then a delta citizen enriched by land deals gave me a ride in another pricey automobile. As we cruised along, he told me he was a party member.

"What does the party do today?" I asked.

"Serves the people," he answered blandly, repeating a slogan of Chairman Mao's.

The people served, it seems to me, are often those who have *guanxi*, or connections, with government and party officials. Some conservative leaders in Beijing have condemned capitalism's unbridled growth, and no doubt they would denounce my party-member friend and his fancy car. But, as another delta citizen said, "We are a long way from Beijing."

SEVERAL FOREIGN FIRMS in Dongguan train unskilled migrants for sophisticated tasks. A Hong Kong electronics company employs them to assemble computers. But most Dongguan enterprises turn out products that require little skill, such as clothing, Christmas decorations, and toys, most of which go to the United States.

Migrants make Barbie dolls in a low brick building in Changan. Barbie lives a cloistered life: Mattel, Inc., forbids visitors. Looking in from the gate, I glimpsed stacks of Barbie cartons being forklifted onto a truck.

I had no difficulty entering the Cha Shan Garment and Toys Factory. Lin Tao Zhu, the director, is proud of this town-owned enterprise, which she has seen grow from a few seamstresses to 2,800 workers. From a storeroom Lin fetched a Cabbage Patch Kids doll, the toy rage of the early 1980s. "My favorite," she said, hugging it affectionately. "Our factory grew up on this doll. We produced it for three years, and our employees worked overtime every day."

In a big spartan room, dozens of sewing machines hummed as seamstresses stitched swatches of orange cloth. As the pieces advanced from one worker to the next, each adding a part—ears, paws—I was finally able to identify the animal taking shape: Tigger, the tiger friend of Winnie-the-Pooh.

Several men and women brushed stray threads from stuffed Mickey and Minnie Mouse dolls, spiffing them up before shipment. One held up an animal and asked, "Is this a kind of dog?"

"Yes," I said. "His name is Goofy."

The questioner, Qi Zhu, a bespectacled young man of 23, had traveled 500 miles from east-central China to find work. After a year in the Cha Shan factory he was earning $80 a

month. The factory deducted $10 of that for his dormitory bed and meals.

Qi's wage is more or less typical in Dongguan. Qi doesn't see it as exploitation. "I intend to stay a long time," he said. "I send money to my family, and I keep some. Maybe I will use it to study. Some people save to start their own businesses."

Most of Dongguan's workers came from rural villages where little if any work was to be had. "If we had lived in towns where we could get jobs, we wouldn't be here," one said.

All the dozen migrants with whom I talked said they sent money home. Officials estimate that nearly one billion dollars flows annually from Dongguan to the Chinese interior. At Qi's rate of pay, that represents about seven months' wages per migrant—and demonstrates an amazing frugality.

"We're here to earn money," a woman named Ping said, "but I also came because I wanted to see the outside world." After three years in Dongguan, she added proudly, "I'm becoming independent."

I met Ping in a clothing factory's four-story dormitory; all Dongguan's large enterprises provide dormitory space. The narrow room that I entered was crowded with eight bunks. However, none of the women complained, since most Chinese are used to tight quarters.

**FRINGE BENEFITS**
Entertaining clients of an air-conditioning company as they celebrate a profitable year, fashion models at a Guangzhou banquet display the latest in leather evening wear. Leaders in Beijing have lectured against the money worship of the south, but these days few entrepreneurs are listening.

One of the women, Yi Lin, wore a fetching blouse, and since it was Saturday, I asked if she was going to a party in town. "I just decided to dress up," she said, but then added, "It's hot outside—maybe I'll just stay here."

Lu, one of her roommates, said: "It's very hard to have contact with town people. We don't understand Cantonese." And apparently these Mandarin speakers felt there was little point in making the effort. "The town and the workers are different communities," Lu added. Some young migrants find mates in Dongguan, but essentially they are like migrant farmworkers in the United States: needed but socially apart; here today, gone tomorrow.

IN GUANGZHOU I went to school. "Backyard," said the fourth-grade teacher, a young Canadian.

"Backyard," the students repeated.

"Washing machine."

"Washing machine," came the chorus.

"Laundromat. . . ."

As I listened outside that classroom at the Guangzhou Huamei International School, on the outskirts of the provincial capital, it struck me that few people in the delta had ever enjoyed the space of a backyard, and that for many a washing machine is still a novelty. "The parents want their children to be able to travel and study abroad," Ye Liqiang, the school's vice principal, said, explaining the unusual vocabulary of the English lesson.

Cantonese have long been more worldly than other Chinese. They have more kin abroad than any other group, because Hong Kong was a stepping-stone out of China. In the 1860s, for example, Cantonese helped build the Central Pacific, the western section of the first U.S. transcontinental railroad.

Catering to the newly rich, dozens of private schools that emphasize English have opened in Guangdong Province. The Guangzhou Huamei International School was founded by four Chinese educated in Canada. "Tuition" is a onetime deposit of 250,000 yuan, about $33,300. Vice principal Ye said parents readily come up with the cash. "When the student graduates, we will return their money," he said. "We simply keep the interest. Even if we just put it in a bank, the interest rate is about 12 percent." Not every school is so conservative. Some that adopted this novel scheme foundered after investing tuition deposits in risky real estate deals.

**GREENER GRASS**
Even as the buildings of Shenzhen (right) grow higher, the most imposing structure for many residents is the prickly wire border that shuts them off from Hong Kong. Some 35 mainland Chinese are caught each day trying to sneak across the border by land or water in search of better jobs or greater political freedom. Among the arrested: two dejected stowaways (below) found on a junk in a Hong Kong harbor.

After Hong Kong reverts to China, the fence will remain standing to restrict illegal entry.

WHILE CRANES RAISE 40-story towers over Guangzhou, old neighborhoods are being gashed open for the construction of subways. An estimated 1.5 billion dollars will be spent on underground rail lines to relieve acute congestion brought on by the city's emergence as both a manufacturing center and a regional base for hundreds of foreign companies. Guangzhou's population is reckoned today at 6.5 million, making the city China's fourth largest, after Shanghai, Beijing, and Tianjin.

The Pearl River, which divides the city, is no jewel. Its water is a flotsam-speckled soup. But the Pearl (the Zhu as locals call it) does its share of moving people and goods. I rode a ferry downstream to Zhongshan University. Only a 15-minute trip, it saved an hour of commuting time for my fellow passengers, many of whom boarded with their bicycles. Small

oceangoing freighters tie up at the wharves, and hydrofoils skim down the Pearl toward Hong Kong. But most of the traffic consists of small cargo boats that sink to the gunwales under their loads of stone or brick.

Unlovely by day, the Pearl becomes beguilingly opalescent as night descends. I sat at an open-air restaurant at waterside as couples arrived by motorbike, the popular conveyance of the middle class. Lights streaked the river with the shimmer of skyscrapers and the neon messages of capitalism, while around me wafted delectable aromas.

The Cantonese, it is said, spend a third of their income on food. My guide, Li Hubing, and I shared a table with Shao and Lin, a couple in their 30s. We took turns ordering stir-fried dishes: shrimp, pork with eggplant, greens, noodles, chicken.

I asked about cultural life. Was Cantonese opera still popular? "It's for old people," Shao said dismissively. Lin added, "We go to nightclubs or some place where we can sing with karaoke music."

"Sauna is popular too," Shao said. Sauna? The steam bath of northern Europe, popular in hot Guangzhou? I was skeptical until I visited the Swan Club, where I saw several men, rosy after a steaming, relaxing on cots. One was calling his girlfriend on a cellular phone.

Others had come to the Swan Club for its restaurant, its bowling lanes, or its pool tables. Some went to its nightclub to watch curvaceous women prance about. To belong to the club, an individual must pay a membership fee of more than $5,000. Family membership costs more than $7,500. That hasn't discouraged 1,500 traders, developers, and bankers from joining.

The Swan Club was founded in a renovated factory by Huang Wei Guang, a tall fellow of 35 with an unruly shock of black hair. His first business was a three-table café. "I had no education for this," he said. "I finished secondary school, but I never really reached that academic level." Like many delta entrepreneurs, he grew up during the Cultural Revolution, when Red Guards were smashing China's treasures and persecuting educated men and women. "In school," he remembered, "mostly we studied about how to farm or be factory workers." Now Huang sends his nine-year-old son to one of the new schools that teach English.

BREAKING OUT of the city's tangled traffic, I followed a highway down the Pearl's western bank. Beside the pavement stretched emerald swales of rice. Farmers shaded by wide bamboo hats and wearing rolled-up trousers waded in the ooze. There wasn't a factory in sight.

But old China didn't last long. Soon the road widened and I was in Zhuhai, another Special Economic Zone. Though Zhuhai produces an array of goods, from shoes to circuit boards, it looks more like a resort. Hibiscuses bloomed around the curving bay, which opens on the South China Sea.

"The sea view belongs to everyone," Liang Guang Da, Zhuhai's longtime mayor, said. "We don't allow uncontrolled growth."

Liang—well connected in Beijing—had a free hand in shaping Zhuhai, and he showed himself to be both a mover and a dreamer. "I've never done a small thing in my life," he said. To give this isolated former fishing village wings, he used cash from land leases to build a huge airport. Its terminal was all but empty when I went there; uncoordinated development has oversupplied the delta with airports. Shenzhen has one, Guangzhou is building a new one, and Hong Kong is investing nine billion dollars to build yet another. There is even a new one at Macau, a hop-skip from Zhuhai. Liang is undismayed. Just wait, he insists—as Zhuhai grows, its airport will have plenty of customers.

His even more ambitious project is a toll road to bond the western side of the Pearl Delta with Hong Kong. There would be 40 miles of island-jumping motorway across the river's mouth. "When this is completed," he said confidently, "people from Hong Kong will be able to get here in an hour. Hong Kong will remain the center of trade and finance, but we are rich in land. We have a brilliant future. We will be the most competitive economic area in Southeast Asia." □

**GOING TO THE SOURCE** Dammed up behind a customs post linking Shenzhen and Hong Kong, a raft of trucks prepares to flood into China to pick up cargo. Already each other's main trading partner, China and Hong Kong prepare to find out whether their ultimate merger is good business or bad.

# MACAU waits its turn

**END OF THE RIDE**

Things Portuguese, like Good Friday processions and colonial buildings, will likely persist after 1999 as China takes over the last European enclave in Asia.

Founded in 1557 by Portuguese merchants, Macau today survives on casino gambling. Whether a new airport (map) can draw enough tourists to keep Macau from being swallowed by surrounding Chinese boomtowns is no sure bet.

IN MACAU'S CASINO LISBOA, jammed with hundreds of patrons on a Saturday night, shouts explode at a baccarat table. A player in a black shirt has just won $25,000.

Soon, louder shouts: Wagering another $25,000, Black Shirt has been dealt a seven and a two, a perfect baccarat hand. Croupiers murmur nervously as his chip stacks rise like skyscrapers. Who is he? "China businessman," a casino inspector whispers, adding with a chuckle, "no more communists."

The Chinese government condemns gambling, but that doesn't stop high rollers from going to Macau, on the Pearl River Delta's southwestern rim, from their own delta cities, where casinos are not officially permitted.

And the casinos apparently will be permitted to stay in business after Portugal hands back control of Macau to China on December 20, 1999. After all, legal gaming, a major enterprise for 150 years, yields taxes enough to pay more than a third of Macau's government expenses.


The last European outpost in Asia to be surrendered, Macau is the odd man out in the flourishing delta. A raffish backwater of just 6.5 square miles, it was long ago eclipsed as a trading center by Hong Kong, and it shares little of the industrial throb of China's other Pearl Delta cities. Its own golden age occurred in the 16th and 17th centuries.

Portuguese traders, the first Europeans to round the Horn of Africa, reached the delta in 1513. They had leapfrogged east in stages, founding colonies at Goa on the west coast of India in 1510 and at Malacca the following year. In 1557 a local Chinese official is said to have allowed them to lease land for a settlement on the peninsula that is now the main part of Macau.

It became a hub in a hugely profitable trade network. The Portuguese gathered the products of both Asia and Europe and brought them to China: pepper and other seasonings from the Spice Islands, cotton and muslin from India, clocks and mirrors from Europe. They departed with silks, which were eagerly sought in the Japanese city of Nagasaki, site of yet another Portuguese settlement. The Japanese paid in silver—a commodity more precious than silk to the merchants of silver-deficient China. Some silver also went to the coffers of the Portuguese crown at Lisbon.

The trade network collapsed after 1640. Japan expelled the Portuguese and a Dutch fleet captured Malacca, a key network port. Severed, Macau sank into history's shadows.

Unlike Hong Kong Island, Macau was never formally ceded by China. Portugal more than two decades ago expressed its willingness to give up the territory. An agreement for Macau's return was signed in 1987.

Though many Portuguese residents have departed, China will inherit something of their 440-year presence. Beyond the casinos with their neon and crowds, a few quiet neighborhoods retain the look of Lisbon, with scalloped arcades over sidewalks and shuttered windows and narrow balconies above. Baroque churches that date from the 1600s are a reminder that Catholic priests came with the traders and that Macau was the springboard for spreading Christianity through much of Asia. In other neighborhoods, however, tiled eaves curl up from the roofs of teahouses and temples, an architectural testimonial that most of Macau's 500,000 residents—95 percent—are Chinese.

"The mix of East and West is very interesting," says Carlos Marreiros, himself the product of both worlds as one of 30,000 Macanese, as people of mingled ancestry here are called. He speaks Portuguese at home but in his work as an *arquitecto* often uses Cantonese. Marreiros could legally live in Portugal, but he likes Macau and plans to stay.

Though Portuguese will remain the official language, Marreiros probably will find himself speaking more Cantonese after 1999. As one Chinese citizen remarked, "We don't need Portuguese to get along in the world." □

# HONG KONG

# Countdown to China

**PRIZE POSSESSION** All this—the gleaming corporate headquarters, the famous harbor, the luxury high-rises—passes into China's hands on July 1, when rich, freewheeling Hong Kong reports to its strict new master.

By MIKE EDWARDS ASSISTANT EDITOR

Photographs by MICHAEL S. YAMASHITA

IN THE BUSY WATERS around Hong Kong the patrol craft H.M.S. *Peacock*, armed with a 76-mm cannon, churns through a hazy afternoon—and through numbered days. Vessels of the People's Republic of China will begin patrols at midnight on June 30. That is the hour of the "handover," as Hong Kongers call it, when Britain's last major Pacific colony reverts to China after 156 years under Britannia's rule.

For now, however, *Peacock* is on station, and the Royal Navy ensign fluttering on her stern proclaims: We're still boss here.

"Maintaining our territorial integrity" is the way *Peacock's* skipper, Lt. Comdr. Will Worsley, describes her patrols. "And we will continue to maintain it until midnight, June 30." Then *Peacock* and other ships of the Hong Kong Squadron will be put up for sale.

On June 30, Chris Patten, last of 28 British governors, will leave stately Government House, on the slope of Victoria Peak above the main business district, to set sail for London. The next day an administrator appointed by China will take charge, and Chinese troops will move into the Prince of Wales Barracks beside Victoria Harbour. In the 1950s more than 30,000 British troops were stationed in Hong Kong, but today the number has fallen to just 2,000.

The handover will yield to China a mere speck of territory—413 square miles—but a speck that is dazzlingly successful. One of the world's foremost centers of trade and finance, Hong Kong has Asia's second busiest stock exchange, after Tokyo's. The per capita income of its six million people, now $25,000 a year, surpassed Britain's in 1994.

To China, where per capita income is only $650, these are huge attractions. But the return of Hong Kong is also a matter of national pride. China has not forgotten the humiliation of defeat in the Opium War of 1839-42. Hong Kong Island was ceded to Britain and became the base from which British merchants (along with Americans) plied the malodorous opium trade on China's coast. To China the handover is the *huigui zuguo*, the return to the motherland, an event that will be celebrated with patriotic fervor north of the border.

Many Hong Kongers fear that their capitalist bastion will suffer under Chinese rule. "I think we are going to have severe difficulties," declares a British businessman, "not so much because the Beijing people have any dreadful ideas but because they simply don't know how to run this place." Though China has initiated economic reforms at home, much of its economy remains state controlled, a far cry from Hong Kong's combination of rampant entrepreneurship and minimal government supervision. Personal taxes no higher than 17.5 percent and skyrocketing real estate values have helped create great wealth.

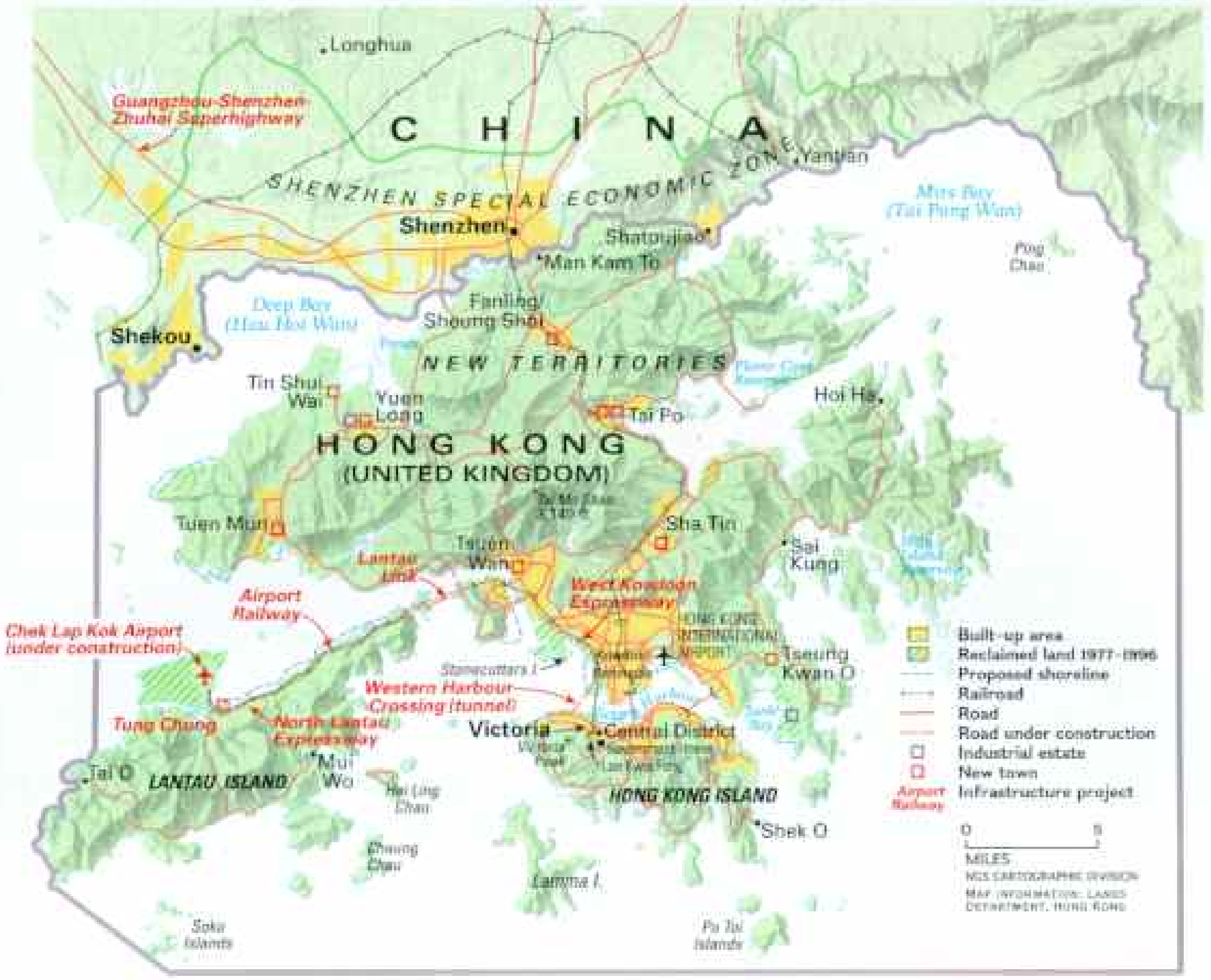
Few places on earth are so ostentatious. While chauffeured automobiles bear businessmen to their offices and clubs, *taitais*—rich wives—stroll through exclusive boutiques, "shopping like crazy," in the phrase of a retailer of European crystal and silver.

After negotiations for the return of Hong Kong were concluded in 1984, China's leader, Deng Xiaoping, proclaimed that China would follow a policy of "one country, two systems"—the former colony could continue its freewheeling ways for another five decades. Deng, however, is now 92 and has not been seen in public for more than two years. The validity of his pledge presumably depends on the Chinese leaders competing to replace him, some of whom are more old-fashioned hardliners than Deng-style moderates.

Polls have shown that the majority of Hong Kongers, if given a choice, would prefer to continue living under British sovereignty or even see the territory become independent. Still, many have expressed friendship for China, and entrepreneurs have tried to encourage a gentle changing of the guard that will not frighten international investors or depress property values and the stock market.

At the same time, brokers say, some businessmen have transferred their savings to foreign markets until they see how things work out. And tens of thousands of long-term residents with foreign passports have departed for

**FOREIGN IMPORTS** Revelers twist and shout at the Madhatters Party, an AIDS fund-raising event let loose in the neighborhood of Lan Kwai Fong, hangout of the young expatriate set. For many old-timers, however, China has crashed Hong Kong's party, triggering a large-scale exodus. Still, the number of foreign-born residents is climbing, many of them working-class British youths in search of jobs. If they get homesick, they can always watch the locals bowl (below) at the Kowloon Cricket Club.




# Reshaping Hong Kong

**GROWTH RINGS** Crowded and gridlocked, Hong Kong has embarked on one of the world's most ambitious land-reclamation projects, which, when finished early next century, will change the face of its harbor and coastline. British governors began reclaiming land from the sea soon after the founding of Hong Kong in 1843; in the past hundred years some 20 square miles of fill have been grafted onto the shore (map, left). The latest and largest expansion, with more than five square miles planned, revolves around the new Chek Lap Kok airport, taking shape on a man-made island. Two suspension bridges, a six-lane expressway, and a high-speed railway, all part of a 20-billion-dollar project, will link the new airport to the rest of the 413-square-mile territory. The congested urban districts, home to four million of the colony's six million people, are also growing outward. A hem of raw land on the Kowloon seafront (above right) will accommodate housing towers and the entry to a third cross-harbor tunnel. On Hong Kong Island, dredging has begun on an extension of the central waterfront. This fill, destined for skyscrapers, will shrink the width of Victoria Harbour, reducing the spectacular space, say opponents, to a mere river.

the United States, Britain, Canada, and other nations.

Most of Hong Kong's countless millionaires and 20 billionaires are Chinese, including the sons and daughters of tycoons who fled to the colony when China fell to communist revolutionaries in 1949.

The communist victory inundated Hong Kong with more than a million refugees. Homeless and hungry, at first they taxed its resources. But among them were numerous textile taipans from Shanghai, China's major manufacturing city. Tapping refugee labor, they transformed Hong Kong into one of the world's most productive makers of cloth and clothing, to the chagrin of mill owners and workers in Britain and the U.S. Soon the industrialists expanded into plastics and such novelties (at the time) as transistor radios.

In the 1980s many of those factories began moving to China, where land and labor were cheaper, and Hong Kong rapidly evolved into a capital of banking, insurance, and trade management, attracting to its proliferating skyscrapers corporations from throughout the world. Many foreign companies used Hong Kong as a conduit for investment in China, and as factories boomed on the mainland, Hong Kong handled their cargoes, becoming the world's busiest port for containerships.

ENGLISH TRADERS began to call at Guangzhou (Canton), on the Pearl River opposite Hong Kong, in the late 1600s. They wanted China's silks and tea, especially the tea. In payment Chinese merchants preferred silver currency over English goods, which they often considered inferior. But with England reluctant to let go of its silver, the traders eventually solved the problem by importing opium from India. Illegally smuggled into China, it lured out Chinese silver, and the traders used *that* to buy their Chinese tea.

China's rulers, regarding the opium trade

with contempt, cracked down on the flourishing drug traffic in 1839, burning a fortune in confiscated opium—or, as it was sometimes called, foreign mud. Britain responded with warships and troops, forcing China to open its ports. China gave up a 35-square-mile "barren island," as Lord Palmerston, Britain's foreign secretary, disdainfully called Hong Kong. British merchants had gained an important base for Far East trade.

Defeated in another war over trade in 1860, China handed over Stonecutters Island and the tip of Kowloon Peninsula, on the mainland side of Victoria Harbour—ceded, like Hong Kong Island, in perpetuity. In 1898 the British demanded another mainland tract, the New Territories, which included nearby islands, a total of 355 square miles, to be leased for 99 years. These additions, it was reasoned, would buffer the thriving colony from outside attacks and give it growing room.

WHEN NEGOTIATIONS on the future of Hong Kong began in 1982—looking toward the end of the New Territories lease in 1997—China insisted on the return of the entire colony. The time had passed when Royal Navy warships could impose Britannia's will on a feeble China. The negotiations concluded two years later with a declaration stipulating that all Hong Kong would become a Chinese Special Administrative Region with "a high degree of autonomy" and its social and economic systems intact for 50 years.

But when China crushed the democratic movement in Beijing's Tiananmen Square in 1989, those pledges suddenly looked suspect. Hong Kong reacted by strengthening democracy. The territory enacted a bill of rights reaffirming such freedoms as assembly, and its legislative council, partly made up of members appointed by the governor, was transformed into a fully elected body.

China was furious, especially when the 1995 elections brought to the 60-member council many lawmakers who were critical of China's human rights record. Beijing condemned Hong Kong's new bill of rights and intends to replace the council after the handover with a friendly body of its choosing. "Beijing wants the legislature to be a rubber stamp," says Martin Lee, leader of the Democratic Party, who predicts that the new rulers will muzzle Hong Kong's press and subvert the legal system that protects individual rights.

**FRAGILE FREEDOMS** Exercising their rights of free assembly and free speech, marchers file through Hong Kong to mark the anniversary of the 1989 Tiananmen Square killings in Beijing, when Chinese soldiers crushed the country's young democracy movement. Hong Kong's riot police (bottom) have traditionally kept to the sidelines during protests. Whether the new Chinese authorities will show such restraint is doubtful. Officials have served notice that "unpatriotic" words and deeds will not be tolerated.

China has good reasons for wanting to see Hong Kong remain prosperous, argues Henry Tang, an industrialist who is the son of one of the Shanghai textile manufacturers who reached Hong Kong as China fell to the communists. "We are much more useful to them the way we are. They can tap into our financial expertise. Also, China has a large stake in Hong Kong already." Indeed, having invested in Hong Kong for years, mainland companies now own property and stock shares worth more than 20 billion dollars.

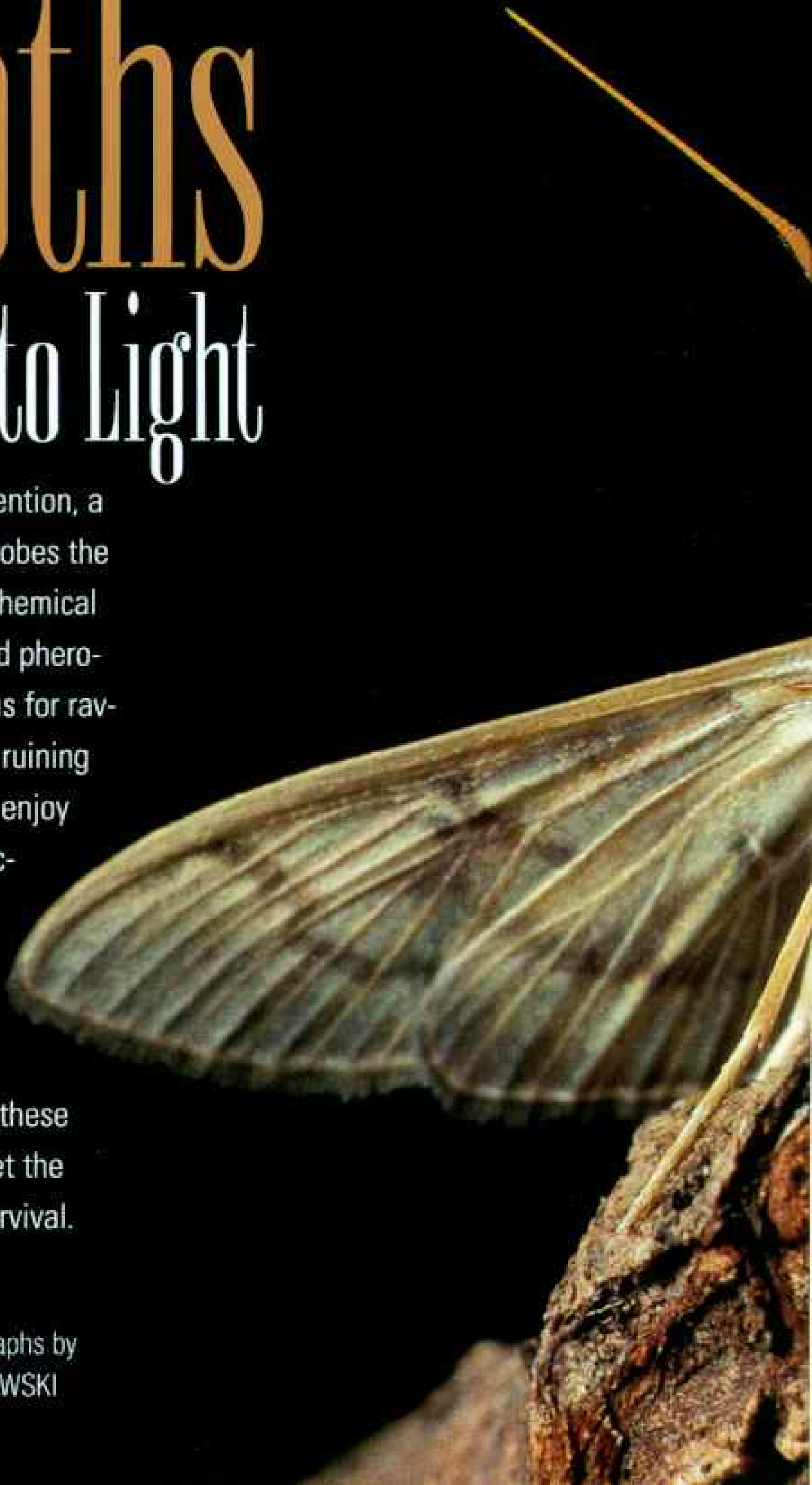
"The fact is, we will become part of China, and we will have to work with China," Tang says. Whether China can work with Hong Kong will depend on how it approaches the task. Hong Kong could be the goose that goes on laying golden eggs. Or it could become the goose that gets cooked. □


CITY
CITY
CITY
招生
英語
招生

# Moths Come to Light

Antennae at attention, a pyraloid moth probes the evening air for chemical love songs called pheromones. Notorious for ravaging crops and ruining woolens, moths enjoy little of the affection lavished on butterflies. But a close look reveals the surprising ways these wily insects meet the challenges of survival.

Article and photographs by
DARLYNE A. MURAWSKI



Arrayed like tanks on review, blue-nose caterpillars half an inch long bristle with defenses. Touch one and it arches up and strikes, delivering painful stings from its spines and irritating burrs from its brown cones.

ACHARIA OPHELIANS; COSTA RICA

Deception is the better part of valor for larval moths, many of which have evolved elaborate disguises to thwart birds, wasps, and other predators. In northern Mexico I spotted a hawk moth caterpillar crawling along a branch. In response to my nudging, it hunched over and inflated its thorax into a snake-like head (below), complete with sparkle in its eyes.

I chanced upon another masquerading larval moth while trekking through a Costa Rican forest. An enemy trying to seize a hairy monkey slug caterpillar (right) is likely to come away with only a mouthful of its fake, detachable legs. The lost appendages—actually extensions of the exoskeleton—will partly grow back on young caterpillars at the next molt.

*XYLOPHANES FALCO (ABOVE); PHOBETRON HIPPARCHIA*

With more than 142,000 recognized species (and thousands more undiscovered, scientists suspect), moths are lords of the lepidoptera, far outnumbering butterflies. Inhabiting nearly every corner of the planet, they come in a welter of forms, some as dainty as snowflakes, others as big as bats. One species native to Central and South America unfurls a foot-long proboscis specially suited for sipping nectar from deep-throated flowers. Another specialist, from Southeast Asia, uses a skin-piercing, stiletto-sharp proboscis to drink its fill of blood. Still others, such as adult luna moths, lack functional mouthparts, living only on energy stored during their larval stage. Breeding is the sole aim of their brief adult lives, and once accomplished, they die.

# Yucca Moths

Keeping a critical appointment with their host plant, yucca moths emerge to mate (top, far left) just as pollen-laden yucca flowers unfold. Mating done, the female climbs atop one of the flower's six stamens (top center) and gathers a cache of pollen, using tentacles tailor-made for the task. Airlifting the cargo to another yucca, she bores into the plant's ovary with the ovipositor on her abdomen (top right) to place an egg inside. She then ascends to the stigma and stuffs some pollen into the funnel (left) to fertilize seeds that grow to become food for her larval offspring.

"It's as if the moths are farming the plants," observes biologist and Society grantee Olle Pellmyr. Such gardening pays obvious dividends for the moths, but for the plants? Pellmyr's cost/benefit analysis shows that the moths' fail-safe pollination service is worth the price of a few seeds.

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DARLYNE MURAWSKI reported on passion vine butterflies in the December 1993 issue.

*TEGETICULA YUCCASELLA*, NORTH AMERICA

*CYDAEMATOPHOBUS*, ARIZONA

*ARTACE*, COSTA RICA

NOCTUIDAE, COSTA RICA

HALISIDOTA, COSTA RICA

*PHRYGIONIS PRIVIGNARIA*,
COSTA RICA

# Night and Day

While most moths fly under cover of darkness, some go about their business in broad daylight. To survive, many diurnal moths, like the three at right, pass themselves off as something fearsome—such as a wasp or a bee—or flaunt lurid markings like warning labels that advertise their toxicity.

By contrast, most nocturnal moths, such as the sampling at left, hide during the day, cloaked in drab colors that blend with their backgrounds. One keeps a low profile by flattening its bark-patterned wings against tree trunks; another holds its abdomen upright, posing as a twig.

In addition to adopting different colorations to fool predators by day, some moths have evolved means to avoid night-flying bats whose diets include moths. Many nocturnal species have "ears," tympanic organs found on the thorax that can detect a bat's echolocation calls and help the moth elude capture.

SYNANTHEDON EXITIOSA, KENTUCKY

MILIONIA, PAPUA NEW GUINEA

HEMARIS DIFFINIS, TEXAS

# Taking Cover

To eat and not be eaten—that's the imperative of a caterpillar's existence. The leaf roller (upper right) reduces its risks of being picked off by predators by silking together a temporary shelter in which to feed and rest. Adopting a different line of defense, the jelly slug (middle) extrudes a sticky, translucent coating that may foul the mouthparts of marauding ants. For its part, the aquatic larva (bottom), mirrored at the top of this image by its watery element, fashions a portable hideout from fragments of aquatic leaves. Its feathery appendages are actually tracheal gills that draw dissolved oxygen from the water.

Cutting a serpentine trail as it feeds on tender young leaves, the minute citrus leaf miner (left) spends its entire larval life inside its host plant, thus keeping its appetizing body safely under wraps. The Asian native spread to Australia and Africa in the 1960s and now bedevils citrus growers throughout the southern United States and Central and South America.

*PHYLLOCNISTIS CITRELLA* (CITRUS LEAF MINER); GRACILLARIIDAE, COSTA RICA (LEAF ROLLER)

*DALCERIDES INGENITA*, ARIZONA (JELLY SLUG); *PARAPOYNX OBSCURALIS*, FLORIDA

NOCTUIDAE, COSTA RICA

*PROLIMACODES UNDIFERA*, COSTA RICA

*ACONTIA*, ARIZONA (ABOVE); NOTODONTIDAE, COSTA RICA

# Look Again

At first glance I saw a twig and a half-eaten leaf (upper left). But closer inspection brought a brown caterpillar, clinging to the twig, to life. Many moths are masters of illusion. Color and texture hide one larva (above) and transform this adult (right) into a mossy rain forest leaf. By folding its wings and facing head down, another moth (left) becomes an unappetizing bird dropping.

THYRIDOPTERYX EPHEMERAEFORMIS, KENTUCKY (ABOVE AND TOP); MALACOSOMA AMERICANUM

body. I cut the bag open to reveal the female moth inside (top). Lacking functional eyes, legs, wings, or mouthparts, she seemed little more than a sack of eggs.

Finding safety in numbers, eastern tent caterpillars sling their silken shelters from the branches of black cherry trees (right). Expanding as the commune grows, the tent regulates temperature and humidity and affords a measure of protection from predators. If threatened, these cooperative insects perform a mass thrashing display to ward off the attacker. That failing, they vomit a bubbly mix of hydrogen cyanide and benzaldehyde. The tent is also a communications center. When a caterpillar finds a branch thick with leaves, it secretes a chemical trail others can follow.

# Safe Havens

To lessen the perils of living outdoors, the evergreen bagworm constructs a mobile home of silk (above), which it camouflages with bits of foliage from its host plant. Inching along on six clawlike legs, the insect carts its shelter everywhere, lashing it to a branch when it stops to rest or molt. Both male and female larvae construct bags, but as adults only males are winged and able to fly free. The male above is hanging from a female's bag. To reach her for mating, he must stretch his abdomen several times the normal length of his

GRAMMIA REVADENSIS, MEXICO (TIGER MOTH); CERURA VINULA, ENGLAND (PUSS MOTH); EUCLEA, COSTA RICA

# Fighting Back

Disarming as a cartoon character, the puss moth larva (facing page) looks harmless—but packs potent weaponry. If intimidated, it retracts its dark head, inflates a multicolored thorax with mock eyes, and spits formic acid from a gland that deviously resembles an innocent grin. As if this formidable front end weren't enough, the larva also brandishes noxious, pink tentacles from a pair of upright appendages on its tail end.

When threatened by an enemy, the tiger moth (above) drops to the ground in a feigned death-throe display. Glands behind its head ooze golden beads of foul-tasting fluid, providing a powerful disincentive to anything intent on eating it.

The poison-charged cones of the crystalline limacodid caterpillar (left, seen from below) bristle with syringes that dispense stinging chemicals. Though measuring a mere half inch long, it carries a surprising wallop—a fact I learned firsthand when I inadvertently brushed this one with the back of my hand while changing film. Yet for me, that momentary pain was a small price to pay for the enduring pleasure of studying these extraordinary insects. □

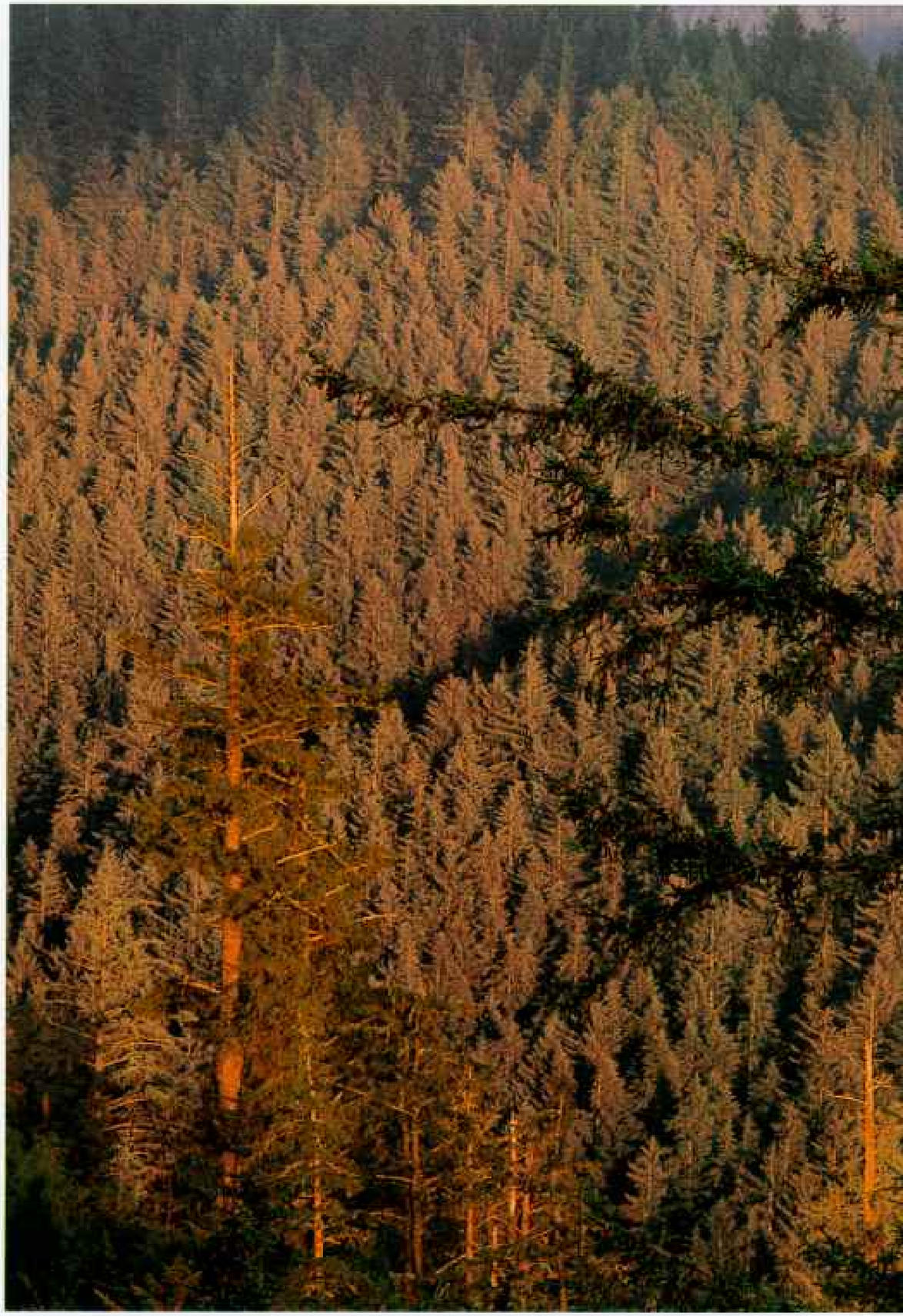
# In the line of fire

# Our National Forests

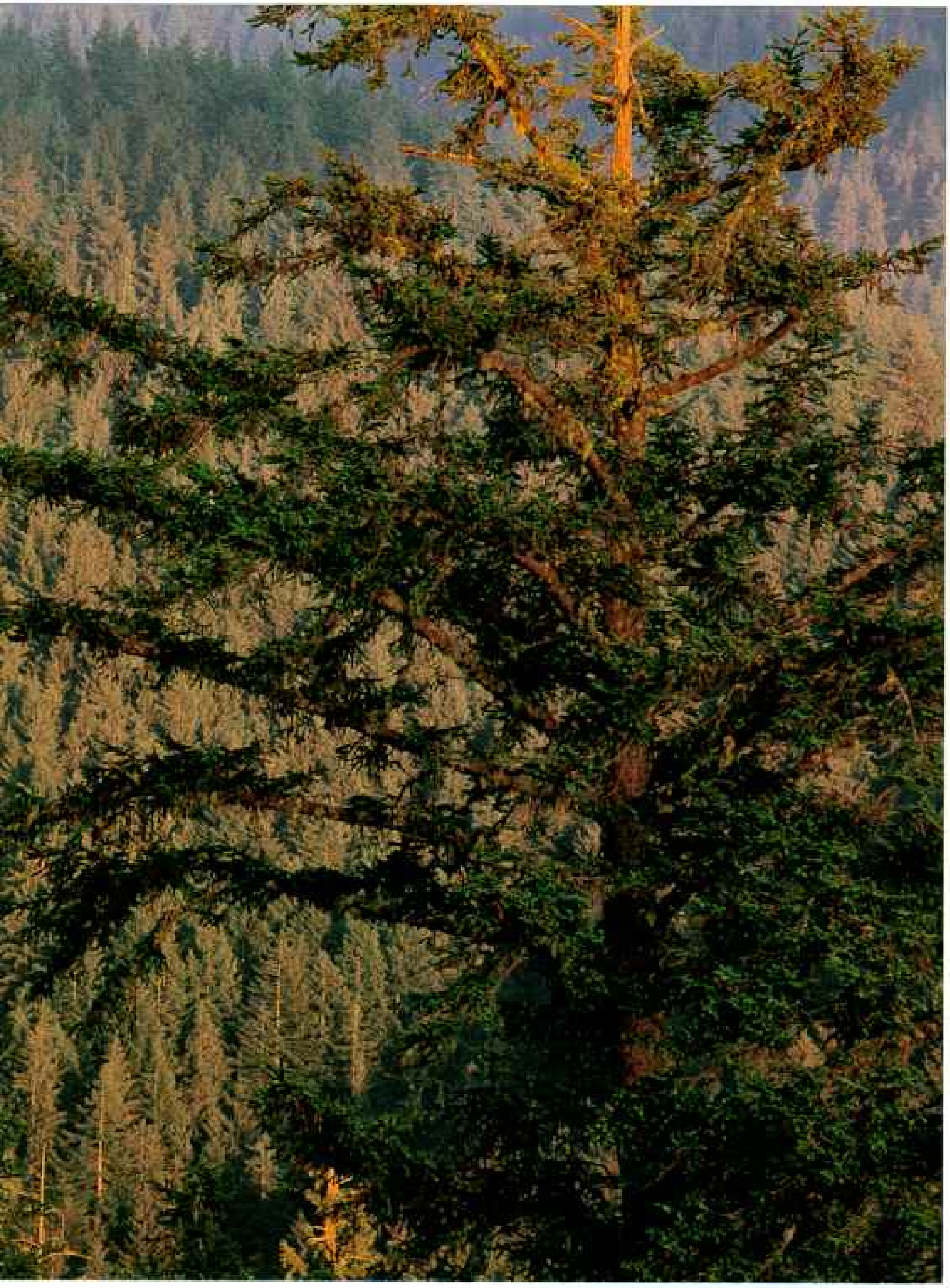
By JOHN G. MITCHELL
SENIOR ASSISTANT EDITOR

Photographs by PETER ESSICK

The cutting edge of Idaho's Targhee National Forest—heavily logged under the Forest Service's doctrine of multiple use—stops dead at the boundary of Yellowstone National Park, where the Park Service practices hands-off forest management. So clearly hewn that it registers on satellite images, this line drawn in the woods underscores the divide over how best to manage our federal lands.



When a tree falls in the forests of the Pacific Northwest, plenty of people hear about it. Nineteen million acres of giant conifers—like these centuries-old Douglas firs in Oregon (above)—once blanketed the region. Today as little as one-tenth of that remains uncut. Most of what's left grows on national forest



lands, where loggers like Bruce Carlson (foldout) harvest old-growth cedar. The future of these forests depends on the 1994 Northwest Forest Plan—a compromise bashed by some environmental groups for including, in their view, "enough loopholes to drive thousands of log trucks through."

**Seasonal ranger Sharon McMillon makes her rounds in the backcountry of California's Angeles National Forest—a rare pleasure for many career rangers. "Our people aren't getting on the land much anymore," laments a Forest Service veteran. "They're nailed to their desks shuffling paper."**

THIS IS PAUL BUNYAN COUNTRY, here on the Upper Peninsula of Michigan. This is where that legendary double-bit lumberjack and his blue ox, Babe, slicked it all off and looked to the West. You can still find a few of the pine stumps bleached bone gray back there in the second-growth timber. And if you know where to look, you might discover a bosky dell that the loggers missed, like this patch of old-growth conifers dappling shards of sunlight on the riffles of Squaw Creek.

Check out the hemlock, likely a seedling when pale-skin voyageurs breached the mists at Bay de Noc. That pine atilt on its mound of duff? More than a sapling, maybe, when the Union Jack came to Mackinac.

Ancient woods. And they're yours—the Squaw Creek Special Management Area of Hiawatha National Forest. If you're a United States citizen, you own it all—this area, this forest, and the whole coast-to-coast 191-million-acre National Forest System. That's the good news. The bad news is, there aren't many places like Squaw Creek left in the national forests. Because of that, some of your co-owners are fighting over how to manage these forests and how to juggle all the multiple uses the public woods are supposed to provide.

"There are two ways of looking at a forest," a federal forester said to me one day in the Oregon woods. "There are the people who believe you push logs in one end and jobs and products come out the other. And then there are the people—I guess I'm one of them—who see the forest as an organism you tinker with a little and hope that you're not doing it any harm."

It occurred to me that the forester was forgetting a third way of looking at it, a way that seems to be gathering favor across the U.S. these days. It is the vision of people who also see the forest as an organism, but one that is not to be pushed at or tinkered with—their idea being that the nation's trees have no higher calling than to provide good habitat for diverse communities of wild plants and animals, and then to die, as these Squaw Creek specimens surely will, of a sudden blow by nature or of creeping old age.

Each of these views engaged me last year as I made the rounds of some of our national forests—a tour that stunned me for the size and scope of the system even more than for its

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Contract photographer PETER ESSICK covered "Polluted Runoff" for the February 1996 issue of NATIONAL GEOGRAPHIC. He lives on a tree-shaded block in Brooklyn, New York.

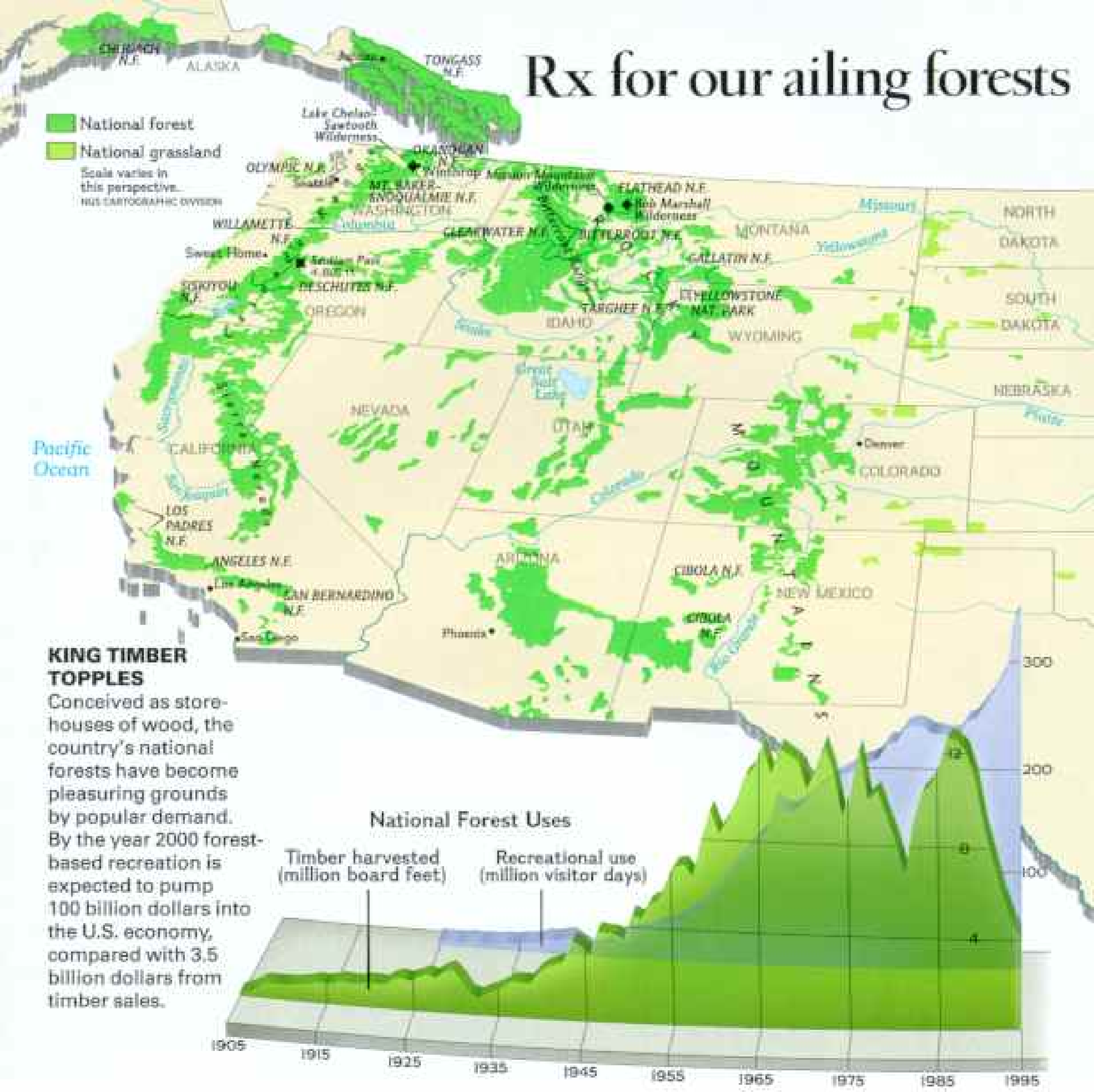

physical diversities. It is a system of 155 separate forests, land enough to carpet Texas and Maine wall to wall. More than twice the size of the National Park System, this one claims to entertain three times as many visitors. And the federal forests are likewise twice as large as that other assemblage of resource lands, the National Wildlife Refuge System, and provide sanctuary for more threatened and endangered species than the refuges.

From the steaming sloughs of Florida's Ocala National Forest to the glacial outwashes of Alaska's Chugach, from the beaches of the Los Padres of California to the summits of the White Mountain Forest in New Hampshire, the nationals offer a showcase of almost every forest ecosystem represented on this continent: northern hardwoods, spruce-fir, pine-oak, piñon-juniper. You name it, they've got it.

It seemed a compelling time to be taking a look at the national forests. There had been a kind of cease-fire in the ongoing political clash—some observers call it "the war in the woods"—between timbermen and tree huggers. But suddenly the war was heating up again. Western congressmen pressed for fewer regulations and more harvests of federal timber. Environmentalists responded with challenges in the courts and sit-ins in the forests.

Then one had to consider the role of the

# Rx for our ailing forests




**KING TIMBER TOPPLES**

Conceived as storehouses of wood, the country's national forests have become pleasuring grounds by popular demand. By the year 2000 forest-based recreation is expected to pump 100 billion dollars into the U.S. economy, compared with 3.5 billion dollars from timber sales.

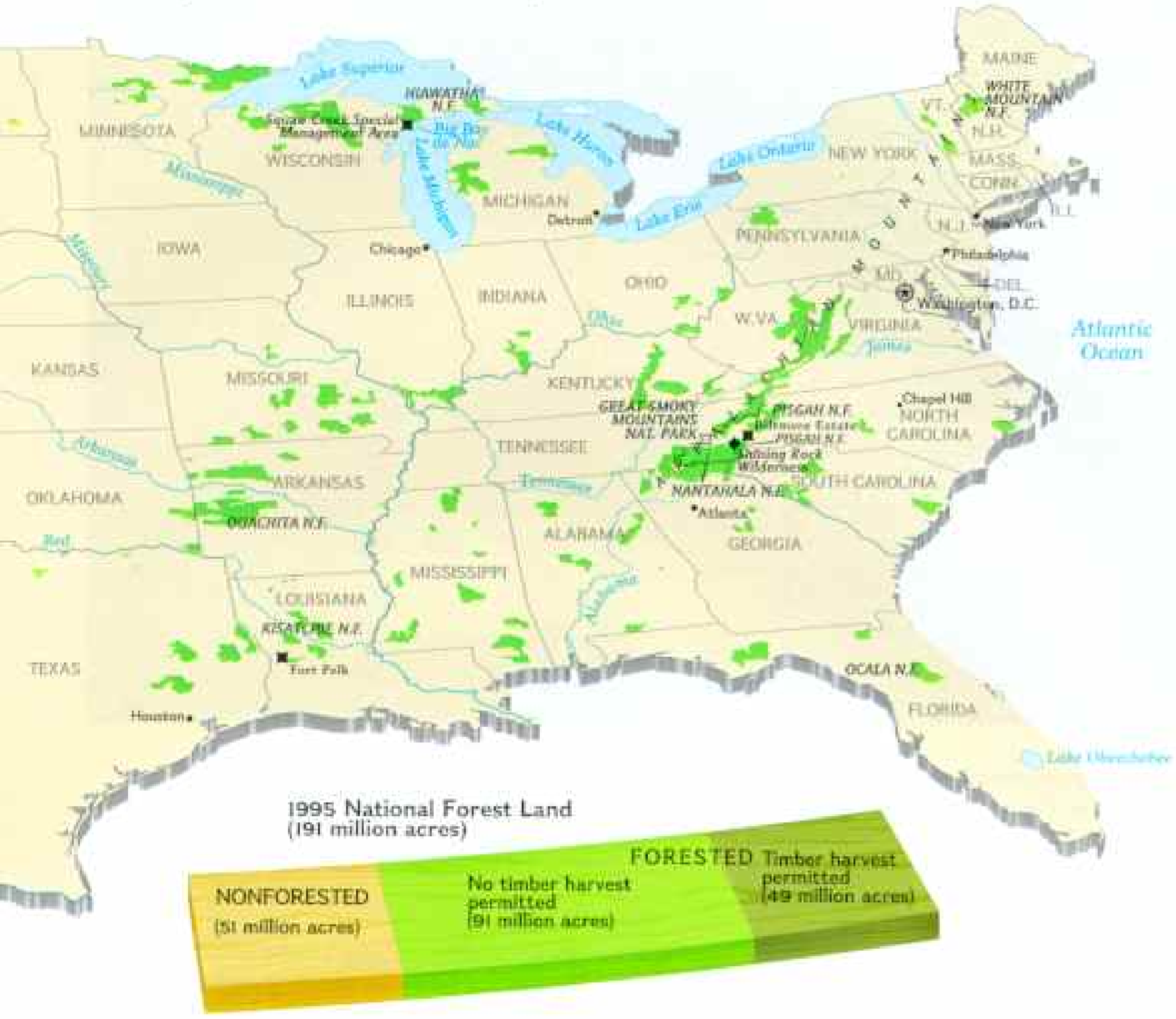



system's stewards, the men and women of the U.S. Forest Service, an agency of the Department of Agriculture. It was reported that the service was re-inventing itself, partly in response to environmentalists who have long challenged the agency's perceived allegiance to the forest industry.

And finally there was an anniversary to celebrate: the centennial of the Forest Management ("Organic") Act, proposed by President Grover Cleveland and made law in June 1897, a statutory milepost by which 40 million acres of the public domain became national forests. The act declared that its purpose was "to improve and protect the forest . . . [to secure] favorable conditions of water flows, and to furnish a continuous supply of timber for . . . the citizens of the United States." Thus was hatched the concept of multiple use.

The Organic Act said nothing of turning the national forests into parks. It just happened that way over the years, driven in part by the public's increasing demand for outdoor recreation and the foresters' proclivity for building roads (378,000 miles, eight times the length of the entire Interstate Highway System). Last year 830 million visitors were tallied in the national forests. That statistic can only begin to suggest, in these times of budget constraints, the price of success—in mounting

Scarred by decades of high-yield logging and menaced by insects, air pollution, and heavy use, many of the country's 155 national forests stand in sore need of healing. The prescription? "Walk softly and carry a little bitty chain saw," urges Arkansas conservationist Jerry Williams.




Clear-cut in 1989 and planted in pine, a tree farm sprouts in the Ouachita National Forest in Arkansas. Branded as "cornfield forestry" by opponents, the practice maximizes wood production at the expense of biodiversity. "Many in the Forest Service believe their job is to put the forest to *work*," asserts a critic. "They think a forest that you can't cut down and sell is useless."

**Plastic-coated hikers brave a downpour at Caribbean National Forest in Puerto Rico, the only tropical rain forest in the U.S. system. Surrounded by civilization, the 28,000-acre forest is a lifeboat for the endangered Puerto Rican parrot and a living laboratory for scientists studying tropical forest ecology.**

accumulations of trash, deferred maintenance of trails and campgrounds, and law enforcement stretched to the breaking point.

NOWHERE IN THE SYSTEM is the human impact more evident than in southern California, where the Angeles and San Bernardino Forests, each roughly the size of Rhode Island, gird the mountains behind Los Angeles. Some 20 million Americans live less than three hours away. Water is the main draw—mountain lakes and canyon creeks. "Wherever there's water," says Angeles forest supervisor Michael J. Rogers, "we can't even begin to keep up with all the people."

On weekends population densities in the Angeles's San Gabriel Canyon begin to soar toward center-city levels. The parking lots are full. The road is congested with slow-moving traffic; the pools of the river asplash with swimmers and fishing tackle; the ambient air awash in charcoal smoke and boom-box decibels. It is a scene played over and over again, not only here on the fringe of Los Angeles but also in forests near Seattle, Denver, Phoenix, and Atlanta.

For rangers in some forests, however, coping with crime can be as serious a challenge as controlling the crowds. In fiscal 1996 the Forest Service reported more than 7,000 felony-level violations ranging from timber theft to murder. Illegal drug activities are especially troublesome in forests where people grow marijuana in the backcountry. According to Forest Service records, a quarter million cannabis plants were eradicated in 1995 alone.

For the careless or unlucky, there are likelier backcountry perils than running afoul of some Uzi-toting marijuana grower. Contained within national forests are most of the nation's remote wilderness areas (34.6 million acres) and wild and scenic rivers (4,385 miles). And

**Snow guns whitewash New Hampshire's Loon Mountain, one of 137 ski resorts located on Forest Service land. The agency's ties with the ski industry frost some environmentalists. "Ski areas can be sited on private land," argues one. "But public forests provide wilderness and other things no private land can."**

some of the best—and fastest—downhill ski slopes are on forest land as well. Where the nearest emergency help might be hours or miles away, a slip of the foot or a flip of the raft can turn ugly, and many inevitably do.

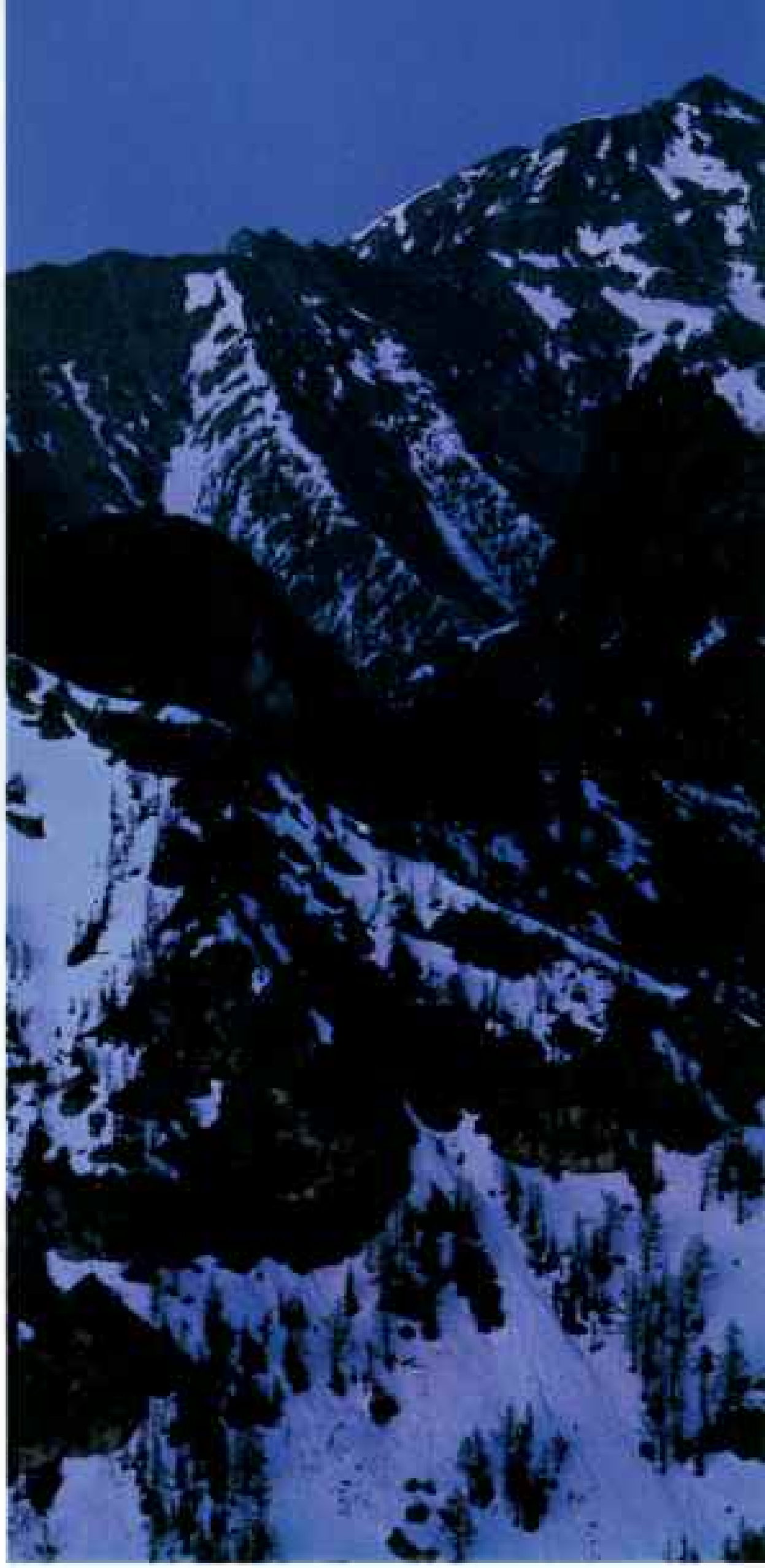
At 6,288 feet, Mount Washington in the White Mountain National Forest of New Hampshire is the highest peak in the northeastern United States. By western standards this might qualify Washington as a hill, yet more people died on its slopes last year than on any other mountain in the lower forty-eight. Two climbers fell to their death and three perished in avalanches.

"People underestimate the power of these mountains," says Rebecca Oreskes, a backcountry recreation specialist. "The weekend warriors come up here to 'bag' Mount Washington in a day. And some just aren't prepared for what it has in store for them."

Over the years, in my own time as a national forest visitor, I safely managed to bag a few mountains, a few fish, a measure of solitude, and a lot of trees. Birders could have their life lists of avian species; I'd have my checkoff of wild American forest trees. Checked off my first ponderosa pine in the Zuni Mountains of Cibola National Forest in New Mexico. Checked off subalpine fir and whitebark pine high up in the Gallatin of Montana; western red cedar in the Olympic rain forest of Washington State. Can't help it. I like trees.

I also like wood—cut wood. I like the textures of it, the smell of it, the colors of it. Indoors I like it under my feet and over my head and crackling in the winter fireplace. Outdoors I've used a chain saw to feed the fireplace and banish the shade. I put these simple disclosures down here to illustrate a bias—my belief that consumers can use part of a forest without losing touch with the soaring beauty of forest trees.

**The moon makes its entrance to the echoing accompaniment of wolves that inhabit the Lake Chelan-Sawtooth Wilderness in Washington State. It is one of 400 national forest wilderness areas, where wildlife and natural wonders take preeminence over human use.**



FOR PERSPECTIVE, it is important to know that the national forests contain only 17 percent of the country's timberlands—the lands capable of providing the raw material needed to manufacture wood and paper products. With states and federal agencies other than the Forest Service holding an additional 10 percent of the timber base, that leaves the bulk of it in the private hands of the forest industry (14 percent) and more than seven million nonindustrial landowners (59 percent).

Historically, most of the timber harvested in the United States has come from the private lands. But when market forces and postwar housing booms induced the forest industry to overcut some of its own lands, the industry looked to the national forests to help feed the corporate mills. Federal foresters were only too happy to oblige, and before you knew it, many of their forests were getting overcut too. Not just overcut but clear-cut, for the federals had adopted the industrials' preferred method of harvesting timber: clearing a site—and often a huge site at that—of all its trees at the same time. The Forest Service called this scientific forestry.

By 1961 clear-cuts had been applied to more than half the harvests in national forests across the country. Public protests led to enactment of the National Forest Management Act of 1976, which, by developing more moderate harvest guidelines, was supposed to ease the public's concern. It didn't.

In the two decades since, Americans have continued to argue over how much timber the national forests might reasonably yield and by what manner of removal and at what cost to the comfort of owls and salmon and loggers and mill workers and tourists. None of the arguments have been resolved to anyone's full satisfaction, least of all the argument over clear-cutting. While environmentalists deplore the practice, most foresters agree that clear-cutting can be an appropriate method of harvesting trees in some forests when it is applied to small sites with stable soils and when the management goal is to enhance habitat for some game animals.

In my travels to the woods, however, I did encounter some significant shifts in both timber practice and policy. For one thing, despite congressional efforts to increase the cut, the volume of timber sold and harvested in the national forests last year was barely a third of what it had been a decade before. For another, public pressure seemed at last to be unraveling the Forest Service's faith in clear-cutting. I found some evidence of both trends, in cameo, in the precincts of Pisgah National Forest, in the mountains of North Carolina.

Among eastern forests, Pisgah stands as a classic, with broad-leaved Appalachian hardwoods hugging the coves and bottoms and spruce and fir running the ridgetops. Situated next door to the popular Great Smoky Mountains National Park and skewered by the Blue Ridge Parkway, Pisgah can claim recreational credentials as impressive as any in the entire forest system. But North Carolina also happens to lead the nation in the manufacture of furniture; and it is no secret that the finest furniture is made of high-quality hardwoods.

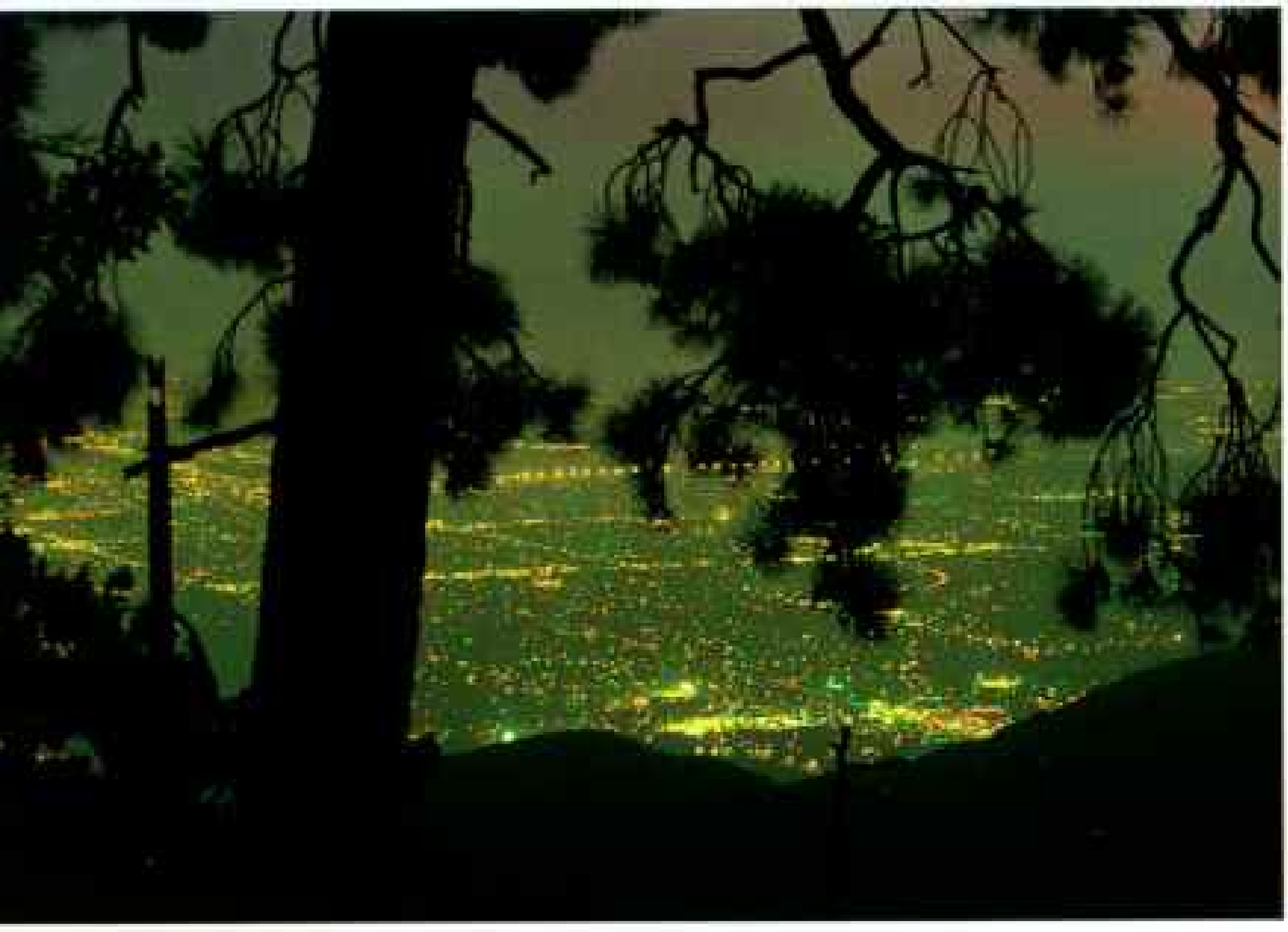
For a number of years timber from the Pisgah and its sister forest, the Nantahala, helped keep the industry busy. A forest plan issued in 1987 promised more of the same, with an allowable annual cut of up to 72 million board feet and 80 percent of that coming from clearcuts. (A board foot measures one foot by one foot by one inch. Seventy-two million board feet is wood enough to build more than 5,000 single-family homes.)

"That timber program was totally bloated and unsustainable," recalls Lark Hayes, an attorney with the Southern Environmental Law Center at Chapel Hill. "There was no way the Forest Service could have masked it. You'd have come around a bend in the road and—wham!—there's your favorite view in devastation."


Drinking in the splendor of the Siskiyou National Forest, sightseers wisk up Oregon's Rogue River aboard a hydrojet tour boat. Though laws generally forbid motorized travel inside wilderness areas, jet boats on the lower Rogue—a national

wild and scenic river—are exempt under a grandfather clause. Operators say they provide a valuable service, opening remote lands to people other than able-bodied hikers. Wilderness purists feel it's a sacrilege—like running a drag race in a cathedral.

Free-fire zone, a creek bed in the San Bernardino National Forest (right) is blighted by trash-become-targets. Beset by garbage, gridlock, and other urban ills, the forest is backyard to 20 million Californians short on elbow room—and forest etiquette. "Our visitors are city folks who don't understand nature," says a recreation officer. "Why, I've seen people carry a couch from their truck down to the creek to set up a living room!" Elsewhere in the forest, smog-stressed trees (below) frame a balcony view of shining San Bernardino.



Yet it never came to that. Citizens complained. The law center filed an appeal with the Forest Service. The chief had to agree that the plan was flawed and forthwith sent it back for a rewrite. And that's exactly what the forest got in 1994—an amended plan that has cut the annual sales target by more than half and reduced the clear-cutting prescriptions from thousands of acres to hundreds.

"It's a new ball game," Larry Hayden was saying. "The culture of our organization is definitely changing." Hayden is a Forest Service planner, one of the architects of the Pisgah's amended plan. In cahoots with several other forest specialists, he was giving me a tour . . . of the impacts of high recreation use at Looking Glass Falls and at trailheads into the Shining Rock Wilderness . . . of a place called the Cradle of Forestry, where visitors salute the memory of Gifford Pinchot, America's premier forester.

Pinchot had come here in the 1890s to manage the cutover woodlands of George Washington Vanderbilt's vast Biltmore Estate. "Here was my chance," Pinchot would write in his memoirs. "Biltmore could be made to prove what America did not yet understand—that trees could be cut and the forest preserved at one and the same time." Later Pinchot would serve as the first chief of the U.S. Forest Service, and the government would acquire more than 80,000 acres of Biltmore as centerpiece of the Pisgah National Forest.

And now Hayden and the others had me up on the Blue Ridge Parkway looking out across the mountains at a faraway clear-cut. The green of its new growth seemed only a shade off the color of the surrounding woods. "From here, it doesn't look that bad," I said.

"That's because it's 20 years old," said Melinda McWilliams, the forest's landscape architect. "In these hardwoods it takes the

sprouts about 15 years to fill in the opening created by a clear-cut."

We moved down the parkway to another overlook. Here, four clear-cuts perched like open sores on the slopes of the next ridge over. "They look like hell," I said.

"They're only seven to ten years old," said McWilliams. Hayden said, "The man who made these timber sales was a traditional old-style industrial forester. Since retired."

"So that's scientific forestry?" I asked.

"No," said McWilliams. "This close to the parkway, that's in-your-face forestry."

ANOTHER DAY, on another mountain. I'm in Oregon, in an open clear-cut, looking out upon a standing forest of dead and dying trees—Douglas and grand firs, mostly, some lodgepole pine, a phalanx of gray ghosts festooned here and there with a few thin ribbons of surviving green. This is Santiam Pass country, on the cusp of the Cascades, where Willamette National Forest meets the Deschutes. I am here to learn from the federal tree doctors why, in their book, nothing short of major surgery will ever restore this particular woodland to good health.

Consider the diagnosis. This forest is overcrowded, the result of more than a century of fire exclusion.* Blame that partly on Smokey Bear, the service's fire-snuffing friend. This forest is dry after several years of drought. Blame that on nature. And blame Smokey and nature together for the spruce budworm epidemic that has defoliated the firs, the fungi that have infected their roots, and the parasitic dwarf mistletoe plants that have sucked the life juices out of the lodgepole pines.

In the clearing Cheryl Ann Friesen, a Forest Service wildlife biologist, is saying: "We

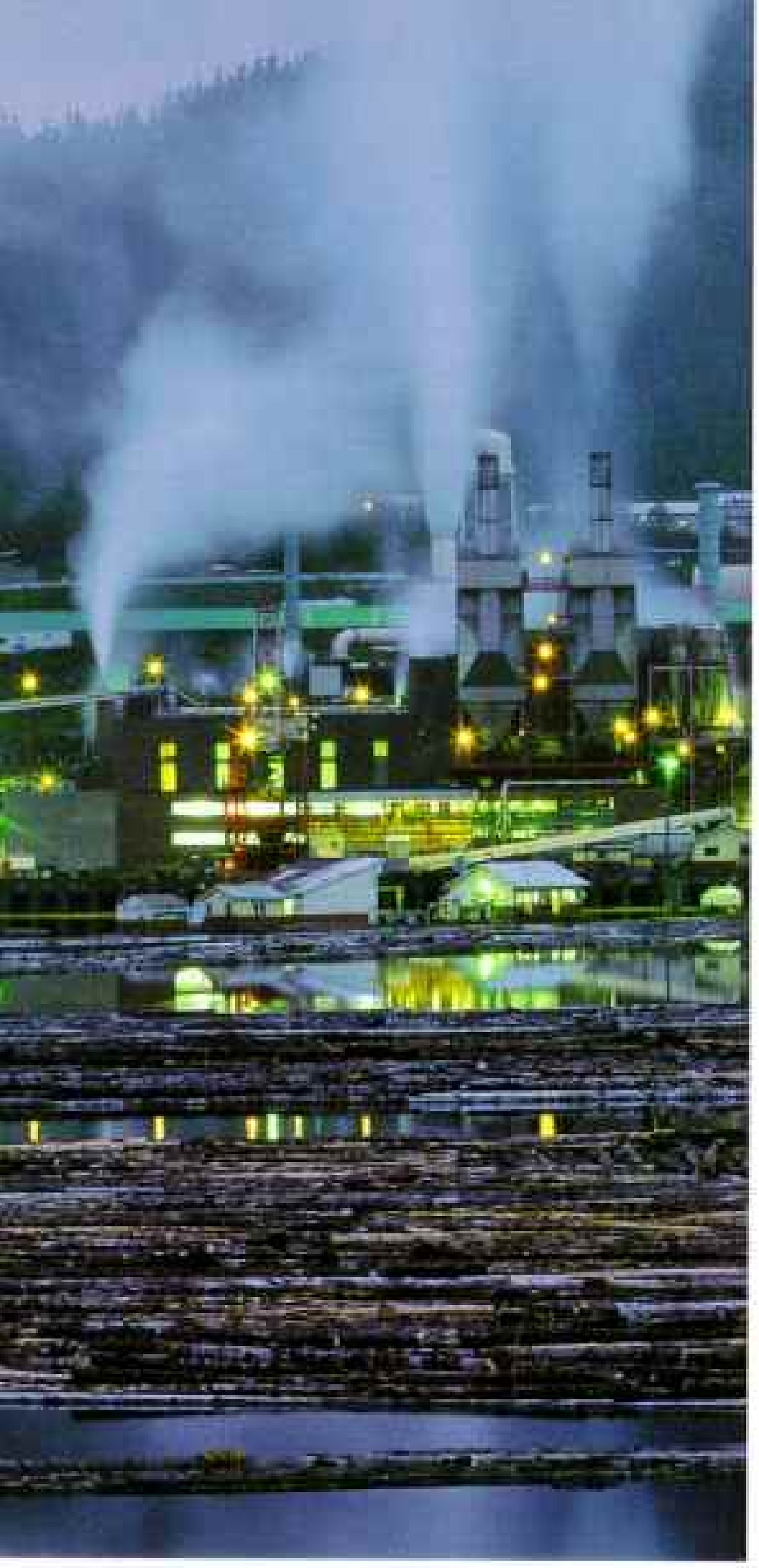
*See "The Essential Element of Fire," by Michael Parfit, NATIONAL GEOGRAPHIC, September 1996.

jumped in here, built roads, put out fires for all these years. We can't go back to the 1800s and expect natural processes to reestablish themselves. It's not a good option."

So the prescription is surgery. Excise the understory with controlled fire. Thin some stands and harvest others. Salvage the best of the dead trees. "And always," says Eugene Skrine, a Willamette silviculturist, "always try to let the ecosystem tell you what to do." Such as? "Such as leaving at least two snags standing on every acre, to benefit the cavity nesters." Because? "Woodpeckers eat budworms, and so do the black ants that live in the snags we'll leave on the ground."

FOREST HEALTH. It is the name of the game in the woods nowadays, and almost everyone seems to be playing it—the Forest Service, to make up for decades of old-fashioned management; the forest industry, to recover through salvage sales some of the federal timber volume denied it under environmental laws; even the environmental community, if only to say it isn't so—that reports of a forest-health crisis are greatly exaggerated and that some folks are using sick forests as a license to cut them down.

There is no denying that throughout the U.S. some forests and tree species are in trouble from a variety of causes, including stress



**Winding down, Ketchikan Pulp Company in southeastern Alaska is calling it quits after losing its 50-year contract for harvesting timber from the surrounding Tongass National Forest. Guaranteed old-growth trees for rock-bottom prices, the mill has been at the epicenter of the politically charged dispute over federal timber subsidies—which as recently as 1994, by one estimate, were costing American taxpayers about a quarter billion dollars a year. Closing the pulp mill marks a pivotal moment for the country's largest national forest, says Bart Koehler of the Southeast Alaska Conservation Council. "Management of the Tongass need no longer be dictated by long-term contracts established when Alaska was a territory and the timber supply seemed endless."**

from overcrowding. Once diverse woodlands shorn by clear-cutting and replanted with a single commercial species now stand predisposed to infestations of insects and epidemics of disease. If not budworms, then beetles; if not borers, moths and cankers, rusts and root rots. Natural pests find good hosts in trees already weakened by air pollution. Powerplant pollutants such as sulfur dioxide, the culprit in acid rain, are implicated in the dieback of spruce in the Appalachians. Atmospheric ozone, a by-product of the automotive age, is singeing conifers in California.

In 1995 the 104th Congress passed, and President Clinton signed into law, a measure its western sponsors said would protect the health of the national forests by converting the sick parts into salable timber. Attached as a rider to a budget bill providing disaster relief, the measure authorized an "emergency salvage timber sale" of 4.5 billion board feet, which, if fully executed, would have doubled the total volume of timber the Forest Service offered for sale in fiscal 1995.

The rider contained three key provisions that infuriated the environmental community. First, it stipulated that the salvage sales could include healthy green trees so long as they were "associated" with the dead and dying ones. Second, it exempted these sales from citizen appeals as well as from regulatory review under such laws as the Clean Water Act and the Endangered Species Act. And third, it mandated the reopening or substitution in kind of a number of sales of living old-growth trees in the Pacific Northwest—sales that had been halted earlier to protect the nesting habitat of the northern spotted owl and marbled murrelet, a threatened seabird. And these sales were also to be conducted without benefit of public appeal or regulatory oversight.

So how did all this play out? The rider expired last December, and the final score isn't in yet. The best estimate is that 3.5 billion board feet were sold under the rider, much of it in western forests that had suffered fire damage in recent years. But the Forest Service also

suspended some 150 sales, having found that they did not truly constitute forest-health emergencies after all.

WHENEVER I find myself in the north country of New Hampshire, I aim for a stroll up the Duke's path to the edge of the Pemigewasset Wilderness in White Mountain National Forest. This is one of the places where Americans first rose up to protect their forests. I like to think of it as a cradle of conservation.

The Duke's path is a well-worn trail now and has been ever since it was abandoned as a narrow-gauge railbed, the rails ripped off the crossties for scrap more than half a century ago. Before that, in the previous century, a man named James Everell Henry—they called him the Grand Duke of Lincoln—logged a billion board feet of timber from these woods and trundled it off to his sawmills by rail. Sparks from the locomotives showered the slash piles. Fires blackened the land, smoke drifted over the porches of the summer resorts nearby and, by one account, "stirred up the people in their rocking chairs." Out of the rockers came the founders of such early conservation groups as the Society for the Protection of New Hampshire Forests. Out of the efforts of the society, among other groups, came the Weeks Act of 1911, which brought the concept of a federal forest system to the East, with White Mountain as its cornerstone.

The woods here along the East Branch of the Pemigewasset River are deep and lush now, their canopies of birch and maple lime-green against the brooding hemlock. I can hear the muted song of the rolling river, smell the sunstruck resin of the pines. A hundred years ago, who could have guessed that such a forest would rise from the ashes of Duke Henry's wasteland? And who would have guessed that from those mountain rocking chairs a conservation constituency would rise to carry the cause of forest protection across the country?

Through much of this century one argument often advanced for protecting forests was that unscarred woodlands protect public water supplies. But after passage of the Endangered Species Act in 1973, the advocates had an issue that would appeal to a larger segment of the American public. The issue was wildlife. And by 1990 the most prominent creature would be the northern spotted owl of the Pacific Northwest. The bird's survival was said to require large tracts of old-growth conifers, and many such tracts were soon placed off-limits to loggers. In turn the loggers complained that their jobs were in jeopardy.

From the flap over the owl, environmentalists rushed to the defense of the salmon. Spawning runs of wild chinook and coho had been declining for years in some river systems of the West. Apart from dams and overfishing offshore, biologists identified sediment runoff from clear-cuts and logging roads as a culprit, since silt suffocates spawning beds.

And it isn't just the salmon that appear to be in trouble. The Pacific Rivers Council, an advocacy group, has issued alarms that the bull trout, the westslope cutthroat trout, and the redband rainbow trout face imminent extinction. According to the council, the bull trout has been extirpated from half of its historic range in Idaho and Montana. Though the introduction of non-native species has been implicated in the bull's decline in some watersheds, in others silted spawning streams are blamed for the crash.

There is concern as well for another Montana creature. Listed as threatened under the Endangered Species Act, the grizzly bear does not mix easily with humankind, especially where humans are building roads for loggers or retirement homes for urban refugees.

Consider, for example, the chessboard of the upper Swan Valley, tucked between two class-act Forest Service wilderness areas—the Mission Mountains on the west, and that high, wide, and handsome Bob Marshall Wilderness up there behind the snaggletoothed Swan Range. It is a chessboard in that the Flathead National Forest manages sections of land alternating with those of Plum Creek Timber Company, a giant in the forest industry. And a chessboard, too, in that you can almost tell who owns what just by looking up at the slopes of the mountainsides. What you notice are the clear-cuts, scores of them, but the largest ones—hundreds of acres in some cases—belong to Plum Creek.

I spent a couple of days last summer poking through the Swan, trying to see it from the perspective of the Forest Service, which believes it is doing the best it can for the grizzly bear, and of the Montana Wilderness Association, which begs to differ.

First day out, Tom Wittinger, a Flathead Forest wildlife and fisheries official, briefed me on a conservation agreement his supervisor

had recently signed with Plum Creek. The measure obliges landowners in the valley to limit logging or road building in core grizzly habitat, including several "corridors" across the Swan. The corridors are deemed essential to ensure interbreeding between a relatively stable bear population in the Bob Marshall and the not-so-stable population of fewer than 25 bears in the Missions.

As we bounced along a back road in an agency 4x4, Wittinger spoke of how, to favor the bear, the Forest Service had scaled back its timber program in the Swan and ordered a number of logging roads closed. But on the second day out, with Steve Thompson of the Montana Wilderness Association as my guide, I heard a different story—of roads kept open across federal lands in order to provide Plum Creek with access to its own chessboard squares.

"What really rankles," Thompson said, "is that right after Plum Creek signed that compact to help save the griz, it announced it was going to start selling off some of its real estate here in the valley." For what? "For retirement housing," Thompson said. "For wilderness ranchettes."

Kris Backes, a Plum Creek spokesperson in Columbia Falls, Montana, later told me that none of the company's land sales in the Swan Valley would violate the letter or the spirit of the bear conservation agreement. "In fact," she said, "in the Swan right now we have nothing on the market."

**Guarding trees slated for the saw, "eco-warriors" barricade a logging road in Oregon's Willamette National Forest. Their vigil turned victory party on day 344, when the disputed timber sale was canceled.**

DUE WEST some 50 miles from Santiam Pass in the Oregon Cascades lies the town of Sweet Home, population roughly 7,500, a blue-collar gateway to the tall trees of the Willamette National Forest. For many years the Willamette produced and sold more sawlogs than any other national forest, and the loggers and mill workers of Sweet Home were only too happy to process their considerable share. But then everything changed—in the technologies of the forest industry, in the judicial perspective on spotted owls, in the degree to which the Forest Service could continue supporting local economies with a steady stream of logs, in the direction circumstance was taking the economy of the entire Pacific Northwest.

Suddenly, as the 1980s rolled into the '90s, the logging trucks no longer passed bumper to bumper down Sweet Home's Main Street. Men showed up for work at the mills and went home early—with pink slips. Hard hats gathered cobwebs in the closets of jobless sawyers.

Wood enough to build a subdivision awaits processing at a lumber mill in Oregon. As public outcry and the presence of endangered species restrict the flow of logs from federal lands, forest industries are turning to their own and other private

timberlands to feed mills. "Most of the productive timberland in this country is in private ownership," says Michael Francis of the Wilderness Society. "We don't have to clear-cut our national forests to meet our need for wood."

Feeling the burn, smokejumpers (right) harden muscles in Winthrop, Washington. Their foe, meanwhile, has been bulking up too: "We're seeing more dangerous and destructive wildfires than we've seen in a long time," says Jerry Williams, a Forest Service fire expert. After years of overzealous fire suppression, the agency is upping its use of planned, preemptive fires. One example: Flame from a drip torch (below) ignites wildfire-fueling debris and readies a logging site for replanting in the Okanogan National Forest in Washington.

And throughout the region politicians dourly predicted that because judicial rulings on the spotted owl were locking up federal timber, communities like Sweet Home would soon be up to their necks in bankrupt businesses and family foreclosures.

It didn't exactly turn out that way, as I discovered when I dropped into Sweet Home from the Willamette Forest one day and called on Mandy Cole at the district ranger office. Cole is a rural community assistance coordinator working with the Forest Service to help timber towns like Sweet Home develop new economic opportunities. "And we're finding those opportunities," said Cole. "People here are beyond believing that the good old timber times are coming back again. We're moving ahead."

The town certainly appeared to be heading that way. I had seen it six years earlier when it was down on its luck and looking a bit dowdy around the edges. Now fresh paint glistened on storefronts. Newcomer businesses were in place: an electronics firm, a manufacturer of titanium golf-club heads, a maker of prefabricated wall units, a hairstyling salon called Clear Cuts.

To be sure, there had been a loss of timber jobs—scores of them in Sweet Home, a thousand in the surrounding county; more than 30,000 if you factor in all the timber jobs lost between 1988 and 1995 in the entire Northwest region (Washington, Oregon, Idaho, and Montana). Of course not all those pink slips could be chalked up to environmental regulations and timber sale reductions. A weak market and the forest industry's continuing investment in labor-saving equipment had helped bury those jobs, just as they had put 36,000 Northwesterners out of work between 1978 and 1988, when federal timber sales were high. And jobs for local mill

workers also hemorrhaged as Northwest timber companies discovered that logs from their own lands fetched higher prices when shipped across the Pacific Ocean to the sawmills of Japan.

But now, with electronics and other high-tech industries moving into the region (and opening tens of thousands of new jobs since 1990), the Northwest was on a roll—earnings up, unemployment down—and Sweet Home wasn't far behind the crest of it.

Even more surprising than that was the way a few of the older companies were not only surviving but prospering.

"I could see what was going to happen," black-bearded Mike Melcher told me when I dropped by the Sweet Home headquarters of Melcher Logging, Inc., one afternoon. "I could see we'd need to replace the old-growth timber we could no longer cut, and what I saw out there were small stems in young stands, a resource that no one had touched yet."

In 1991 Melcher went high-tech himself, investing in a fleet of Scandinavian mechanical harvesters that can handle young timber the way John Deere's top-of-the-line handles a field of corn. And even though these computer-aided machines reduce the old chain-saw workforce by two-thirds, Melcher now employs 30 people—three times as many as he employed before he bought the machines.

"It's the volume," he explained. "The veneer and plywood industry really likes this little log." All of Melcher's logs are cut from private lands.

Before leaving Sweet Home, I stopped at the new KOA campground just up the highway from Willamette Industries' Foster plywood plant, a survivor from earlier shutdowns and a market for some of Melcher's logs. Jeri Reynolds and Jeanette Gelatt, the campground proprietors, were sprucing the place

**Salmon still fatten bears in the Tongass National Forest, but elsewhere salmon stocks are crashing—casualties, in part, of stream-degrading logging and road construction. "Most wild stocks in the Pacific Northwest are at risk of extinction," says Jeff Dose, a Forest Service biologist. "The outlook is pretty grim."**

up for a grand opening. Reynolds's and Gelatt's husbands are pink-slip mill workers, now employed in other trades.

"This is it," said Gelatt. "Eighty-one sites for tents and hookups, and those little log cabins over there. The fulfillment of a five-year dream."

I asked the proprietors if the noise of trucks and cranes in the Foster mill's log yard next door might drive some of their business away.

"Are you kidding?" Reynolds replied. "That's not noise. What you hear is the sound of money."

UNTIL his unexpected retirement last November, Jack Ward Thomas was chief of the U.S. Forest Service, 12th in line of succession after Gifford Pinchot, the founding father. A round-faced, white-bearded Texan who spent most of his 40-year career as a wildlife research scientist in Oregon, Thomas at the time of his appointment in 1993 was best known for his work identifying the old-growth habitat requirements of the northern spotted owl. And this led more than a few environmental advocates to assume that once the new chief got his feet on the ground in Washington, D.C., he would somehow not only re-invent the Forest Service but also possibly—sorry, Mr. Pinchot—recast it in the tree-hugging image of their hero, John Muir.

The environmentalists soon tossed that assumption out the window. Not that it bothered Jack Ward Thomas one bit. He seems to enjoy turning a stereotype upside down.

"I'm a Texas A&M-trained wildlife biologist from the old school," he told me in his office one morning last summer. "And I'm proud of it."

The chief was in a truculent mood. He had just come from a meeting with U.S. Army

**Living among the lichen-bearded giants of the Pacific Northwest, the northern spotted owl attracted national attention in the early 1990s after a federal judge halted logging in 17 national forests to protect its habitat. It is too early to tell whether reductions in timber cutting have slowed the owl's decline.**

officials who were seeking to "borrow" a ranger district in the Kisatchie National Forest, near Fort Polk, Louisiana. Thomas slapped the top of the conference table in his office and said, "Hell, they walk in and say, 'Give us a ranger district so we can train troops.' But wait a minute, I say—that's the public's land. The Army says, 'But we have a mission.' Hey! The last time I looked, the Forest Service has a mission too. With the Pentagon's budget the Army could buy 30,000 acres somewhere else out of petty cash."

I asked the chief if the Louisiana affair was perhaps the tip of an iceberg, considering recent moves in Congress to dispossess natural resource agencies of some federal lands.

"As long as there's 191 million acres of beautiful land out there," Thomas said, "we will have to stand guard at the gates. Because in tight financial times, some people start thinking of trading off these lands for baubles. Well, as far as I'm concerned, the national forests ain't for giveaway, ain't for sale, ain't for nothing but the American people."

We talked for a while about the agency itself—with its 2.3-billion-dollar budget still heavily weighted, at Congress's behest, toward timber management—and its reduced staff of some 37,000 employees. I asked the chief about the changing culture of the Forest Service, these younger people, pedigreed biologists and landscape architects who could look at a clear-cut and call it "in-your-face forestry." The youngsters weren't calling the shots yet, but some of the good old Smokey Bear boys I'd met were watching them over their shoulders, a bit worried.

"Well," said Jack Ward Thomas, "it's like anything else. You evolve to fit your habitat, or you die."

As the Forest Service moves on to its second century of managing the federal woods, one

**Green spires rise beside glacier-fed Wells Creek in Washington's Mount Baker-Snoqualmie National Forest. "The days have ended when the forest may be viewed only as trees and trees viewed only as timber," declared Senator Hubert Humphrey, author of a 1976 law aimed at reforming national forest management. Yet 21 years later that assertion still sparks debate.**

big question remains unanswered: How much of that management will be shifted from timber production to recreation and the protection of biodiversity? Industry observers already are wondering whether there will be any significant timber harvest in the national forests after the turn of the century. Some of the big companies appear to be preparing for that possibility, expanding their corporate land holdings. Willamette Industries last year doubled its land base by purchasing 390,000 acres, then announced that it wouldn't be buying federal or state logs in the West anymore.

"The fact is," says Luke Popovich of the American Forest and Paper Association, the industry lobby, "the environmental activists have made it virtually impossible for anyone to count on a predictable supply of federal timber. But there are still many companies—primarily small, family-owned mills—that are wholly dependent on federal logs simply because they have no timberland of their own."

I WAS MULLING OVER some of these issues one day in the woods with Bud Moore, a Renaissance man of the forest if ever there was one. Moore spent 40 years in the Forest Service, fighting fires in the Bitterroot of Montana, rangering in the Clearwater of Idaho, shaping policy in Washington, D.C. Now long retired, he lives with his wife, Janet, in a log house in Montana's Swan Valley and, with a portable sawmill and small skidder, practices low-impact, selective-cut forestry on his own 80 acres and the woodlots of some of his neighbors. It is the kind of forestry that could open a future for some of our second-growth national forests, and a future as well for some of those family-size mills.

I had first met Moore here in the Swan almost ten years earlier when the timber wars were just about to peak. Right off the bat he had impressed me with his practical knowledge of the woods and his fair and dispassionate appraisal of the warriors, including the ones who had been cudgeling his longtime buddy Smokey Bear.

But now, with a couple of independent and admiring loggers in tow, Moore was showing me how some folks in the Swan were hoping to put the polarized posturing behind them. We had come out from Moore's place to a 30-acre demonstration site in Flathead National Forest. With Forest Service approval, an ad hoc citizens' committee including loggers, mill owners, and environmental activists had negotiated an agreement to thin the stand of smaller trees in order to give a boost to

scattered specimens of old-growth ponderosa pine. In Flathead country, ponderosas of a golden age are getting about as rare as Mission Mountain grizzlies. But here were scores of the big pine, unburdened of competing understory. About 30 truckloads of small, salable logs had been hauled from the site. The ground was unscarred by heavy equipment. The slash would be burned to recycle some nutrients.

"This isn't perfect, but it's sort of how it has to be done if it's going to be done at all," said Bob Love, one of the loggers. "Leave the best. The art of logging lies in knowing when it's time to quit."

"And it's knowing the connections," said Bud Moore. "In the old, old forestry, way back, those people didn't have much science, but they knew the connections afield between all the parts of an ecosystem. Of course we didn't call it that, then. Couldn't even spell it. But those connections are what we kinda lost somewhere in the string of things. And so now that we're coming back, the idea that science alone should guide us just won't do."

"So what's the answer?" said Bob Love.

Moore reached out and placed his hand against the cinnamon bark of one of those big ponderosas, as though he were making some connection for himself. "The land," he said. "We've got to have that feel for the land." □

# PAPER

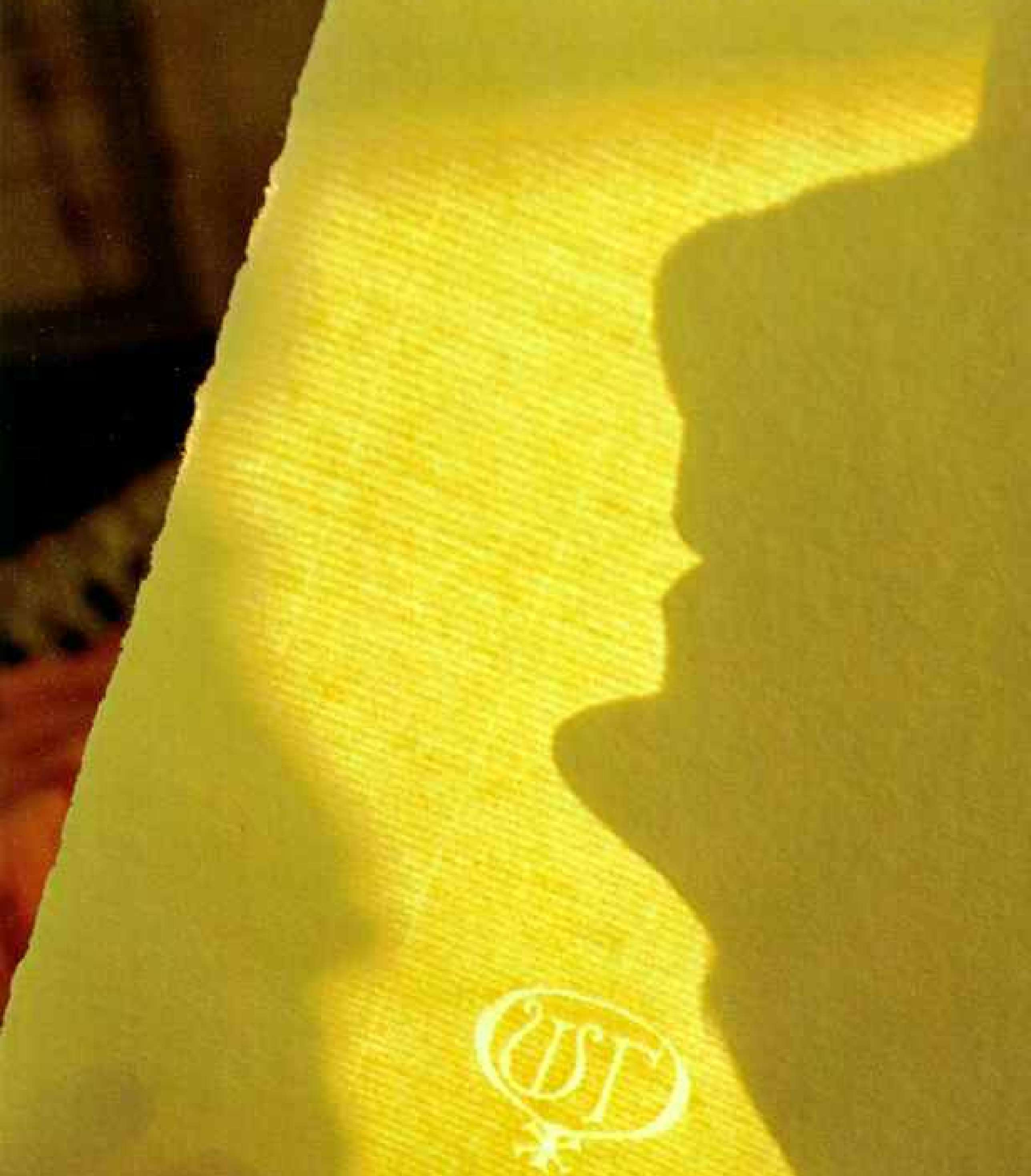
## *The Magic of*

*The profile and water-mark initials of Luigi Mecella leave no doubt: This sun-goldened sheet, molded in the renowned papermaking center of Fabriano, Italy, is his handiwork. Endlessly useful and often elegant, versatile paper can be a vehicle for a writer's expression, a surface for an artist's brush, and, sometimes, art itself.*

By JON R. LUOMA

Photographs by SISSE BRIMBERG

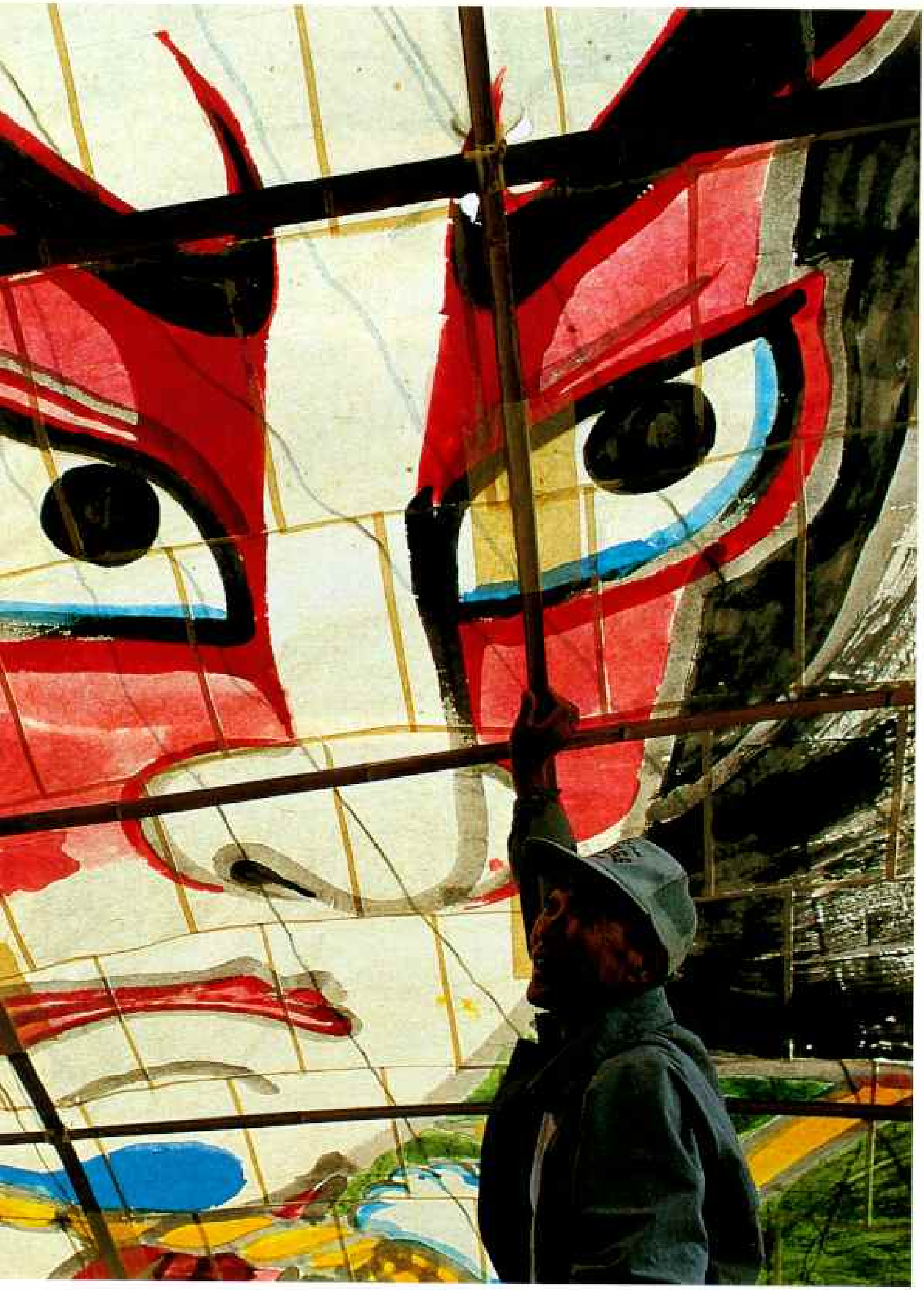
NATIONAL GEOGRAPHIC PHOTOGRAPHER



*Explosions of paper streamers ignite the faithful in Palazzolo Acreide, Sicily, on the feast of San Paolo. Taking its English name from Egyptian*

*papyrus, paper moved through the Arab world to Italy a thousand years after Chinese eunuch Ts'ai Lun first presented it at court in A.D. 105.*

*Painted in a permanent scowl, the image of a warrior is as tough as the kite that flaunts it. The long fibers of* washi, *handmade Japanese*



*paper, give kites the strength and lightness needed for waging air-borne battle at the annual Shirone kite festival.*

SOICHIRO SAKAMOTO'S MODEST HOUSE sits shadowed by lush green mountains in the tiny village of Futamata, not far from the Sea of Japan. In his workshop, a place suffused with soft light and the burbling of water in motion, Sakamoto glances over his shoulder and grins.

"A geisha once told me I was an excellent dancer," he says.

Sakamoto is gracefully swaying as water drains out the bottom of a large, shallow tray he holds by two handles. The tray is a *sugeta*, or paper mold, little more than a wooden frame around a removable screen of split bamboo stalks.

Yet the device might as well be a sorcerer's tool for the magic Sakamoto works with it. Into a vat of water he has mixed a few handfuls of damp fluff—fibers from a small tree called *kozo*. He scoops his mold into the vat, lifts it out brimming with liquid, and shakes it while the water drains through.

When the water vanishes, a rectangle the color of oatmeal materializes atop the screen. The rectangle will dry into a sheet of paper, a substance that has been a cornerstone of civilization for two millennia. On paper the lessons of history and the fire of human genius have blazed across space and time—the notes of Mozart, the words of Shakespeare, the sketches of Picasso, the wisdom of Gandhi.

Words on paper changed the way people thought. Martin Luther went so far as to call printing "God's highest and extremest act of grace." If every man could own a Bible, Luther reasoned, he would no longer need a priest to interpret God's word. Paper and printing guided Europe out of the Dark Ages: Just 50 years after Johannes Gutenberg invented his printing press in the mid-15th century, more than six million books had been published on law and science, politics and religion, exploration and poetry.

From the remarkable to the ordinary, paper bespeaks the magic of innovation. It is as simple as a factory-made roll of kitchen towels, as extraordinary as the luxurious kimono sashes Sakamoto sells for $5,000 and up. Paper is durable U.S. currency stock rolling off machines in a

JON R. LUOMA is the author of several books, including *A Tree and Its Forest*, which will be published later this year by Henry Holt & Co.

*Picked clean of impurities, silken fibers (below right) from the inner bark of the kozo, or paper mulberry tree, await the next stage in traditional Japanese papermaking. Keeping the art alive in the village of Kurodani, Tokuichi Fukuda and his wife, Tsujiko, bend to their craft. While she scrapes bark (top), he*

tightly guarded mill. It is a cardboard box filled with delicate computer parts in a warehouse, the same discarded box a homeless man fashions into temporary shelter.

As an industrial commodity paper ranks among giants such as petroleum and steel. Modern mills worldwide produce a third of a billion tons of paper every year—three times the total weight of the world's production of motor vehicles. In the U.S. alone a 170-billion-dollar industry makes enough paper each year for two billion books, 24 billion newspapers, and some 372 billion square feet of corrugated cardboard.

Today's business is a far cry from the ancient craft of papermaking as practiced down the centuries by highly skilled artisans like Sakamoto. Contemporary papermakers still use the essential recipe of their predecessors—water and cellulose fibers. Paper forms when atoms in the fibers bond with those in the water molecules. As the water is drained through a screen, the water molecules tug at the fibers with a force that enmeshes them so tightly new bonds form between the fibers to create a solid surface.

Throughout the U.S. I saw modern paper machines the size of strip malls being run by men in booths that looked like the bridge of the starship *Enterprise*. Each machine thundered and steamed, a howling mass of rollers, ducts, and pipes. On one end water containing a small amount of wood pulp cascaded onto a conveyor belt that looked like an immense piece of window screen. A ribbon of paper as wide as a two-lane highway rolled out the other end.

Those highways often dead-end as waste in landfills, taking up more space than any other garbage. In addition, environmentalists charge, the paper business denudes forests and pollutes air, land, and water by spawning poisons like dioxins as an industrial by-product. "Right now, the industry is one of the world's worst polluters," says Joe Thornton of Columbia University's Center for Environmental Research and Conservation.

But some innovators are working to solve these problems. By recycling paper and its industrial wastes or even by creating new building materials from used paper, this essential commodity can be made more environmentally sound.

*stirs a mix of kozo fibers and neri—a mucilage derived from mallow root that prevents the fibers from clumping. After draining a film of interlocking fibers, he places the new sheet of paper on a stack (bottom left). Families in this village are related through intermarriage, a custom that once guarded the secrets of washi.*


*Old photographs and faded mementos mark a paper trail through the well-lived life of Siegfried Larson, Pennsylvania-born son of Swedish immigrants.*


*"I just put things away," he says. "You never know when they'll come in handy." Of all paper's uses, the most basic is this: It gives us a past.*

Such issues are part of the practical story of paper, the one that I set out to tell: big fast machines, pollution control, recycling, forest management, the important matters of the industrial world. But along the way I discovered artists, papermakers, conservators, and scientists obsessed with the magic of this substance.

EVER SINCE THE CRO-MAGNONS began painting bison and mammoths on the walls of caves, humans have been searching for the ideal surface on which to record ideas. The ancient Chinese carved pictographs in bone. Greeks scribbled on parchment made from animal skin. The Maya painted hieroglyphs on beaten mulberry bark. The ancient Egyptians made papyrus, the writing material that one day would lend paper its name, by pressing together wet layers of that Nile sedge. But real paper proved cheaper than parchment to make and could be produced in great quantities. And paper was better than papyrus or tree bark for printing.

The first papermaker, according to legend, was Ts'ai Lun, who created paper from hemp, tree bark, rags, and fishnets in A.D. 105, perhaps to fulfill Chinese calligraphists' desire for a more practical writing material than silk or bamboo strips. The Chinese have loved paper ever since. Centuries before Gutenberg, they invented movable type. They were the first to make paper money, toilet paper, and paper books. It was forbidden even to step on a piece of paper with writing on it.

"Lovely and precious is this material," wrote Fu Hsien, a scholar in the third century. "Luxury but at a small price; / Matter immaculate and pure in its nature / Embodied in beauty with elegance incarnate, / Truly it pleases men of letters."

When papermaking reached Europe in the 12th century, it set the stage for the first information revolution, which began three centuries

*"Demons don't like paper's hissing noise," says a Shinto priest in Hiroshima. With a whisk of a* harai-gushi, *a sheaf of cut and folded paper strips, he purifies a new car by driving spirits out. Priests equated white paper's beauty with godly perfection when the material arrived in Japan about A.D. 600. Since then, ritually folded paper has represented prayer and offering.*

later with Gutenberg's printing press. "It was mass printing that was responsible for the big spreading of ideas," says Peter Tschudin, president of the International Association of Paper Historians. "And there is no doubt at all that the arrival of paper was the real advent of the printed word."

In the Gutenberg era, printers used paper made of hemp and linen rags. The purity and strength of these papers ensured the survival of great works for hundreds of years. Jesse Munn, a paper conservator at the Library of Congress in Washington, D.C., treated me to such a work, Saint Augustine's *City of God*, printed in 1473. It looked as handsome today as it did when new: The thick pages were the color of Devonshire cream, the lettering was ornate and filigreed, with each drop initial carefully hand-colored.

Jumping ahead a few hundred years, we then examined a cantata in the hand of Johann Sebastian Bach: "Feast of the Visitation: My Soul Doth Magnify the Lord." Slashing, slanting sixteenth notes, and sometimes excess drips of ink, rushed across the page.

But while I marveled at Bach's energy, Munn only nodded distractedly at the cheap, dull paper Bach bought, apparently because he couldn't afford anything better. "He really used poor papers," she said, shaking her head. At least one of his compositions appears to have been committed to a sheet he got from the fishmonger.

Yet even the maestro's paper was in better shape than the yellowing pages of books I bought only 20 years ago. Why are some of my books slowly turning to dust?

The problem stems from the increased demand for paper during the 19th century, when papermakers turned to fiber from trees for their raw material because it was cheaper and more abundant than rags. Unlike cotton, which is almost pure cellulose, tree fibers are cemented together with a natural substance called lignin, which eventually oxidizes and

*Bidding farewell to her deceased father-in-law in the Chinese tradition, Ausanat Laoapasuwong of Bangkok, Thailand, sends him off to the afterlife with paper necessities—a Mercedes-Benz for the journey and a jet for trips home. In the 13th century Marco Polo witnessed Chinese funerals where paintings on paper of "male and female servants, horses, camels" were burned for use in the hereafter.*

turns the paper brown. An acid sizing added to the paper made the problem worse. Over time, the paper turned as brittle as a dead leaf.

In the U.S. today the majority of the books published are printed on nonacidic paper to better preserve them, but what about most of the books published since 1900? Conservators rescue some damaged pages by bathing them in solutions that neutralize the acids. But the Library of Congress, which houses some 20 million volumes, has only a handful of conservators to save its treasures. It is also scrambling to store its collection on microfilm or in computerized form, but with the books decaying at an alarming rate, it expects to record only a fraction.

Can nothing else be done? I asked Marvin Kranz, a history librarian, who waved his arm toward the towering stacks overhead. "You go to the house of worship of your choice, and you pray."

WHILE YOU'RE AT IT, you can pray for ways to save paper from the trash heap, especially in the U.S., where people use and discard more paper than in any other nation. In 1995 each American used an average of 731 pounds of paper, more than double the amount of a decade before. Contrary to predictions about the computer age displacing paper, consumption is soaring.

*Accidents can and do happen at Procter & Gamble's disposable diaper testing lab in Cincinnati, Ohio, where a toddler's diaper is checked for fit. Most discarded diapers end up in landfills.*

*This Russian woman will save her festival costume from a similar fate, though old newspapers are usually left to disintegrate in the nation's overburdened dumps.*

At the same time, people are recycling far more wastepaper than they were just five years ago. Then it seemed as if every U.S. city had set up a recycling program. But there wasn't enough demand for the old paper or enough recycling mills to take it in. The result was warehouses like the one I visited at the Waldorf Corporation, a mill in St. Paul, Minnesota, so stuffed with newsprint in 1989 that it was forced to turn recyclers away.

"There was a glut," Tom Troskey, who procures paper for Waldorf, told me recently. "Some cities were paying mills to take newsprint off their hands. Now demand is rising to where we're looking at 50 percent of paper being recycled by the year 2000."

That sounds like good news. But recycling has its limits: Every time paper fibers are repulped, they degrade, and the paper loses strength.

At the U.S. Forest Service's Forest Products Laboratory, in Madison, Wisconsin, researchers are finding new ways to use paper that is past its prime. From old newspaper combined with used plastic, then heated and compressed, the lab has made lawn chairs, seat-belt covers, and even dog dishes. It has licensed another technology to two companies for paneling made mostly from used paper, which has found its way into Hollywood stage sets and may someday provide temporary shelter for California's migrant workers.

Ted Laufenberg, a scientist at the Madison lab, handed me a cross section of the new paneling, which was as light as cardboard but as stiff as a steel I beam. Its outer layers were wood veneer; the inside was constructed from compressed newspapers, molded like an egg carton into a series

of arches to provide support. Laufenberg believes it's strong enough to replace particleboard at half the weight.

But could something like these squares of paper trash catch on enough to make a difference? Will they ever be taken seriously as a construction material? Laufenberg thinks so—for interior use at least.

The new products may someday reduce the number of trees cut for timber, but they won't stop forests from being axed for pulp. Every year an estimated ten billion cubic feet of pulpwood is harvested worldwide for paper products. But contrary to a common misconception, that's less than 9 percent of the total timber harvest. And in the U.S. most pulp comes not from wild woods but from forests that are managed primarily for paper production.

One fine spring day I was driving through a forest of maple, beech, and cherry on the Tug Hill plateau east of Lake Ontario with Bruce Carpenter, who heads an environmental group called New York Rivers United. Green buds were just breaking open in woods that looked so wild they might have been protected parkland. But this was 50,000 acres of commercial forest, owned by the Lyons Falls Pulp and Paper Company. Like much paper-company land in northern New York, it had been selectively logged.

Carpenter was worried that this virtually unbroken expanse of forest wouldn't remain that way much longer. Lyons Falls was faced with declining profits and rising property taxes and was tempted to sell off its forest. To keep that from happening, Carpenter and other environmentalists—along with several industry representatives—had been lobbying state politicians to purchase conservation easements that would protect the land and help the company stay in business.

"Here we have a chance to sustain an industry and the forest at the same time, and we're blowing it," Dan McGough, former vice president

*Hanging on every word, would-be buyers preview part of an Abraham Lincoln speech before the document is auctioned at Christie's in New York City. Delivered during his campaign against Senator Stephen A. Douglas, the speech was penned by the future President, transforming otherwise ordinary sheets of rag paper. The coveted pages sold for $497,500.*

of Lyons Falls, told me after the New York Legislature failed to pass the conservation easement bill in 1994.

Early in 1996 the company announced that it had sold its land to the Hancock Timber Resource Group. Although Hancock has a solid reputation for good long-term management of woodlands it owns elsewhere in the U.S., Carpenter worries that without formal conservation easements in place the demand for vacation property in the region will continue to put pressure on landowners to fragment their holdings.

"Hancock could end up selling off places like this in 20-acre parcels for homes and condominiums," he said, his arm sweeping the surrounding woods. "We'll end up with more roads, more sediment in wild rivers, and clearings around every building. We feel that this is the place to prove that the paper and lumber industries could be one of the environment's best friends."

THAT'S NOT LIKELY TO HAPPEN SOON. For decades environmentalists have accused the paper business of gulping water, logging vast expanses of forest, producing waste, and spewing pollution. Meanwhile, the industry counters that it has increased its use of recycled papers (less than half of discarded paper ends up in landfills today), reduced energy consumption and pollution, and replanted forests.

"The paper industry has been a good corporate citizen," says Tom Schmidt, president of the Wisconsin Paper Council. "The industry recycled 43.3 million tons of paper in 1995, versus about 22.5 million in 1986. And for years it has operated beyond compliance with air and water pollution regulations."

Schmidt has reason to get defensive. Since 1985, when highly toxic dioxin was first discovered in the effluent of paper mills, the industry has spent more than a billion dollars to clean it up, claiming that by the end of 1994 it had cut dioxin discharges to under three ounces a

*Inquiring minds gather in Washington, D.C., at the Main Reading Room of the Library of Congress, world's largest library and storehouse for such rare documents as a Gutenberg Bible. In 1995 staff conservators fought to save some 12,500 volumes, many dating from the mid-1800s, when industrial mills began using acid-treated wood pulp to make paper in bulk.*

year—less than one percent of the amount released by all sources in the U.S. annually. But even tiny amounts may be harmful, hence the Environmental Protection Agency (EPA) recommendation of a water-contamination limit of .013 parts per quadrillion.

This is why environmentalists continue to pressure the industry, which releases dioxin and related organochlorine compounds in mill discharges as by-products of bleaching processes. To remove residual wood impurities and to improve paper's printing quality, mills have traditionally bleached their pulp with chlorine, which reacts with pulp to form organochlorines. Many of these chemicals, including dioxin, later work their way into the food chain by accumulating in the fatty tissues of fish, birds, and other creatures.

Although the health effects on humans from these chemicals remain controversial, in 1994 the EPA released the draft of a long-awaited study suggesting that further exposure to even small amounts of certain organochlorines could lead to increased risk of cancer, immune-system suppression, and birth defects.

PERHAPS NO PLACE DEMONSTRATES the persistence of the environmental problems better than the Fox River Valley in northern Wisconsin, where there are more paper mills than anywhere else in the nation. In the city of Green Bay, I dropped in on Mike Zettel, proprietor of Ole' Deviley's Bait Shop, a ramshackle gray building filled with fishing lures, night crawlers, and leeches. A burly fellow dressed in wing tips and dress pants, Zettel looked a bit out of place. He had just come from his job as a city police detective.

Zettel recalls the odor of the paper mills and the river in the early 1970s, when he walked the beat as a uniformed cop.

"It was so bad there were nights you couldn't stand it. There wasn't any oxygen in the river, and there weren't any fish except carp. It's gradually come back to the point that you've got a good fishery out there."

But you shouldn't eat the walleye and catfish from this river. Zettel tells me the fish still contain traces of harmful chemicals, the industrial residue dumped by paper mills long ago.

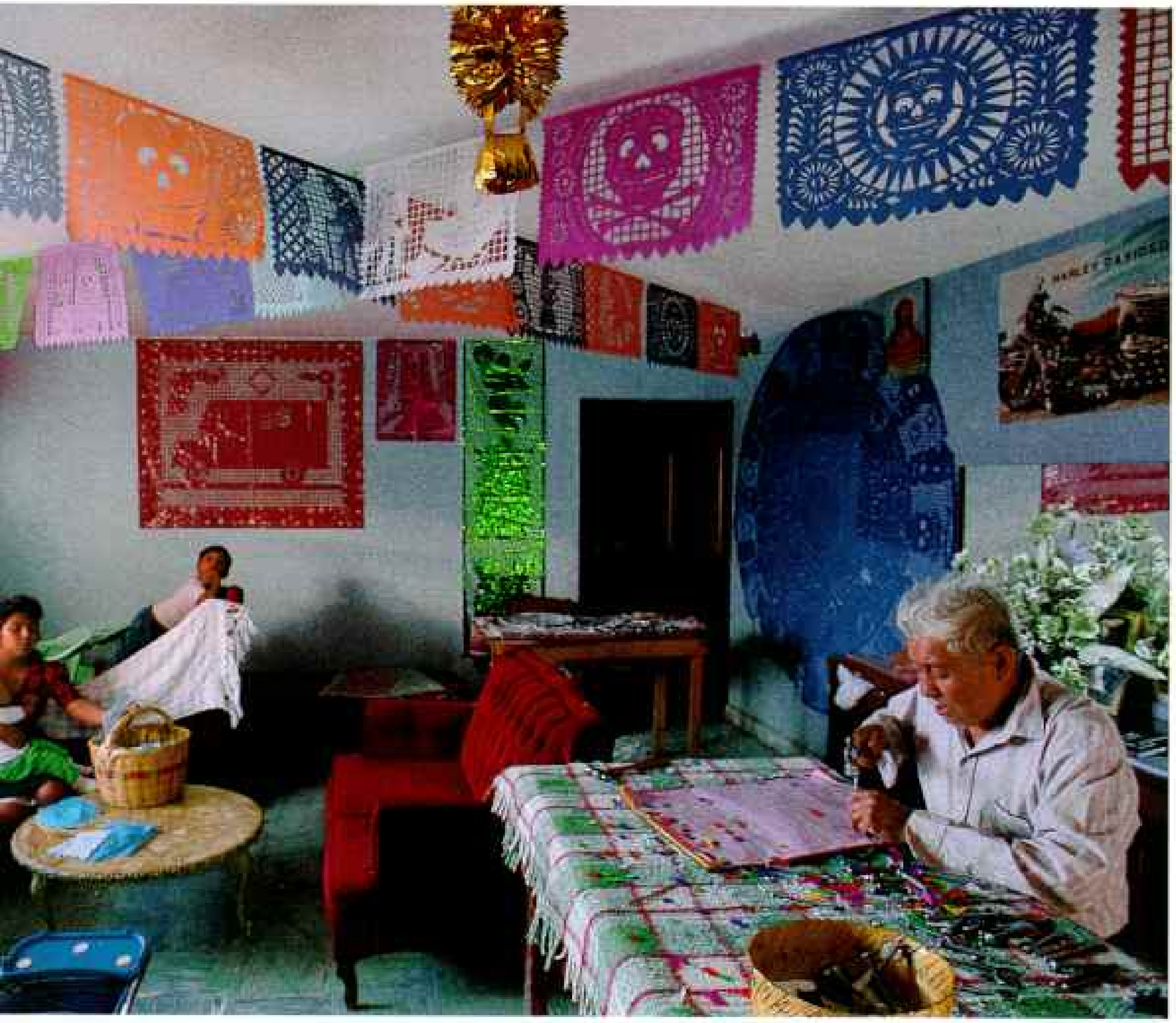
At least one local mill, owned by Green Bay Packaging, Inc., has figured out how to manufacture paper safely. No one complains about how many trees the Green Bay mill logs. Nor is anyone inclined to gripe about the pollutants it discharges. The reason is simple: It doesn't.

Inside the mill Jeff Walch, the general manager, took me to a loading area where forklifts were pushing bales of old corrugated boxes, what he called their "urban forest," onto conveyors that ramped up to a huge pulp vat. Then we slipped out back to look at where the mill used to discharge its wastewater into the Fox. Instead, I found a series of tanks filled with water to be recycled back to the mill.

"This valley is lined with paper mills because this is where the raw material was," Walch said. "And we needed to be on the river because this industry uses horrendous quantities of water. But in 1988 we made a commitment to rebuild this mill to make 100 percent recycled cardboard products and to completely close up our water loop." The system here recycles water that would otherwise be discharged. It is the sort of move that environmentalists like to see, where wastes become resources.

But this particular mill doesn't have to worry about bleaching its paper, because customers don't expect the cardboard it makes to be white. What about businesses like publishing that need white paper for high-quality printing? If you print a full-color magazine on paper that is

*A cut above the rest, Mexican craftsman Luis Vivanco Macías brings perfection to the art of* papel picado, *or punched paper. For over a century his village of San Salvador Huixcolotla in the state of Puebla has turned out banners celebrating whimsical—and macabre—characters. Bought by the armload at the local market, the*



*cutouts decorate homes and altars across the country on such holidays as El Día de los Muertos, the Day of the Dead.*

*Ghoulishly gorgeous, "La Catrina" makes no bones about laughing at life. Vamping in Mexico City's posh district of San Angel, she is a fine example of* cartonería, *the art of sculpting with cardboard tubing, wire, and papier-mâché.*

*Fantasy leaps to life in a swirl of paper snow as the Joffrey Ballet of Chicago dances* The Nutcracker *at the Kennedy*

*Center in the nation's capital. Says confetti maker Jim Watkins: "Paper snow makes magic in the air."*

not bright white, it distorts and muddies the color photographs. Are there no alternatives to chlorine bleaching? The industry is exploring several other bleaching methods. One of the mills that supplies paper to NATIONAL GEOGRAPHIC, for example, has switched from elemental chlorine to chlorine dioxide, which reduces organochlorines dramatically. Other mills are spending millions of dollars each to follow suit. They soon may not have a choice, because the EPA is considering regulations that would prohibit the use of elemental chlorine in any mill.

TALK to an average Japanese citizen about paper and such issues are not likely to be part of the conversation. Few nations revere paper as much as Japan, where the ancient art of *washi*, or handmade paper, endures: Calligraphers still bend over ivory sheets of washi. Geishas protect their skin from the sun with washi umbrellas. Children fly colorful washi kites and fold washi into intricate origami.

"We were born in a house of paper," said Kyoko Ibe, an artist I met in Kyoto, referring to *shoji*, the translucent paper windows of the traditional Japanese home. "And we retain the good feeling. Behind the shoji screen we cannot really see you, but we can know your actions, whether or not you are lively."

She pointed to a long piece of white washi hanging in her studio window. The sunlight warmed and softened as it passed into the room. "The best condition for paper is between the eye and light," Ibe said. "I can feel the life of the fiber. I can hear it. Perhaps we respond because of our own veins and arteries. We are knitted and connected, like the fiber."

A wistful note crept into Ibe's voice. "So often today people don't even think about paper," she said. "They just throw it away."

Not far from Kyoto, the mountain village of Kurodani, known for its papermakers, seemed locked in a changeless setting: Steep slopes, green with apricot trees, bamboo, and persimmon, rose above the village, shadowing its low wooden houses.

Kiyoshi Fukuda, chief of the local papermakers' cooperative, showed me small shops where papermakers were stirring pulp, forming sheets of paper, and plastering them onto boards of ginkgo wood to dry.

All this activity was deceptive. "I come from a family of papermakers. I learned by watching my father," Fukuda said. "But young people today see papermaking as a low-status job. They all want jobs in the city," he added, casting a sorrowful eye over the little workshops where a few hands kept the old tradition alive.

As recently as 20 years ago, there were nearly 900 households making washi in Japan. Today there are 360. "At one time a hundred households made paper in this village," Fukuda said. "We have 20 households making paper today. I tell young people this is a wonderful old craft, and we need to preserve it."

No longer am I surprised by the passion people like Fukuda have for this simple medium. Sometimes I find myself holding sheets of paper to the light to look at its specks and mottles; paper made of tree fiber, cotton, linen, or the bark of shrubs.

I asked Mr. Fukuda to teach me his wonderful craft. He stood at my side in a workshop in Kurodani, helping me dance with the paper mold.

My first sheet was not so bad. Fukuda-san smiled.

"One more," I said. With confidence this time, I danced the fibers into line without help. Another sheet formed, a butterfly of a thing.

"Just one more," I said again.

Fukuda gave me a knowing nod.

*Strings of folded paper cranes—the bird is Japan's symbol of peace and hope—screen the devastation depicted on a monument in Hiroshima, site of the first atomic bombing in 1945. Since then, children have draped winged offerings to honor a young girl who, dying from radiation poisoning, set out to fold a thousand paper cranes in the belief*

*that she would be healed. The Japanese have intermingled their faith and lives with paper. It is the fabric of a ceremonial kimono and a sheltering umbrella (left) for a dash through the rain.*

*Ubiquitous in modern life, the stuff of ordinary cellulose appears as the ephemeral and the long lasting, the sacred and the mundane. Such is the magic of paper.* □

# Kalinin

## Coping with a German past and a Russian future

# grad

BY PRIIT J. VESILIND
NATIONAL GEOGRAPHIC SENIOR WRITER

PHOTOGRAPHS BY
DENNIS CHAMBERLIN

STEVE RAYMER

Trying to picture the way they were, German tourists get a hand from local historian Ivan Makeer during a stop in Yasnaya Polyana, a village in the Russian Oblast of Kaliningrad on the Baltic Sea. It was variously a land of Teutonic Knights, Prussian kings, and, after 1933, Nazi soldiers. When the Soviet Army stormed in, Germans who didn't flee were deported. Some 50 years later the Germans are back, looking for pieces of their past—and of themselves—and finding Russians searching for the same thing.

SHE DOESN'T KNOW WHO SHE IS, only what people call her. Her last memories of home, in the city of Königsberg, the capital of German East Prussia, were of "big buildings burning and a strong man, who helped me onto a wagon filled with people."

Inge Kraus was about four years old in 1945, in the final agonizing months of World War II. Allied bombers had already shattered the city, and the Soviet Army, pressing toward Berlin, had stormed down the Baltic seacoast, scattering refugees. East Prussia, a nugget of land separated since World War I from the rest of Germany by a Polish corridor to the sea, was the first German territory the army encountered (map, page 115). In April Soviet artillery began to rain misery on Königsberg.

"I saw in back of us a red sky and heard bombing, a terrible noise," Inge told me in Berlin, at a meeting of the Königsberg Society of Exiles, where all stories are sad. "Dead horses lay in the fields around us, and we ate potato peels from the garbage of abandoned farms, and I was sick. When we arrived in Germany, I was put into an orphanage."

Inge can't go home again. Königsberg is now a Russian city of 400,000 called Kaliningrad, capital of a Russian-inhabited, Russian-speaking part of the Russian Federation, half the size of Belgium, wedged between Lithuania and Poland. East Prussia is gone.

She looked around at the pensioners who had gathered to be sentimental together. "I was hoping," Inge said, tears welling in her eyes, "that someone would recognize me."

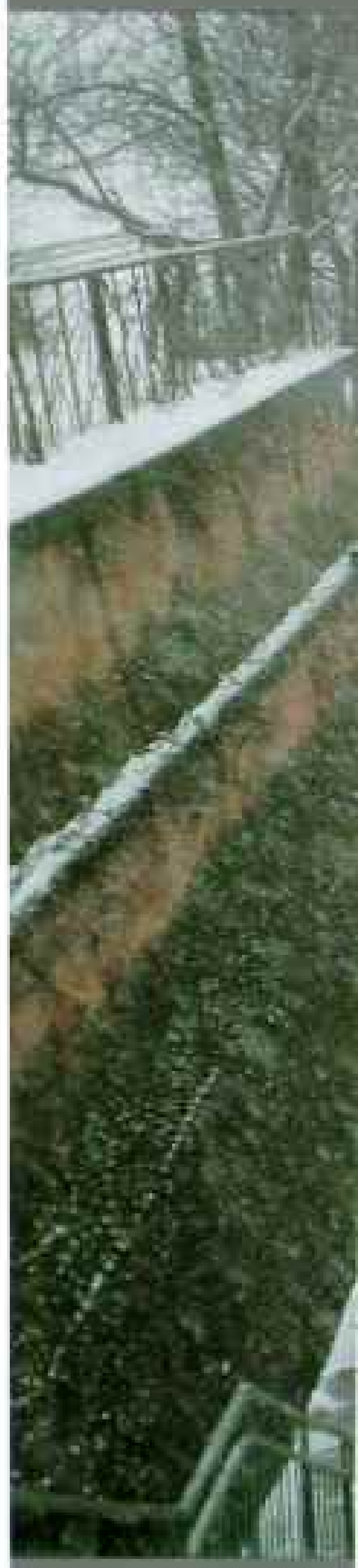
Identity, homeland, nationhood: All were fluid and emotional concepts at the end of World War II in Eastern Europe. The victorious Allies allowed the Soviet Union to annex Latvia, Lithuania, and Estonia, where I was born and from where my own family fled. The Allies took a carving knife to Germany, slicing off part of West Prussia for Poland. They bisected East Prussia; its southern part went to Poland, the rest to the Soviet Union to form today's Kaliningrad Oblast.

In Prussia, considered the cradle of German militarism, ethnic cleansing was thorough. Russian and other Slavic settlers were brought in to occupy the "new lands"; the remaining Germans, 139,000 of the original one million, were shipped to Germany or, in some cases, to Siberia. In 1946 Joseph Stalin named the city in honor of the puppet ruler of the Soviet Union, Mikhail Kalinin, a man who let his own wife die in a forced-labor camp.

I came to Kaliningrad on a commuter plane from Copenhagen in a February snowstorm and rode by taxi into the city on a road still lined with stately oaks and lindens, the kind of road that once led to some of the finest estates of the Prussian military aristocracy.

The Oblast of Kaliningrad, a 100-by-50-mile jigsaw piece of the Northern European Plain, is a bucolic land of rich soil and moist forests that shelters herds of elk, a land once considered part of the granary of Germany. Its coastline is buffered by two pine-covered sandbars, the Kursian and Visling Spits, as narrow as a quarter-mile, that extend like ropes from a promontory to tie Kaliningrad to its moorings.

Almost a million people live in the oblast, half of them in the city of Kaliningrad on the estuary of the Pregolya River, but much of the countryside suggests an archaeological site waiting for the next civilization to emerge, with slumping villages and the ruins of bankrupt communal farms built over crumbling Prussian barns—two layers of collapse. "New Russians," the entrepreneurial class, have built their mansions in the suburbs, but the



DENNIS CHAMBERLIN covers Eastern Europe from Gdańsk, Poland, a 100-mile drive from the city of Kaliningrad. This is his first GEOGRAPHIC assignment.

*Winter descends on the city of Kaliningrad, known as Königsberg until the Soviets renamed it in 1946. Stalin deported 139,000 Germans from the region, then replaced them with 400,000 Russians and other Slavs. "Deep in their hearts," one historian says of the Russians, "they cherished hopes to go back home." So too did the Germans.*

PHOTO: VESILIND, NGS

*Cargo cranes along the Pregolya River raise the hopes of local capitalists, who plan to profit from the region's special tariff-free status and proximity to Western Europe. The fortunes of Russia's naval fleet in the Baltic also rest on Kaliningrad: Its waters are the only part of Russia's Baltic coast that remain ice free year-round.*

post-communist order has not had time to build anything but brave plans.

In 1945 the Soviet Army tore the medieval core of Königsberg into rubble. Where Teutonic Knights had founded a fortress in 1255, where centuries of Prussian kings had been crowned, and where philosopher Immanuel Kant had lived in the 18th century, they obliterated as many reminders of German culture as possible. In 1947 the military sealed the region from outsiders. Occasional visitors spoke of a dark and wretched military enclave.

Kaliningrad lay 200 miles from the nearest point of Russia proper but was bounded by docile client states. It became a beachhead of Soviet power, headquarters for its Baltic Fleet, a prolific fishing port, and a supply depot for Warsaw Pact satellites such as Poland and East Germany. During the Cold War the outpost bristled with some 200,000 soldiers and sailors by Western count, 50,000 according to Russian military sources. As the Soviet Union unraveled, Kaliningrad was left behind, an island of armed, confused Russians separated from Mother Russia by three new sovereign nations—Lithuania, Latvia, and Belarus—once Soviet republics.


When the oblast finally opened its borders in 1991, among the first visitors were busloads of "nostalgia tourists" from Germany, old Königsbergers returning to the scenes of their childhoods. In the new order they and their deutsche marks were both welcome.

"People here are very sympathetic with the Germans who come," said Igor Yefimenok, a guide who took a crash course in German. "They also have a sense of the motherland. They cry when the Germans cry and bring them into the houses for lunch and vodka and ask them to stay longer. Many Germans come back year after year and bring gifts to the people living in their houses. They start thinking of each other as relatives."

Although German investment here is small and the German government has taken pains to deny interest in Kaliningrad, rumors of Germanization persist. The oblast officially lists some 5,000 ethnic German residents, but other estimates run as high as 20,000. Many of these are recent immigrants from Kazakstan, Russianized descendants of the Volga Germans whom Catherine the Great invited to colonize parts of Russia 200 years ago.

Some Kaliningrad Russians, morose about the breakup of the Soviet empire, seem fatalistic. Said Vladimir Busel, a technician who has been laid off at the Kaliningrad shipyard, "The Germans will come and exile us, just like the Soviet Army was pushed out of Germany."

City authorities denounce such rhetoric as a figment of an overzealous press. But in their eagerness to bury the past, they choose not to notice that Kaliningrad is haunted. The Russians and others who came here after World War II for a new life moved into the shell of a nation, into other people's homes and farms, to use other people's furniture and pots and pans. They came from their own burned-down villages, from the gulags, from

holes in the ground, and they did not mind displacing the Germans. After all, 20 million Soviets had died in the war that Nazi Germany had kindled.

Handicapped by poverty and uncertainty, the newcomers created little new. "They did not adopt anything from the German, and they lost whatever they had of the Russian," said Marina Klemesheva, a history professor at Kaliningrad State University. "They felt like strangers here."

Some were mystified by flush toilets and two-story farmhouses. They built outhouses and moved sheep and cattle into the first floors. When one place became unlivable, they moved to the next. Hundreds of villages were abandoned, the land grew fallow. Yet the settlers survived, picking berries, learning to grow potatoes in the burned soil, rearing a new generation.

Alexander Skryabin, the former chief of security for the oblast, was born here and now has sons 13 and 19. "When you hear that in Kaliningrad there is only a gang of people without roots, that's not true," he said. "I don't feel separated from the motherland. We grew up in the Soviet Union and don't really think of these other countries [Lithuania and Belarus] as foreign. I've had lots of opportunities to move to Moscow, but I like it here. The seawater temperature is comfortable, and the beaches are beautiful."

In winter the Baltic Sea spawns erratic snow squalls that bluster in and dissipate, leaving crystal blue skies above Kaliningrad. At night the streetlights glow dimly, like candles, bathing falling snow and fur hats in amber light. Sometimes you can barely see the *babushkas*, the old women, who sit by streetcar stops, selling apples, cigarettes, sunflower seeds, dried fish.

The city has never recovered from the war and has no true center. Where old Königsberg clustered, there are vast parks and plazas, surrounded by the bleak apartment buildings of the proletarian state. Where the Prussian Royal Castle once stood, the 22-story Communist Party headquarters—the House of Soviets—squats behind a construction fence, empty. Never used.

"The Soviets built it right on top of the castle," Klemesheva, the historian, told me, "but didn't realize that it was practically hollow underneath—full of basements, tunnels, secret compartments, and storage houses. The new building simply began to collapse."

Königsberg Cathedral, which survived the war, is where Immanuel Kant is buried. It sits beside the Pregolya River as if orphaned; newlyweds have begun to bring flowers to Kant's tomb, as they once did at the statue of Lenin, who still strikes a heroic pose on Victory Square, formerly Adolf Hitler Platz. Kant has become a local celebrity to disillusioned Russian youngsters, many of whom have taken Prussian history as part of their own.

"People here are different from those in Moscow," said Vladimir Gilmanov, professor of philology at Kaliningrad State University. "We have been deprived of our roots. We call ourselves Russians, but we were born into a double world, on land that by history was a part of a different country."

CAPITALISM FALLS HERE LIKE RAIN, depressing some, nourishing others. "If we only had the money . . ." is what I heard again and again. At the coastal town of Yantarnyy, which means "village of amber," I was led to the unhappy deputy director of the world's largest amber mine, who did not rise to shake hands.

"This year we were forced to stop production from October to January," the deputy director said wearily. "We had no money for electricity, and we still have debts. Output for the year has been cut in half. And we had to lay off workers."

We took a muddy road to an overlook above the strip mine, saw the giant dredgers and siphons that scoop out blue clay, the soil layer that holds the

*Hanging together during calisthenics, cadets at Kaliningrad's Higher Naval College have seen Russia's military presence here decline dramatically. Yet the troops still make neighboring nations nervous. "We trust them," says Adm. Vladimir Yegorov, commander in chief of Russia's Baltic Fleet. "They should trust us."*

*Sliding from revolution to religion: The House of Soviets, at left, was unknowingly built atop passageways under the demolished Prussian Royal Castle. As the tunnels slowly collapse, so too does this never occupied building. Renovation of Kaliningrad's soaring cathedral ends what one student calls "70 years of humiliating atheism."*

hardened resin of pine forests that bled when a warming period changed the climate here millions of years ago.

Officials admit that more than 20 tons of amber is smuggled yearly out of Kaliningrad, including more than 50 percent of the grade used to make jewelry. This, despite heavy security. Said one production worker, who declined to be named, "The police guards who get stationed here end up driving new cars within weeks, despite their state salaries. They're able to give their children $50 to pay off teachers to get better grades."

But as the heavy industry of Soviet times withers, the market economy sprouts. In the Kaliningrad city center a shopping mall built of prefabricated Polish-made kiosks, the Old Town Trade Center, spreads like a Bedouin camp. Renovated hotels, restaurants, and billboards dot the city like dandelions on a vacant lot.

MOSCOW MAY HAVE MORE MONEY and raw capitalism, St. Petersburg may have more culture, but Kaliningrad has location. Air routes, ship lanes, and railways are plugging Kaliningrad into the Baltic community. The autobahn to Berlin, partly completed by Hitler in the 1930s, is being rebuilt in a joint enterprise with the German state of Brandenburg. Western businessmen see Kaliningrad as a halfway house where they can negotiate for Russian markets without entering Russia proper, and distant Russian jurisdictions have set up shop in Kaliningrad to meet them.

Kaliningrad has resources: an ice-free port, amber, oil, an educated workforce, many institutions of higher learning. Recently the oblast gained permission from Moscow to operate on special status. Imports are not taxed if they stay in the region. Kaliningraders also conduct a brisk business in used cars, buying cheaply in Germany and selling to customers from other areas of Russia, who assume the tax payments.

As Kaliningrad changes in faster and different ways than the rest of Russia, speculation grows about its future: A Russian Hong Kong? Union with Poland or Lithuania? An independent fourth Baltic state? Or, what strikes anxiety in city officials most, a reborn, re-Germanized East Prussia?

"We are Russian and will stay Russian," said Vitaly Shipov, who was then the aggressively forward-looking mayor of Kaliningrad, "but we are far ahead of other Russian cities of this size. Other mayors have visited me. They take lessons here. We're going to be a boomtown!"

When I offered the mayor some observations about Kaliningrad, he said, "You have touched my heart with your wrong opinion of the city." He then lectured me for three hours, stringing Kaliningrad in bright lights. The city, he said, has bypassed Moscow and plugged into aid programs of the World Bank and the European Union. It could even be a visa-exempt gateway to Russia, a melting pot of Russian and foreign markets. Tourism is up.

But why was the region kept closed so long when other more militarized areas of Russia were open?

"Somebody declared it closed in 1947," Shipov answered, "and nobody dared to question it. It was a kind of inertia. That's all."

For NATO, Kaliningrad has long been the bogeyman of the Baltic. But since the retraction of Russian troops from the Baltic nations and Eastern Europe, the oblast has served less as a fortress than as a transit point back to the motherland and a bazaar for surplus military equipment.

A major effort has been to transform military factories to civilian ones—swords to plowshares. But Valentin Zakharov, then the deputy chief of economic development, surprised me when he said that no more than six factories need such retooling, even though Kaliningrad was known to be

profoundly dependent on the military. "That has been a myth," he insisted. "Only 5 percent of our enterprises here were working directly with the military-industrial complex. Our big military establishment was in the center of Russia. We didn't want to build it here, under the nose of NATO."

Captain of the First Rank Alexander Gorbatyuk, then the acting chief of the press center for the Baltiysk Naval Base, readily admitted that these were not the best of times. "Between 1991 and 1994 the Baltic Fleet was reduced by 40 percent, both in ships and personnel," he said. "Now we have just enough to maintain the security of Russian people in the Baltic area. We don't feel any threat from our neighbors, so we don't need any more."

The Russian military is struggling with the collapse of both ideology and support. The most acute problem now is the lack of housing for retired officers; 3,770 are on the waiting list in Kaliningrad.

Adm. Vladimir Yegorov, commander in chief of the Baltic Fleet, has led the conversion of military enterprises to civilian uses. He has given permission for a civilian workforce to build a deepwater port in Baltiysk, intended to accommodate oceangoing vessels and put at least some recently discharged sailors back to work. The admiral invited me to come see.

Baltiysk occupies the former German port of Pillau on the Visling Spit, now the westernmost point of Russian territory. More than 20 military attachés from Western nations have visited, according to Admiral Yegorov. "We have no secrets there," he said.

Vice Adm. Vladimir Komoyedov, chief of the Baltic Fleet headquarters, received me at the gate. But we had traveled only 500 yards when an urgent telephone call came to the admiral's staff car. It was an order from the KGB: He could not take the American journalist to see the fleet.

Embarrassed, Admiral Komoyedov escorted me into his office and offered vodka. He was gracious—all peasant roughness and a Russian willingness to get personal. I asked him about the image of Kaliningrad as a fist thrust into the West, a provocation.

"For the Baltic States," he said, "we are still a fist, but for the Western powers, just a finger. This is now a small piece of Russia. Why be afraid?"

Two days later I was summoned by the KGB and accused of going to Baltiysk without their permission. They made me sign a "confession form." It was a flashback to the old days but without the old fear.

THE FALLOW FIELDS of Kaliningrad attracted many who fell through the cracks during the Soviet Union's painful transition from socialism to private enterprise. During the first years that the oblast was opened, the Russian government offered five tax-free years to settlers who would move as private farmers onto collective farms, many of which were on the verge of collapse.

"Nowhere else could you find houses so cheap," said Alexander Poprov, a former helicopter pilot who came with his copilot and engineer to the village of Kuibyshevskoye, about 35 miles east of Kaliningrad city.

The pilots are known today as the most successful Russian farmers in the region. "If you understand the earth, it will understand you," Poprov told me, "but we Russians have been subjected to all kinds of agricultural experiments for 70 years. We've lost all the talents we had for farming. You can't imagine what a tragic situation the collectives are in."

For the past few years the original German owner of Poprov's new house has come back to visit: "He stayed for 20 days last summer. He's an ornithologist named Albert Schultz, 77 years old. He collects eggs from trees."

"He's climbing trees at that age?" I asked.

"No," Poprov said sheepishly. "It is I who climb the trees for him."

*Fields of lupines, tree-lined lanes, a red-tiled roof near Chekhovo:*
*These were typically German and part of the forced bequest to thousands of relocated Soviet families. The new arrivals were moved into evacuated homes, many still furnished. Yet families often failed to maintain the houses, since others in better shape stood nearby for the taking.*

*The warm glow of oil lamps keeps Irena Agapova's flowers from freezing on a corner of Leninsky Prospect in the city of Kaliningrad. No longer sustained by a Soviet light, the region relies on foreign investors, who are generating new jobs—and a bit of angst: Gazing back at Mother Russia, hundreds of miles away, people here wonder who they will become.*

Ironically, Kaliningrad has become a place of refuge for those fleeing nations such as Kyrgyzstan, Uzbekistan, and Kazakstan, former republics of the Soviet Union where truculent nationalism has made life unbearable for non-natives. I was told that more than 200 German-Russian families have come, many of them unaware that this was originally German land.

By the German law of return they could emigrate all the way to Germany, but Germany does not want more immigrants, and Russia does not want to lose good farmers, so the two governments conspired to make that option difficult: Germany does not officially aid or encourage German-Russians here; Russia will not approve a German consulate in Kaliningrad.

Both public and private sources in Germany have provided seeds and machinery, sent specialists to the oblast, and sponsored German-Russians on visits to Germany, in the hope that their "countrymen" abroad will stay abroad. More problematic are German nationalists who call Kaliningrad occupied territory and go there to create political mischief.

WE DROVE east from the city one Saturday afternoon along the valley of the Pregolya, its floodplains soaked by an early thaw. Winter wheat had sprouted kelly green, and plows had turned up dark, coagulated earth. Outside the city of Chernyakhovsk, formerly Insterburg, beside the brittle ruins of a Prussian estate, some one hundred German-Russian farmers from Kazakstan and Kyrgyzstan have created their own village. The state farm they were meant to resuscitate had folded, but a generous German firm from Kiel, headed by Dietmar Munier, helped them build new houses.

The foreman of the village is Vitaly Goltsman, a solid, sober German-Russian who came from Kyrgyzstan five years ago with his wife, Katya, and two children. For Goltsman the future seemed promising—until Dietmar Munier was exposed as an ultranationalist whose goal was the return of Kaliningrad to Germany.

The farmers argued with Munier over who would own the new houses, and the project was discontinued. Weary of the struggle, the Goltsmans are now on a waiting list to emigrate to Germany. "But what will I be in Germany?" he asks rhetorically. "We will stay foreigners forever." Goltsman stared at me, inviting contradiction, finding none.

"But Kaliningrad is no motherland for us either," he said. "I was born in the Ural Mountains and lived in Kyrgyzstan for 30 years—our best years. I built an eight-bedroom house there, everything from foundation to roof with my own hands. It broke my heart to leave."

Identity, homeland, nationhood: They still seem like transitional concepts in this embattled corner of the Baltic where World War II has not yet fully ended. We are both members and victims of our tribes, I thought. Few of us can measure up to Immanuel Kant, who never left East Prussia yet felt he was a *Weltbürger*, a citizen of the world, not of a particular nation. In a profoundly examined life Kant posed three eternal questions: "What can I know? What ought I to do? What may I hope?"

And I remembered what professor Vladimir Gilmanov had confessed to me: "In Kaliningrad we don't really know where we live. And so we don't know what to do, and thus we don't know what to hope for."

I watched Vitaly Goltsman and his wife, Katya, leaning into each other on the couch, steadying themselves as the ground beneath shifted once again. Their faces were German, but their apartment, decorated with Oriental carpets, was pure Russian, and their beaded curtains spoke of Turkish Asia. They were the lost Soviet couple, rattling around the failed empire without a motherland, wondering who they really were. □

# BEARDED SEALS

# GOING WITH THE FLOE

BY KIT KOVACS PHOTOGRAPHS BY FLIP NICKLIN

*Saucer eyes reveal surprise as a bearded seal confronts an intruder. To flesh out the portrait of these appealing creatures, Canadian biologist Kit Kovacs and her partners, Christian Lydersen and Ian Gjertz of the Norwegian Polar Institute, are making the first detailed studies of the lives of bearded seals on the animals' home turf: drifting floes of Arctic ice.*


Remote, harsh, and incomparably lovely, Svalbard, Norway, is an Arctic archipelago of crystalline glaciers and ghostly mountains that rise from the sea. When I first joined my colleagues here in 1992, I contracted "Svalbard fever," a passion for the place and its natural inhabitants. The following year we encountered the creature that has lured me back ever since.

In April 1993 the ice broke early. This forced our team to forsake snowmobiles and instead use boats to travel across a fjord from our base in Ny Ålesund. We steered around rafts of ice in Kongsfjorden to reach the land-fast ice on the other side, where we had been conducting research on ringed seals. During the crossing we were surprised to see several pairs of bearded seals—mothers and pups—drifting on the loose pack ice. Instantly we could see it in one another's eyes: Our research was about to shift focus.

Bearded seals, the largest of the northern phocids, or earless seals, were barely known to science. Because they are solitary animals that live on transient ice floes in high polar seas, little hands-on work had been done with live bearded seals in their natural environment. The possibility of working with these creatures was too tempting to pass up. "Let's just see how close we can get," I said. Moments later Christian abruptly leaped from the front of our boat, and that was that. Our first bearded seal pup was in hand, and a new program was launched—literally.

Since then we've honed our capture technique, found the first recorded birth sites in Svalbard, and studied growth, lactation, diving, and feeding. But we've much yet to learn on the shifting ice.

**ON THE LOOKOUT**
Bundled against springtime temperatures that can dip past minus 20°F, I observe bearded seals from a small boat. Finding them is often the toughest job of the day. Though they live throughout the high north, the seals are sparsely spread and are highly mobile. Luckily they are inquisitive, even tame around us. Yet they remain wary, resting near the edge of ice floes (above) so they can quickly escape from polar bears.

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KIT KOVACS, a professor at the University of Waterloo in Ontario, is currently working for Akvaplan-niva, a research institute in Norway. FLIP NICKLIN photographed sperm whales for the November 1995 issue.

**UNWIELDY ROUNDUP**

Bearded seal pups are the most charming animals I have ever worked with. But capturing them for study can be a challenge.

First we've got to find them. Because bearded seals are not gregarious, we must patrol an area of about 50 square miles to locate individuals or pairs.

Pups are born on the ice—often on pieces not much longer than the mother's body. And unlike most other seals, which spend their nursing periods on solid land or ice, bearded seals soon take to the sea. We've recorded pups less than a week old diving for more than five minutes to 250 feet. This skill may have evolved as a means to escape polar bears. For us it means a bit of fancy boat work.

We maneuver our boat alongside a swimming pup. As it surfaces to breathe, we scoop it into our dip net (bottom left). In these endeavors Ian drives, I crouch in the middle to help land the seal, and Christian mans the net, calling out, "Right! Right! No, the other right!" (The only call we really pay attention to is "Man overboard," which is uttered with some regularity.)

Once a pup is caught, we go to the nearest ice floe to begin our work. If there's no floe in sight, we tie up to the boat carrying graduate students to weigh the pup (below)—no easy task, as bearded seals weigh about 80 pounds at birth and can top 250 pounds in just a few weeks.

A Research Project Supported In Part By Your Society

It's hard to think of these seals as babies—that is, until they suckle on a finger for comfort, as one pup did to Christian (upper left). While most other seal species struggle during handling, bearded seal pups are placid, drawing affectionate coos even from my field-hardened Viking-stock companions.

**BALLET IN BLUE**

With the grace of a dancer—and the concern of a parent—a bearded seal mother dives for food, staying close to the floe where we examine her pup. Because Svalbard's bearded seals tend to feed along the coastline on bottom-dwelling invertebrates such as shrimp and clams, their dives average only about 300 feet—much shallower than the dives of most other earless seals. Yet bearded seals are more at home in the sea than out of it, spending most of their lives in the water. In the wild their lifespan averages 25 to 30 years.

**MATERNAL INSTINCTS**

Angelic bearded seal pups are effective "bait" to lure mothers onto the ice. We color mark a pup for identification and hold it near the ice edge so its mother can nuzzle it to make sure it's hers (facing page, at top). Then we'll back away and hold the pup (right). With luck the mother follows, and we jump her with a net (below). This is a bit of a grunt: Adult bearded seal moms can weigh more than 850 pounds. But we feel our low-tech method is safer than drugging or using aquatic nets that could cause drowning. And it works.

**HIGH-ENERGY SHAKE**

Soon after birth, bearded seal pups spend half their time romping and diving in near-freezing water, so they need energy to burn with some left over to store as fat. Mothers provide most of the fuel during a nursing period that lasts from 16 to 24 days, with pups feeding about every three hours day and night.

Obtaining milk for analysis is a tricky business. The mother's four mammary glands are tucked inside her body to improve hydrodynamics during swimming and to keep them warm. They descend when the pup nudges its mother's belly. Our own gentle probing fails to extract a teat, so we cheat and inject the hormone oxytocin to stimulate milk let-down, then suction the milk into a tube (below).

Like a double-thick shake spiked with cod-liver oil, bearded seal milk is 50 percent pure fat—an elixir for pups, who drink about 16 pounds of it a day. On this rich diet pups gain about eight pounds daily, packing on enough bulk to beat the cold.

**SPYING AT SEA**
Modern technology allows us to track at-sea behavior of bearded seals without bothering them—and without getting wet. After coloring epoxy with fluorescent dye for easy visual identification, we glue a black time-depth recorder (TDR) and a VHF radio transmitter to the fur on a seal's back (left). Every ten seconds the TDR records whether the seal is in or out of the water and how fast and deep it swims or dives. VHF transmitters let us keep tabs on the seals so we can retrieve our gear and its precious data.

**BON VOYAGE**

With an "Off you go" and a friendly shove, Ian coaxes a TDR-tagged female toward the sea (left). Graduate students Randi Holsvik and Bjorn Krafft help make sure that the pup soon follows. The seals' journey will then become a part of our own.

We'll check their locations daily—weather permitting—for the next few weeks, keeping as far as three miles away. If all goes well, we'll recapture these seals just before the pup is weaned, then download their TDR data into our portable computers.

From data collected so far, we've learned that mothers attend their pups very closely during the first week of life, mirroring their babies' dives. But pups soon become more independent, spending less synchronized time with their mothers and venturing out on their own. Satellite data from one of our earlier studies show that one pup took a jaunt to Greenland just a few months after being weaned.

Before any captured seals are released, we take blood samples and attach flipper tags for identification, which the animals will wear for life. This process leaves the snow bloodstained but the seals unhurt. (Pups have occasionally been known to doze off while being worked on.)

Once we have collected blood samples from enough animals, we'll begin to study their DNA to learn more about their genetic makeup, mating patterns, and population distinctions. We'll also analyze their blood for contaminants. Bearded seals may accumulate concentrations of toxic compounds such as PCBs, found in the clams and some other invertebrates the seals eat.

Our work on the ice complete, it's gratifying to watch a bearded seal glide back into the sea (below). Her neon color mark will soon molt off, but her contribution to our knowledge of the species will remain.

**POLAR SOLOIST**

Looking every bit the baritone, a male bearded seal lolls in the sun. As his whiskers dry, they will curl toward his reddish face, stained from iron in the mud where he feeds. Males are known for their melodic trills, which travel many miles underwater. We suspect that these songs, as well as exuberant bubble displays, could be used to attract mates or to defend underwater territories. To confirm our suspicions, we've made these big boys our next research target. □

# *The 1997 LeSabre.*
# *The family's safely home...*

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Kenji Toma
*"Reduce Speed, Curves Ahead"*
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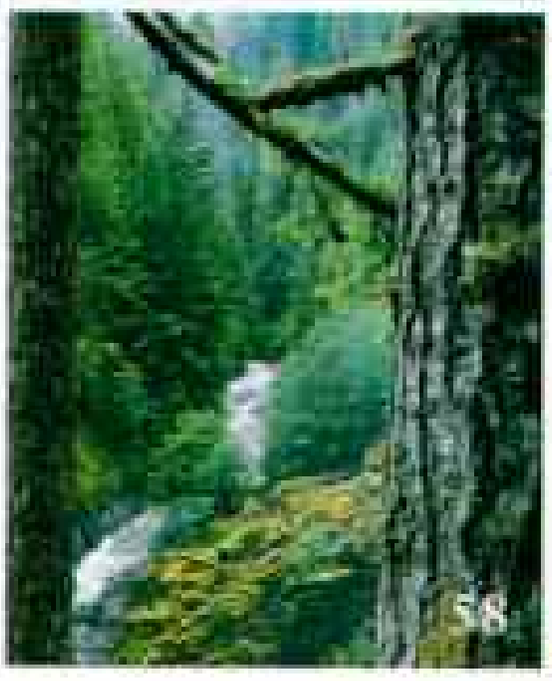
# NATIONAL GEOGRAPHIC

MARCH 1997













## The Cover

*A startled bearded seal encounters the photographer in Arctic waters 300 miles east of Greenland. Photograph by Flip Nicklin.*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NATIONAL GEOGRAPHIC

# *Behind the* Scenes

SISSE BRIMBERG, NGS

## All Wrapped Up in Paper

For this issue's paper story, photographer Sisse Brimberg went to the Mexican village of San Pablito, where a shaman's pre-Columbian healing ritual depends on paper. In an attempt to gain good health and good crops for her clients, the shaman leaves intricate paper cutouts of ancient gods, similar to those above, along with cutouts of the villagers at a shrine in town.

## Pictures of Hope

Taking photos can make a difference. Just ask frequent GEOGRAPHIC contributor Reza. In 1994, when war broke out between Rwanda's Hutus and Tutsis, thousands fled. Some 100,000 children were separated from their parents; about 12,000 ended up in camps partly sponsored by UNICEF in Zaire. While photographing the camps, Reza lent his support to help return children to their families. He persuaded companies to donate cameras and film and trained volunteers. Thousands of children were photographed (lower right). Their portraits were hung in makeshift galleries (upper right), where hopeful parents searched for familiar faces. The project had reunited 3,500 kids with their families by last October.

For their work, Reza and UNICEF jointly received the Award of Hope at the Visa pour l'Image photo festival in Perpignan, France; a $10,000 prize went to UNICEF. But Reza's real reward was helping the children. "If you don't care what happens," he says, "what kind of person are you?"

REZA / GRAPHIS

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## A Ringing "Happy Birthday" to Alexander Graham Bell

He did more than invent the telephone. He experimented with flying machines and phonographs, cancer cures and metal detectors. The son of a hearing-impaired mother, he was a lifelong advocate for the deaf. But Alexander Graham Bell (right), born 150 years ago on March 3 in Edinburgh, Scotland, is not as well-known for one of his most famous endeavors: He helped launch the National Geographic Society. This month the Royal Mail of Scotland honors Bell with a commemorative series of international airmail letters. BELL COLLECTION, NGS IMAGE COLLECTION

MAYA LAURINAITIS, NGS

## Garden Variety Show

Hollywood came to suburban Virginia when National Geographic Television filmed "Savage Garden" at the home of NATIONAL GEOGRAPHIC TRAVELER Editor Richard Busch. The show depicts the rough-and-tumble reality of the seemingly serene garden. Richard's wife, garden writer Olwen Woodier, watched actor Leslie Nielsen (left)—and 35 crew members—trample her beloved borders. "By the 12th take in the tomatoes, the lights were wilting the foliage. So they went to my other tomatoes and broke off fresher branches. But now, at least, my garden lives on—in film." The show airs on EXPLORER on TBS later this year.

## Marine Photo Exhibit

"To See the Sea: the Underwater Vision of Al Giddings" appears in Explorers Hall through May 4. The exhibit, which includes this portrait of a sea anemone and interactive displays, features the innovative work of the photographer/cinematographer.

PATRICK BEATY

## His Burning Ambition

AL GIDDINGS, AL GIDDINGS IMAGES

You might say freelance photographer Mike Yamashita has a dream job working for NATIONAL GEOGRAPHIC, but actually he has two dream jobs. For ten years Mike has volunteered at the Ralston Engine Company in his hometown of Mendham, New Jersey. But even during a blaze, photos are never far from his mind. "I keep a waterproof camera in my turnout gear," Mike says. "When the alarm rings, I'm a fireman first. But you never know when you'll see something good."

—MAGGIE ZACKOWITZ

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# Forum

*While preparing "Colorado's Front Range" for the November 1996 magazine, we received criticism from a developer, and comment from the governor, regarding the accuracy of a photograph of congested housing at Highlands Ranch. The controversy was widely reported in the Colorado media. The picture was published.*

## Colorado's Front Range

I am a native of Colorado and have lived here almost all my 66 years. I know that the political and economic forces of Colorado did not want certain pictures and remarks made in your article. The people of the world need to know how badly the people of Colorado have managed their beautiful land. I hope your article serves as a lesson to other communities in the West so that they can unite and prevent the wasting of their precious resources. It is too late now for the Front Range.

RALPH MARSH
*Niwot, Colorado*

How Mission Viejo, the prominent developer of the Highlands Ranch area, could complain about the photograph on pages 84-5 is beyond me. It is a very apt depiction.

Newcomers want and expect the same services, strip malls, trendy but bland restaurant franchises, and life just like it was where they came from. The end result? An erosion of the Front Range and the homogenization of a former cow town to just another city with all the problems a city possesses: pollution, crime, uncivilized attitudes. If you are considering moving here, stay where you are. More people is the last thing we need.

H. STEVEN ROSEN
*Denver, Colorado*

After spending most of our lives in Long Island and Connecticut, we moved to Highlands Ranch in 1995. Reading Michael Long's article, we were annoyed by the lack of recognition given to the quality of life here. The Front Range is one of America's best kept secrets when it comes to quality of life. We now find ourselves selfishly hoping to stem the growth that has ruined the Northeast. We have not once regretted moving here. We believe the "Ranch" to be as close to the "white picket fence" neighborhood of the past as you can get today.

CAROLINE AND PAUL ZULKOSKI
*Highlands Ranch, Colorado*

By looking at your photo of Highlands Ranch, one would wonder why anyone would want to live like that. Well, you can't see the whole picture or what we see in the morning out the bedroom windows: some of the most breathtaking views of mountain majesty that I have ever seen. We have greenbelts with picnic tables, bikeways, walkways, and trees.

I am not happy about all the traffic I encounter as I drive up the interstate to ski, fish, hike, climb, camp, breathe clean air, lunch at Vail, dine in Breckenridge, shop in Silverthorne, attend concerts at Red Rocks, and go to a Rockies, Broncos, Avalanche, or Nuggets game. It's a tough life, but somebody has to live it.

TISH JEFFERS
*Highlands Ranch, Colorado*

There is a big shortage of water here. We are now five inches below the normal annual precipitation of 14 inches. Yet Douglas County alone has 11 golf courses and more in the planning. Where is the common sense of these college-educated planners we have? Is it so important to have all these golf courses that use millions of gallons of water daily, forcing people whose wells go dry to drill deeper for water?

MILDRED WILLIAMS
*Larkspur, Colorado*

The author left me with the feeling that the only problems of Front Range communities are a lack of water and the brown cloud. Yet they are also experiencing an increase in the cost of living, crime, drugs, and gang violence, not to mention the undertones of resentment against gays and gay rights.

TAMMY WOOD
*Joplin, Missouri*

Looking back at your article about Utah (January 1996), I was struck at how similar the Wasatch Front is to the Front Range of 20 years ago. I urge Utah residents to address their issues now, or they will soon be like us.

MELISSA STEGEMAN-ROBERTS
*Arvada, Colorado*

## Orbit: Astronauts' View of Home

I was delighted to find the stunning photographs of Mount Everest and the Baltoro Glacier area [Geographica] taken from the shuttle *Atlantis*. I am a Quaternary scientist working on the glacial history of these regions. The amount of detail visible makes the images extremely useful resources for research and teaching. I am planning a second research trip to the Khumbu Valley next autumn, and looking at my field area from 184 miles high brought forth a flood of new ideas for things to look at.

DOUG BENN
*Department of Geography*
*University of Aberdeen*
*Aberdeen, Scotland*

Fascinating. The pictures inspired me to put myself in the position of an ancient scientist who could only dream of seeing the islands of Greece and the rivers of Mesopotamia from above, just as the gods might see them.

IGOR ROGELJA
*Ljubljana, Slovenia*

I liked the picture of the muddy river in Madagascar flowing into the Indian Ocean. It realistically shows

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the damage caused by the continuous clearing of new land. Sometimes facts and figures cannot explain what is happening to our environment.

TIM WHITE
*Huntington Beach, California*

## Sir Joseph Banks

Thank you for the beautiful presentation on Sir Joseph Banks. I grew up along Botany Bay. My mother was raised in the Sydney suburb of Bankstown, now a sprawling city next to the suburb of Revesby, named after Banks's English estate. But I must question your attribution of "father of the Commonwealth of Australia" to Banks. Federation in 1901 was mainly the work of Sir Henry Parkes, Premier of New South Wales. Banks was far removed by birth and interest from an independent Australian Commonwealth.

RODNEY M. PYNE
*Faulconbridge, New South Wales*

*The expression referred to the fact that Banks was among the first to suggest that Australia be colonized with British people.*

Banks lives on as a major character [Sir Joseph Blaine] in Patrick O'Brian's fictional adventures of Capt. Jack Aubrey and ship's surgeon Dr. Stephen Maturin, which occur during the Napoleonic Wars. Dr. Maturin is both naturalist and intelligence agent. As the former, he collects specimens, mostly beetles. As the latter, Maturin collects information and acts as an agent provocateur for Blaine, who is portrayed as a British intelligence figure. Mr. O'Brian's accuracy describing many other historical events leads me to believe that Banks was much more than a dedicated naturalist.

JAMES B. CURRIE
*San Antonio, Texas*

I am a 16-year-old girl who is interested in natural science. I have always wanted to be a biologist or botanist. Your article is truly inspiring. Such articles show me that my life belongs in science.

MILENE TILGHMAN
*Santa Monica, California*

## Gibraltar

There can be little doubt that the majority of Britons would be quite happy to see Gibraltar and, for that matter, the Falkland Islands leave British control and decide upon their own future. I suspect that the British taxpayers and their exchequer would be somewhat relieved.

ERIC JONES
*Southend on Sea, England*

I wonder where Spain gets the moral authority to demand the return of Gibraltar when it is obvious from the map (page 56) that Spain occupies a territory called Ceuta in Africa that should clearly belong to Morocco.

DAVID A. RODGER
*North Vancouver, British Columbia*

The article says that Tariq dubbed the place Jabal Tariq—Tariq's Mountain—"a name the English tweaked to beget 'Gibraltar.'" We Spaniards were more than able to tweak names centuries before the English even knew the Arab name of the Rock. I have in front of me a Spanish text written in 1444 by a poet and scholar from the court of King Juan II of Castile in which the word "Gibraltar" appears. The Arabic component "Jabal" is common in geographical names in Spain: Gibralfaro, Gibraleón, and Gibraltar for mountainous places.

JULIO BAENA
*Professor of Spanish Literature*
*University of Colorado*
*Boulder, Colorado*

## First Run Down the Shuiluo River

Having spent a little time in white water, I spent much time imagining what these river runners must have gone through. But why would seasoned professionals, amateur adventurers, and sane (presumably) physicians follow through with the excursion with such obstacles in their way? The refusal of the Chinese government to allow such benign safety measures as aerial reconnaissance and portable two-way radios should have put a halt to the process. Some endeavors cross the line from risk to bad judgment. This, I believe, was one of those times.

WILLIAM J. TRUAX, JR.
*Jacksonville, North Carolina*

"I'm scared." Eric Hertz's words lend more testimony to his credibility as a white-water professional than most might imagine. Great rivers like the Shuiluo defend themselves against the invasion of man by presenting opportunity after opportunity to make a bad decision. Once on the river, man's best defense is not great paddling skill but well-seasoned, finely tuned fear and the wisdom it brings, particularly, of knowing when to yield. Too many checkbook adventure travelers don't understand this. Professionals do. They have earned their wisdom. Their reward? All 18 members of their team get to leave the Shuiluo victorious and alive.

ALAN PATTÉ
*Toronto, Ontario*

*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 Internet to ngsforum@nationalgeographic.com. Include name, address, and daytime telephone. Letters may be edited for clarity and space.*

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**CONTRAINDICATIONS:** Hypersensitivity to any component of this medication. Active liver disease or unexplained, persistent elevations in liver function tests (see **WARNINGS**). Pregnancy and lactation. Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development including synthesis of steroids and cell membranes. Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. **Pravastatin should be administered to women of childbearing age only when such patients are highly unlikely to conceive and have been informed of the potential hazards.** If the patient becomes pregnant while taking this class of drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus. **WARNINGS: Liver Enzymes —** HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. Increases of serum transaminases (ALT, AST) values to more than 3 times the upper limit of normal occurring on 2 or more visit (not necessarily consecutive) occasions have been reported in 1.3% of patients treated with pravastatin in the UK over an average period of 18 months. These abnormalities were not associated with cholestasis and did not appear to be related to treatment duration. In those patients in whom these abnormalities were believed to be related to pravastatin and who were discontinued from therapy, the transaminase levels usually fell slowly to pretreatment levels. These biochemical findings are usually asymptomatic although anecdotal experience indicates that anorexia, weakness, and/or abdominal pain may also be present in rare patients. **It is recommended that liver function tests be performed before the initiation of treatment, at 6 and 12 weeks after initiation of therapy or elevation in dose, and periodically thereafter (e.g., semiannually).** Patients who develop increased transaminase levels should be monitored with a second liver function evaluation to confirm the finding, and be followed thereafter with frequent liver function tests until the abnormality(ies) return to normal. Should an increase in AST or ALT of three times the upper limit of normal or greater persist, withdrawal of pravastatin therapy is recommended. Active liver disease or unexplained transaminase elevations are contraindications to the use of pravastatin (see **CONTRAINDICATIONS**). Caution should be exercised when pravastatin is administered to patients with a history of liver disease or heavy alcohol ingestion (see **CLINICAL PHARMACOLOGY: Pharmacokinetics/Metabolism**). Such patients should be closely monitored, started at the lower end of the recommended dosing range, and titrated to the desired therapeutic effect. **Skeletal Muscle — Rare cases of rhabdomyolysis with acute renal failure secondary to myoglobinuria have been reported with pravastatin and other drugs in this class.** Uncomplicated myalgia has also been reported in pravastatin-treated patients (see **ADVERSE REACTIONS**). Myopathy, defined as muscle aching or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values to greater than 10 times the upper normal limit, was rare (< 0.1%) in pravastatin clinical trials. Myopathy should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. **Pravastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. Pravastatin therapy should also be temporarily withheld in any patient experiencing an acute or serious condition predisposing to the development of renal failure secondary to rhabdomyolysis, e.g., sepsis; hypotension; major surgery; trauma; severe metabolic, endocrine, or electrolyte disorders; or uncontrolled epilepsy.** The risk of myopathy during treatment with another HMG-CoA reductase inhibitor is increased with concurrent therapy with either erythromycin, cyclosporine, niacin, or fibrates; however, neither myopathy nor significant increases in CPK levels have been observed in these reports involving a total of 100 post-transplant patients (34 renal and 76 cardiac) treated for up to two years concurrently with pravastatin 10-40 mg and cyclosporine. Some of these patients also received other concomitant immunosuppressive therapies. In one single-dose study, pravastatin levels were found to be increased in cardiac transplant patients receiving cyclosporine. Further, in clinical trials involving small numbers of patients who were treated concurrently with pravastatin and niacin, there were no reports of myopathy. Also, myopathy was not reported in a trial of combination pravastatin (40 mg/day) and gemfibrozil (1200 mg/day), although 4 of 75 patients on the combination showed marked CPK elevations versus one of 73 patients receiving placebo. There was a trend toward more frequent CPK elevations and patient withdrawals due to musculoskeletal symptoms in the group receiving combined treatment as compared with the groups receiving placebo, gemfibrozil, or pravastatin monotherapy (see **PRECAUTIONS: Drug Interactions**). **The use of fibrates alone may occasionally be associated with myopathy. The combined use of pravastatin and fibrates should be avoided unless the benefit of further alterations in lipid levels is likely to outweigh the increased risk of this drug combination. PRECAUTIONS: General —** Pravastatin may elevate creatinine phosphokinase and transaminase levels (see **ADVERSE REACTIONS**). This should be considered in the differential diagnosis of chest pain in a patient on therapy with pravastatin. *Metoprolol. Familial Hypercholesterolemia.* Pravastatin has not been evaluated in patients with rare homozygous familial hypercholesterolemia. In this group of patients it has been reported that HMG-CoA reductase inhibitors are less effective because the patients lack functional LDL receptors. *Renal Insufficiency.* A single 20 mg oral dose of pravastatin was administered to 24 patients with varying degrees of renal impairment (as determined by creatinine clearance). No effect was observed on the pharmacokinetics of pravastatin or its 3α-hydroxy isomeric metabolite (SQ 31,906). A small increase was seen in mean AUC values and half-life (T½) for the inactive enzymatic ring hydrolyzed metabolite (SQ 31,980). Given this small sample size, the dosage administered, and the degree of individual variability, patients with renal impairment who are receiving pravastatin should be closely monitored. **Information for Patients —** Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. **Drug Interactions —** *Immunosuppressive Drugs. Gemfibrozil. Niacin (Nicotinic Acid). Erythromycin.* See **WARNINGS: Skeletal Muscle.** *Aspirin.* Since concomitant administration of pravastatin had no effect on the clearance of aspirin, interactions with other drugs metabolized via the same hepatic cytochrome enzymes are not expected. *Cholestyramine/Colestipol.* Concomitant administration resulted in an approximately 40 to 50% decrease in the mean AUC of pravastatin. However, when pravastatin was administered 1 hour before or 4 hours after cholestyramine or 1 hour before colestipol and a standard dose, there was no clinically significant decrease in bioavailability or therapeutic effect. (See **DOSAGE AND ADMINISTRATION: Concomitant Therapy**.) *Warfarin.* In a study involving 10 healthy male subjects given pravastatin and warfarin concomitantly for 6 days, bioavailability parameters at steady state for pravastatin (parent compound) were not altered. Pravastatin did not alter the plasma protein-binding of warfarin. Concomitant dosing did increase the AUC and Cmax of warfarin but did not produce any changes in its anticoagulant action (i.e., no increase was seen in mean prothrombin time after 6 days of concomitant therapy). However, bleeding and cabrotrise prolongation of prothrombin time has been reported with another drug in this class. Patients receiving warfarin type anticoagulants should have their prothrombin times closely monitored when pravastatin is initiated or the dosage of pravastatin is changed. *Cimetidine.* The AUC∞ for pravastatin when given with cimetidine was not significantly different from the AUC for pravastatin when given alone. A significant difference was observed between the AUC's for pravastatin when given with cimetidine compared to when administered with antacid. *Digoxin.* In a crossover trial involving 19 healthy male subjects given pravastatin and digoxin concurrently for 6 days, the bioavailability parameters of digoxin were not affected. The AUC of pravastatin tended to increase, but the overall bioavailability of pravastatin plus its metabolites (SQ 31,906 and SQ 31,945) was not altered. *Carbamazepine.* Some investigators have measured carbamazepine levels in patients on pravastatin, and to date, these results indicate no clinically meaningful alterations in carbamazepine levels. In one single-dose study, pravastatin levels were found to be increased in cardiac transplant patients receiving carbamazepine. *Gemfibrozil.* In a crossover study in 76 healthy male volunteers given concomitant single doses of pravastatin and gemfibrozil, there was a significant decrease in urinary excretion and protein binding of pravastatin. In addition, there was a significant increase in AUC, Cmax, and Tmax for the pravastatin metabolite (SQ 31,906). Combination therapy with pravastatin and gemfibrozil is generally not recommended (see **PRECAUTIONS**). *Ketoconazole, nicotinic acid, or probucol.* No statistically significant differences in bioavailability were seen when PRAVACHOL (pravastatin sodium) was administered. *Other Drugs.* During clinical trials, no noticeable drug interactions were reported when PRAVACHOL was added to diuretics, antihypertensives, digitalis, ACE inhibitors, calcium channel blockers, beta-blockers, or nitroglycerin. **Endocrine Function —** HMG-CoA reductase inhibitors interfere with cholesterol synthesis and lower circulating cholesterol levels and, as such, might theoretically blunt adrenal or gonadal steroid hormone production. Results of clinical trials with pravastatin in males and post-menopausal females were inconsistent with regard to possible effects of the drug on basal steroid hormone levels. In a study of 21 males, the mean testosterone response to human chorionic gonadotropin was significantly reduced ($p < 0.004$) after 16 weeks of treatment with 40 mg of pravastatin. However, the percentage of patients showing a > 100% rise in plasma testosterone after human chorionic gonadotropin stimulation did not change significantly after therapy in these patients. The effects of HMG-CoA reductase inhibitors on spermatogenesis and fertility have not been studied in adequate numbers of patients. The effects, if any, of pravastatin on the pituitary-gonadal axis in pre-menopausal females are unknown. Patients treated with pravastatin who display clinical evidence of endocrine dysfunction should be evaluated appropriately. Caution should also be exercised if an HMG-CoA reductase inhibitor or other agent used to lower cholesterol levels is administered to patients also receiving other drugs (e.g., ketoconazole, spironolactone, cimetidine) that may diminish the levels or activity of steroid hormones. **CNS Toxicity —** CNS vascular lesions, characterized by perivascular hemorrhage and edema and mononuclear cell infiltration of perivascular spaces, were seen in dogs treated with pravastatin at a dose of 25 mg/kg/day, a dose that produced a plasma drug level about 30 times higher than the mean drug level in humans taking 40 mg/day. Similar CNS vascular lesions have been observed with several other drugs in this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of intraganglionic fibers) in clinically normal dogs in a dose-dependent fashion starting at 50 mg/kg/day, a dose that produced mean plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose (as measured by total enzyme inhibitory activity). This same drug also produced vacuolization/loss Nissl-ran degeneration and retinal ganglion cell chromatolysis in dogs treated for 14 weeks at 180 mg/kg/day, a dose which resulted in a mean plasma drug level similar to that seen with the 80 mg/kg/day dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility —** In a 2-year study in rats that pravastatin at doses of 10, 30, or 100 mg/kg body weight, there was an increased incidence of hepatocellular carcinomas in males at the highest dose ($p = 0.01$). Although rats were given up to 125 times the human dose (80) on a mg/kg body weight basis, serum drug levels were only 6 to 10 times higher than those measured in humans given 40 mg pravastatin as measured by AUC. The oral administration of 10, 30, or 100 mg/kg/day produced plasma drug levels approximately 0.1 to 5.0 times the human drug levels at 40 mg of pravastatin. No mice fed 22 months resulted in a statistically significant increase in the incidence of malignant lymphomas in treated females when all treatment groups were pooled and compared to controls ($p = 0.05$). The incidence was not dose-related and male mice were not affected. A chemically similar drug in this class was administered to mice for 77 weeks at 25, 100, and 400 mg/kg body weight, which resulted in mean serum drug levels approximately 1, 11, and 23 times higher than the mean human serum drug concentration (as total inhibitory activity) after a 40 mg oral dose. Liver carcinomas were significantly increased in high-dose females and mid- and high-dose males, with a maximum incidence of 90 percent in males. The incidence of adenomas of the liver was significantly increased in mid- and high-dose females. Drug treatment also significantly increased the incidence of lung adenomas in mid- and high-dose males and females. Adenomas of the eye Harderian gland (a gland of the eye of rodents) were significantly higher in high-dose mice than in controls. No evidence of mutagenicity was observed *in vitro*, with or without rat liver metabolic activation, in the following studies: microbial mutagen tests, using mutant strains of *Salmonella typhimurium* or *Escherichia coli*; a forward mutation assay in L5178Y TK +/- mouse lymphoma cells; a chromosomal aberration test in hamster cells; and a gene conversion assay using *Saccharomyces cerevisiae*. In addition, there was no evidence of mutagenicity in either a dominant lethal test in mice or a micronucleus test in mice. In a study in rats, with daily doses up to 1000 mg/kg, pravastatin did not produce any adverse effects on fertility or general reproductive performance. However, in a study with another HMG-CoA reductase inhibitor, there was decreased fertility in male rats treated for 24 weeks at 25 mg/kg body weight, although this effect was not observed in a subsequent fertility study when the same dose was administered for 11 weeks (the entire cycle of spermatogenesis), including epididymal instillation, in rats treated with this same reductase inhibitor at 180 mg/kg/day, aspermia/oligospermia, tubular degeneration (necrosis and loss of spermatogenic epithelium) was observed. Although not seen with pravastatin, two similar drugs in this class caused drug-related testicular atrophy, decreased spermatogenesis, spermatocytic degeneration, and giant cell formation in dogs. The clinical significance of these findings is unclear. **Pregnancy: Pregnancy Category X. —** See **CONTRAINDICATIONS.** Safety in pregnant women has not been established. Pravastatin was not teratogenic in rats or mice up to 1000 mg/kg/day or in rabbits at doses of up to 50 mg/kg/day. These doses resulted in 20x (rabbit) or 240x (rat) the human exposure based on surface area (mg/m²). However, in studies with another HMG-CoA reductase inhibitor, skeletal malformations were observed in rats and mice. There has been one report of severe congenital limb deformity, tracheo-esophageal fistula, and fetal stress (intrauterine death) in a baby born to a woman who took another HMG-CoA reductase inhibitor with lipid-complexone sulfate during the first trimester of pregnancy. PRAVACHOL (pravastatin sodium) should be administered to women of child-bearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking PRAVACHOL (pravastatin sodium), it should be discontinued and the patient advised again as to the potential hazards to the fetus. **Nursing Mothers —** A small amount of pravastatin is excreted in human breast milk. Because of the potential for serious adverse reactions in nursing infants, women taking PRAVACHOL should not nurse (see **CONTRAINDICATIONS**). **Pediatric Use —** Safety and effectiveness in children less than 18 years old have not been established. Hence, treatment of patients less than 18 years old is not recommended at this time. **ADVERSE REACTIONS:** Pravastatin is generally well tolerated; adverse reactions have usually been mild and transient. In 4-month long placebo-controlled trials, 1.7% of pravastatin-treated patients and 1.2% of placebo-treated patients were discontinued from treatment because of adverse experiences attributed to study drug therapy; this difference was not statistically significant. In long-term studies, the most common reasons for discontinuation were asymptomatic serum transaminase increases and rash, non-specific gastrointestinal complaints. During clinical trials the overall incidence of adverse events in the elderly was not different from the incidence observed in younger patients. **Adverse Clinical Events —** All adverse clinical events (regardless of attribution) reported in more than 2% of pravastatin-treated patients in the placebo-controlled trials are identified in the table below; also shown are the percentages of patients in whom these medical events were believed to be related or possibly related to the drug.

| | All Events | | Events Attributed to Study Drug | |
|---|---|---|---|---|
| Body System/Event | Pravastatin (N = 900) % | Placebo (N = 811) % | Pravastatin (N = 900) % | Placebo (N = 811) % |
| Cardiovascular | | | | |
| Cardiac Chest Pain | 4.0 | 3.8 | 0.7 | 0.0 |
| Dermatologic: Rash | 4.0* | 1.1 | 1.3 | 0.0 |
| Gastrointestinal | | | | |
| Nausea/Vomiting | 7.3 | 7.1 | 2.8 | 3.4 |
| Dyspepsia | 6.3 | 5.6 | 2.0 | 1.6 |
| Abdominal Pain | 5.4 | 6.9 | 2.0 | 3.9 |
| Constipation | 4.0 | 3.1 | 1.4 | 0.7 |
| Flatulence | 3.3 | 3.6 | 2.1 | 3.4 |
| Heartburn | 2.9 | 1.8 | 0.8 | 0.7 |
| General | | | | |
| Fatigue | 3.6 | 3.4 | 1.9 | 1.0 |
| Chest Pain | 2.1 | 1.9 | 0.3 | 0.2 |
| Influenza | 2.4* | 0.7 | 0.0 | 0.0 |
| Musculoskeletal | | | | |
| Localized Pain | 10.0 | 9.0 | 1.4 | 1.5 |
| Myalgia | 2.7 | 1.9 | 0.6 | 0.9 |
| Nervous System | | | | |
| Headache | 6.2 | 3.8 | 1.7* | 0.7 |
| Dizziness | 3.3 | 3.2 | 1.0 | 0.5 |
| Renal/Genitourinary | | | | |
| Urinary Abnormality | 3.4 | 2.8 | 0.7 | 1.2 |
| Respiratory | | | | |
| Common Cold | 7.6 | 6.3 | 0.0 | 0.0 |
| Rhinitis | 4.0 | 4.1 | 0.1 | 0.0 |
| Cough | 2.8 | 1.7 | 0.1 | 0.0 |

*Statistically significantly different from placebo.

In the Pravastatin Primary Prevention Study (West of Scotland Coronary Prevention Study) (see **CLINICAL PHARMACOLOGY: Clinical Studies**) involving 6595 patients treated with PRAVACHOL (pravastatin sodium) (N = 3302) or placebo (n = 3293) the adverse event profile in the pravastatin group was comparable to that of the placebo group over the median 4.8 years of the study. The following effects have been reported with drugs in this class, not all the effects listed below have necessarily been associated with pravastatin therapy: Skeletal: myopathy, rhabdomyolysis, arthralgia. Neurological: dysfunction of certain cranial nerves including alteration of taste, impairment of extra-ocular movement, facial paresis, tremor, vertigo, memory loss, paresthesia, peripheral neuropathy, peripheral nerve palsy, anxiety, insomnia, depression. Hypersensitivity Reactions: An apparent hypersensitivity syndrome has been reported rarely which has included one or more of the following features: anaphylaxis, angioedema, lupus erythematous-like syndrome, polymyalgia rheumatica, dermatomyositis, vasculitis, purpura, thrombocytopenia, eosinophilia, hemolytic anemia, positive ANA, ESR increase, eosinophilia, arthritis, arthralgia, urticaria, asthenia, photosensitivity, fever, chills, flushing, malaise, dyspnea, toxic epidermal necrolysis, erythema multiforme, including Stevens-Johnson syndrome. Gastrointestinal: pancreatitis, hepatitis, including chronic active hepatitis, cholestatic jaundice, fatty change in liver, and, rarely, cirrhosis, fulminant hepatic necrosis, and hepatoma, anorexia, vomiting. Skin: alopecia, pruritus. A variety of skin changes (e.g., nodules, discoloration, dryness of mucous membranes, changes to hair/nails) have been reported. Reproductive: gynecomastia, loss of libido, erectile dysfunction. Eye: progression of cataracts (lens opacities), ophthalmoplegia. Laboratory Abnormalities: Elevated transaminases, alkaline phosphatase, and bilirubin; thyroid function abnormalities. **Laboratory Test Abnormalities —** Increases in serum transaminase (ALT, AST) values and CPK have been observed (see **WARNINGS**). Transient asymptomatic eosinophilia has been reported. Thrombocytopenia usually returned to normal despite continued therapy. Anemia, thrombocytopenia, and leukopenia have been reported with HMG-CoA reductase inhibitors. **Concomitant Therapy —** Pravastatin has been administered concomitantly with cholestyramine, colestipol, nicotinic acid, probucol and gemfibrozil. Preliminary data suggest that the addition of either probucol or gemfibrozil to therapy with lovastatin or pravastatin is **not** associated with greater reduction in LDL cholesterol than that achieved with lovastatin or pravastatin alone. No adverse reactions unique to the combination are an addition to those previously reported for each drug alone have been reported. Myopathy and rhabdomyolysis (with or without acute renal failure) have been reported when another HMG-CoA reductase inhibitor was used in combination with immunosuppressive drugs, gemfibrozil, erythromycin, or lipid-lowering doses of nicotinic acid. Concomitant therapy with HMG-CoA reductase inhibitors and these agents is generally not recommended. (See **WARNINGS: Skeletal Muscle** and **PRECAUTIONS: Drug Interactions.**) **OVERDOSAGE:** To date, there are two reported cases of overdosage with pravastatin, both of which were asymptomatic and not associated with clinical laboratory abnormalities. If an overdose occurs, it should be treated symptomatically and supportive measures should be instituted as required.

**CAUTION: Federal (USA) law prohibits dispensing without prescription.**

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## Tomb Yields Clues to Scythian Home Life

Laid out on a platform, the well-preserved remains of a Scythian chieftain had all the comforts of home within his burial mound south of Kiev. Fabrics draped the walls and the ceiling, reed mats lined the floor, food and wine were set out. But there was one anomaly in the domestic scene: Nearby lay the bodies of a servant and a decapitated horse, apparent sacrifices.

Unlike most Scythian tombs (GEOGRAPHIC, September 1996) it was unlooted—the first Scythian central burial chamber found intact in Ukraine in 160 years. Probably buried in the third century B.C., the chieftain wore red trousers and a white caftan and was surrounded by 150 finely crafted gold objects, such as a sword handle (left) and this necklace being examined by Polish archaeologist Jan Chochorowski (above right). Other objects were silver, like a drinking cup (top) with the image of a griffin tormenting a deer. But among the most remarkable items were cooked sheep bones in a pot covered with a crocheted cloth—rare evidence of Scythian home life. Ukrainian archaeologist Sergey Skoriy, who helped excavate the site, says the burial holds hints—such as the living room setting—that these nomadic people sometimes settled down.

ERTAN BEDESTENLI

## Rare Wombat Finds Itself Ever More Alone

A creature of sedentary, nocturnal, and antisocial habits, Australia's northern hairy-nosed wombat is rarely seen in its remaining native habitat of central Queensland. But rarely may soon be never: Only an estimated 65 members of this largest of three wombat species remain—all in Epping Forest National Park. Perhaps 15 of them are breeding females. Habitat damage, drought, and competition from cattle have lowered the population to crisis level.

Like other wombats, the three-foot-long, 70-pound northern hairy-nosed variety sleeps in a burrow by day—alone except during mating season—emerging at night to nibble grass. The marsupial forages in early evening during the austral winter, later at night in the summer, says Andrew Woolnough who, with Society funding, is monitoring the creatures' little-known behavior in hopes of saving the species.

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## Thai Dog Finds a Bone: It's a Dinosaur!

Led to a gully in Thailand by a thirsty dog, a scientist spotted large bones protruding from rocks. The bones could be from the earliest tyrannosaur yet found, 120 million years old and more than 21 feet long, a predecessor of North America's renowned *Tyrannosaurus rex*.

Named *Siamotyrannus isanensis*, the remains were identified by "features known in later tyrannosaurs, notably in the bones of the pelvis," says Eric Buffetaut, a French paleontologist whose team included Thai colleague Varavudh Suteethorn (above). The oldest previously known tyrannosaur, from Mongolia, is at least 30 million years younger. The find supports the theory that tyrannosaurs arose in Asia, then crossed a land bridge to North America.

## Pecking Birds Pester Ocean Behemoths

Already endangered, southern right whales face a bizarre new threat: attacks by kelp gulls, who gouge their backs and feed on skin and blubber (below). "Harassment has reached alarmingly high levels," say Roger Payne and Victoria Rowntree, who have studied right whales in calving grounds off Argentina since the 1970s with Society support. Most vulnerable are females, which fast this time of year and rest on the surface to save energy. The attacks—which cause them to flinch, writhe, and flee—began in the 1980s when a growing human population boosted gull numbers also. New gull generations have learned the behavior and may force the whales to seek new calving sites.

## Scrolls Offer a Glimpse Into Buddhism's Past

Fragile and flaking, 2,000-year-old birch bark scrolls at the British Library are among the earliest Buddhist manuscripts known. Acquired in 1994 with the help of an anonymous benefactor, the 13 scrolls were written in a now dead language called Gandhari, after a region straddling eastern Afghanistan and northwestern Pakistan. Some record philosophical treatises; others hold moral guides and poems explaining Buddhism. By comparing them with later manuscripts, scholars may learn how the religion spread from India to China along the Silk Road after Buddha's death in the fifth century B.C.

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"The worn-out texts were so sacred that they weren't discarded but were buried in clay pots," says Richard Salomon of the University of Washington, who is deciphering the scrolls. "They won't revolutionize our understanding of Buddhism, but they will clarify the origins and development of traditions and texts."

—BORIS WEINTRAUB

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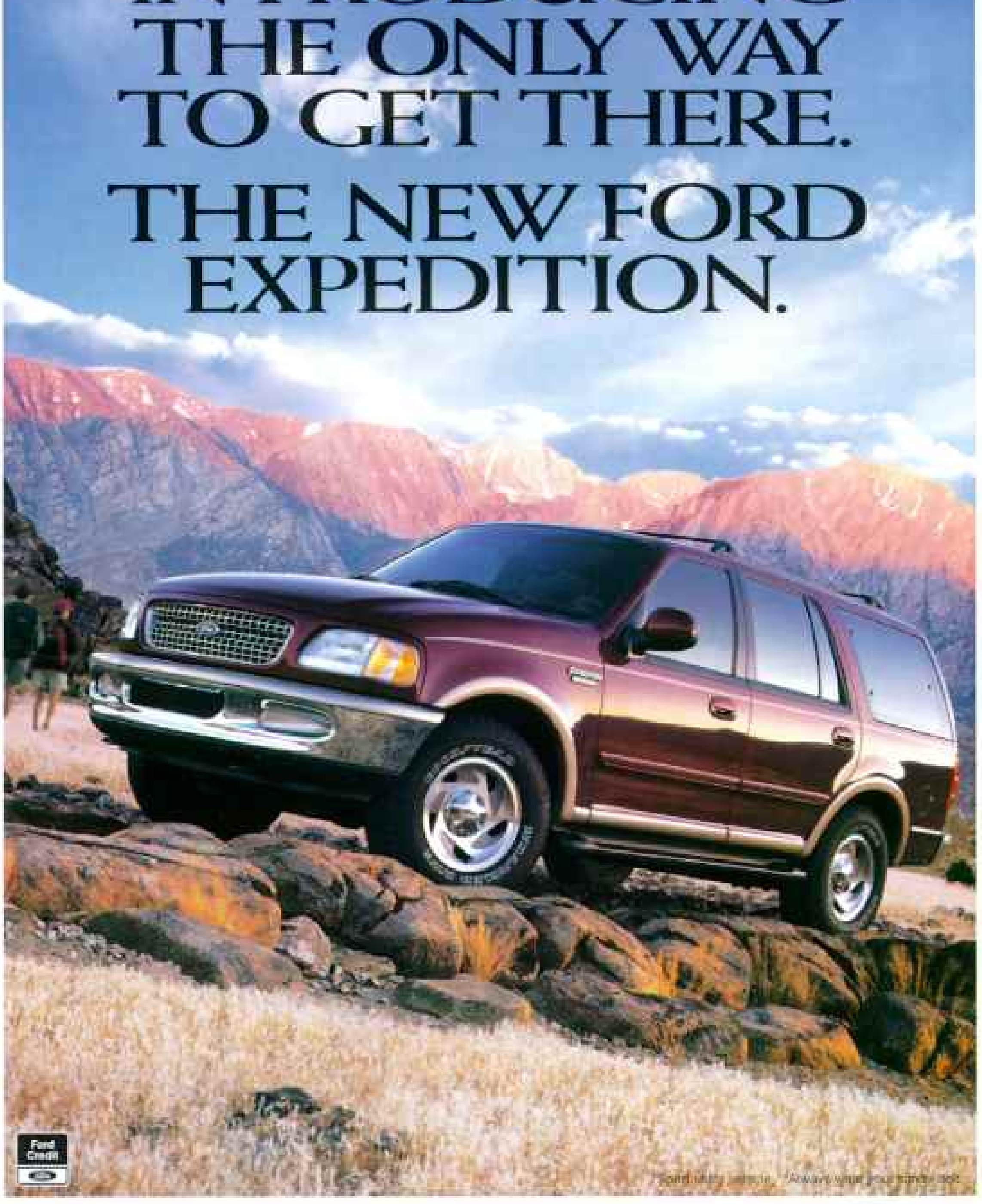

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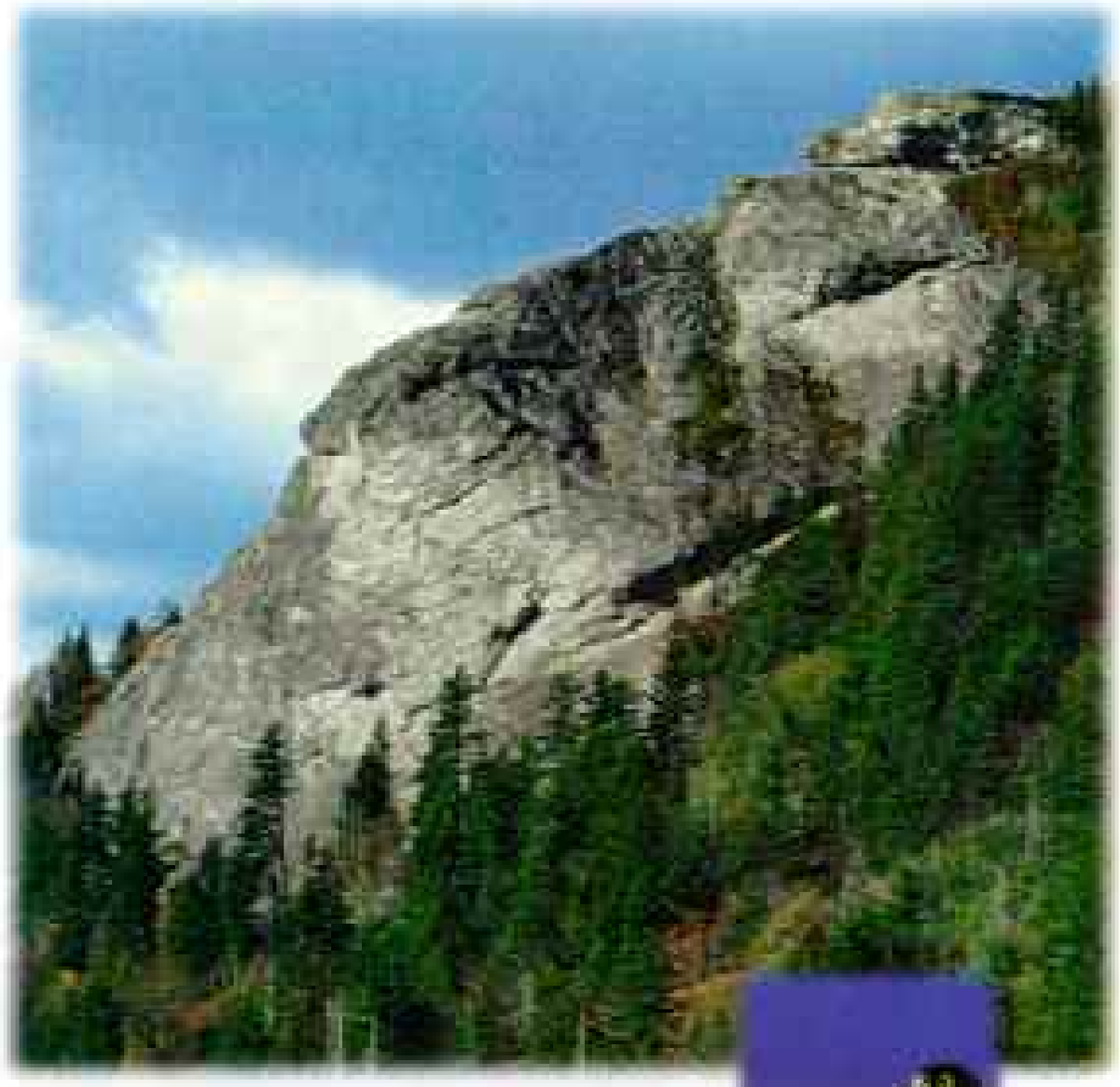

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■ FROM THE GEOGRAPHIC ARCHIVES

## On the Timber Line

A trainload of tree—actually one-half of one old-growth redwood—steams through California's Humboldt County to the sawmill shortly after the turn of this century. Logging first took hold in the region in the 1850s when forty-niners, disappointed by the gold rush, realized that the world's tallest timber held riches too. Taking down a redwood was no small job. Twenty feet off the ground, lumbermen nailed a working platform around a tree, then spent a week sawing a massive undercut—sometimes 8 feet high and 12 feet deep—to direct the giant's fall.

This photograph was published in our August 1907 article "Saving the Forests," by Herbert A. Smith. Remaining redwoods are still not totally safe. On privately owned stands of old-growth redwoods within Humboldt's 60,000-acre Headwaters Forest region, logging of the giants continues. It's no wonder: A 500-year-old tree, as tall as a 30-story building, can be worth $50,000 as cut lumber.

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NATIONAL GEOGRAPHIC

# *On* Television

AMY BUCHER, NGT

■ EXPLORER, MAR. 30, 7 P.M. ET

## The Lively Traditional Dayak Death Ritual

Once legendary headhunters, the Ngaju Dayaks preserve much of their traditional death ritual, known as tiwah. In 1996 North Carolina State University anthropologist Anne Schiller, an adopted member of a Ngaju family, participated in a tiwah (top) at Petakputih on the Mendawai River (also known as the Katingan) in Indonesia's Central Kalimantan Province.

EXPLORER's "Borneo: Beyond the Grave," accompanies Schiller deep into the rain forest to witness the macabre yet joyous ceremony of the Ngaju Dayaks.

In modern tiwahs, participants wear fantastical masks, join in revelry and song, and

MICHAEL HOSENFELD, NGT

stage mock attacks. Then, with utmost reverence, they exhume, anoint, and re-inter the bones of their dead in elaborately carved ironwood repositories.

While headhunting is no longer part of the tiwah ritual, other centuries-old traditions survive. To help ensure the comfort of the deceased in the afterlife, the Ngaju Dayaks fill ceremonial boats with offerings of food and rice wine. And family members still carve figures to serve as servants for the dead, as seen in these figures from early in this century (left), whose clothing and weapons reflect modern influences.

One of the largest rituals ever performed along the Mendawai, it was the first tiwah for Schiller as a participant rather than just a scholarly observer.

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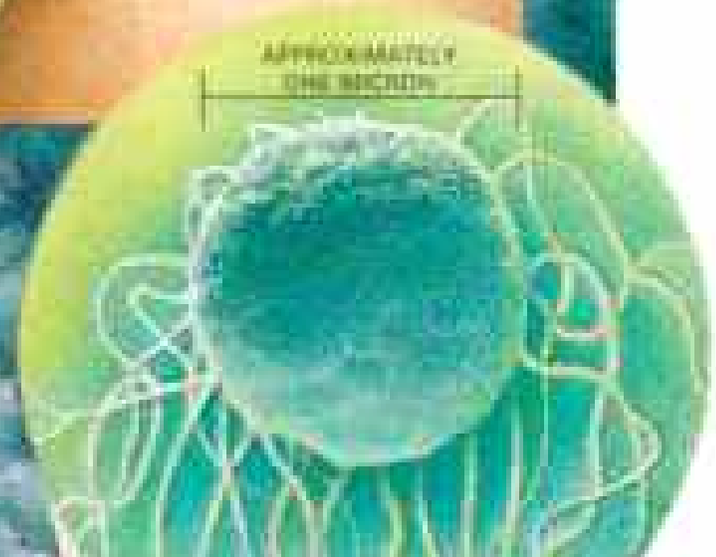
NATIONAL GEOGRAPHIC

# Earth Almanac

## Third Branch on Tree of Life

That life exists even on the barren seafloor, amid scalding heat and caustic chemicals spewed by hydrothermal vents, was revealed by submersibles such as *Alvin* nearly two decades ago. Now a tiny microbe from such a vent has astonished scientists. Recent studies of its genes reveal how different the microbe is from other life-forms.

Biologists long assigned all organisms to two groups: one for plants, animals, and fungi, the other for bacteria. Then in the mid-1970s a third group, or domain, was proposed by evolutionist Carl Woese of the University of Illinois, who named it archaea. In 1982 one of its species, a microorganism called *Methanococcus jannaschii* (inset, right), was found on the chimney of a hydrothermal vent, thriving in a realm of tube worms a mile and a half deep in the Pacific Ocean off Mexico. Last year analysis determined that of its 1,738 genes, at least half are unknown in either plants and animals or bacteria.


ART BY ROBERT HYNES

**Sloth Bear** *(Melursus ursinus)* **Size:** Head and body length, 140 - 180 cm **Weight:** Male, 115 kg; female, 100 kg **Habitat:** Lowland forests in India, Nepal, Sri Lanka, Bhutan, and possibly Bangladesh **Surviving number:** Estimated at 10,000 - 25,000

Photographed by E. A. Kuttapan


# WILDLIFE AS CANON SEES IT

Two sloth bear cubs cling to their mother's shaggy fur while she rummages for food. Among bears, only the sloth bear carries its young cubs on its back. Also unique to this bear is its preferred diet of ants and termites. With the finesse of an anteater, the sloth bear tears open a mound with its claws and pushes its long snout into the hole to draw in a meal. Long, coarse hair gives the bear a disheveled look, but it also keeps out the angry biting ants and termites. Though known for its belligerent nature, the sloth bear has not fared well against poachers or encroachments on its dwindling habitat. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

## Secret of a Lizard's Water Dash

Known as the Jesus Christ lizard in Central America, the basilisk "walks" on water, partly to escape hungry snakes and birds. Harvard University researchers James Glasheen and Thomas McMahon used a high-speed video camera to study the mechanics of the basilisk's quick-footed gait. Its hind feet slap the surface and plunge down, displacing the water and creating "potholes" of air. So quick is the lizard's stroke that it pulls its feet out of the potholes before they collapse and fill with water.

Image not available

## Medieval Herbs End a Long Sleep

Seeds have long memories in England's Mount Grace Priory, a 14th-century monastery. After Henry VIII closed it in 1539, herbs tended by the monks ceased to grow. In 1992 archaeologists excavating the priory's courtyard disturbed the earth, and a few years later some of the long-lost herb seeds sprouted, including weld, displayed by Susan Garnett, a priory custodian. Monks used weld to dye clothing yellow. Mullein—another newly regenerated herb—was made into candlewicks.

## Dwindling Lynx Await Legal Aid

Because large mammals get the lion's share of preservation efforts, some conservationists argue that smaller forest dwellers have been ignored. Last year 13 organizations sued the U.S. Fish and Wildlife Service for refusing to list the lynx under the Endangered Species Act; a decision is pending.

"We think no more than 300 to 500 may remain in the lower 48, due to habitat fragmentation," says attorney Eric Glitzenstein, who represents Defenders of Wildlife. However, the lynx is still plentiful in Alaska and Canada. The outcome of the case, which could change timber management in several states, will affect three other furbearers that share the lynx's habitat: wolverines, fishers, and martens.

—JOHN L. ELIOT

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NATIONAL GEOGRAPHIC

# *On* Assignment

■ BEARDED SEALS

## Seal of Approval

Waiting in the water with his camera, hoping to get an 800-pound seal to look at him, photographer Flip Nicklin finally got his picture, which appears on this issue's cover. "Then all of a sudden I felt a pair of flippers on my forearms, and there she was, nuzzling the top of my head," he says. Once surfaced (right), the two swimmers saw eye to eye—a new experience for Flip. "In my ten years of photographing in the Arctic, I've probably gotten two shots of bearded seals, and those were from a distance. It was great to get that close at last."

Navigating two open-air powerboats on choppy water through floating chunks of ice, Flip and the seal researchers wore heavy, metal-toed "survival suits" for protection.

"For 14 days in a row I spent up to 12 hours a day on the boat and lost all feeling in my feet," Flip recalls. "It's nice to have them back!"

DAVID WRIGHT

T. A. WILKINSON

■ MOTHS

## Her Winged Victory

"Everywhere I go I look for lepidoptera," says photographer and biologist Darlyne Murawski, who attracted moths in the Arizona desert using a sheet illuminated by a powerful light. Darlyne started as an artist, earning degrees from the Art Institute of Chicago. While pursuing her doctorate in plant population ecology at the University of Texas, her love of natural history led her to study butterflies and moths. From Costa Rican rain forests to a Cincinnati parking lot she tracked moths for her article in this issue, her second for the magazine. "People tell me they've never seen such fantastic moths," she says. "But the insects could be right under your nose. Pay attention. Turn over leaves, go slowly, look closely. They're out there."

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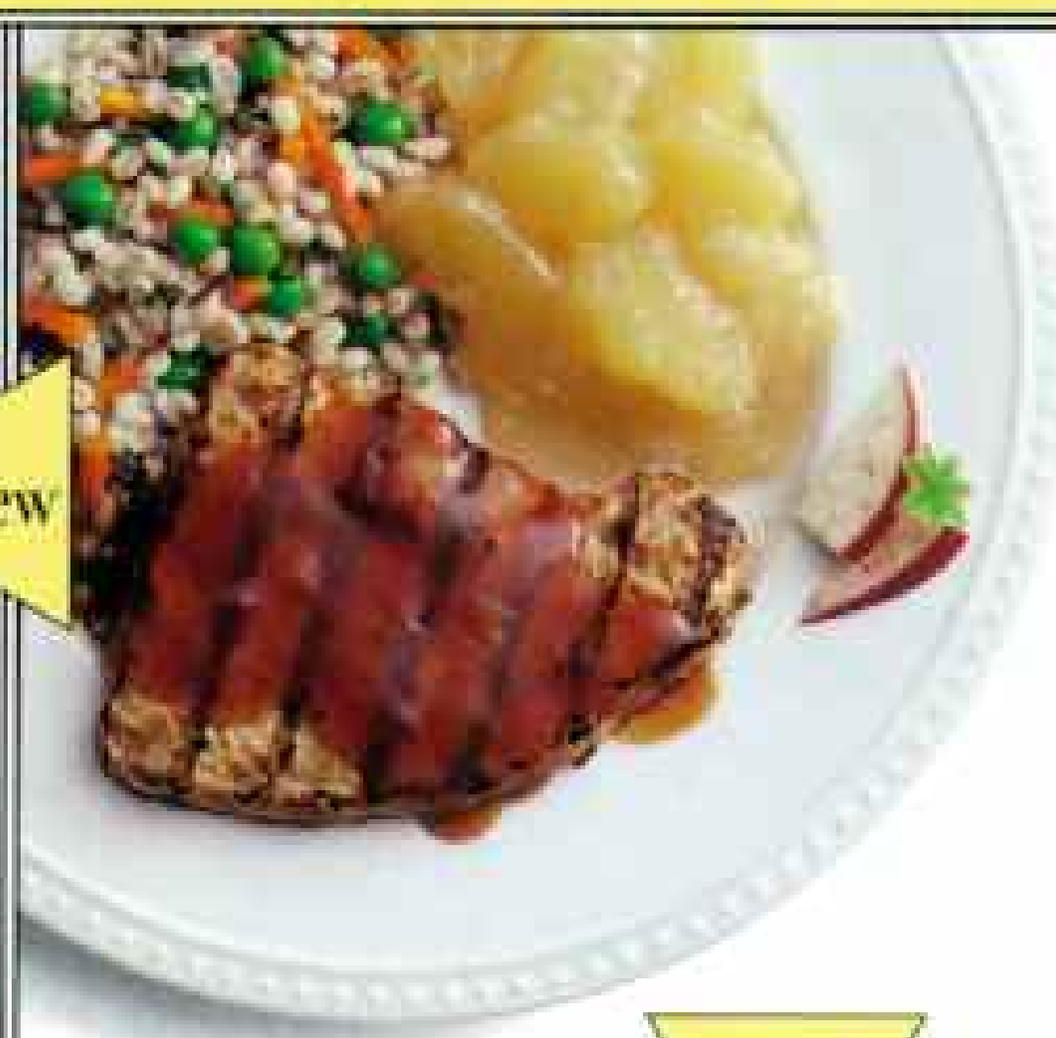

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