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COVER: Holiday spirits send Pakistani girls soaring during the Moslem festival of Eid al-Fitr (page 23).

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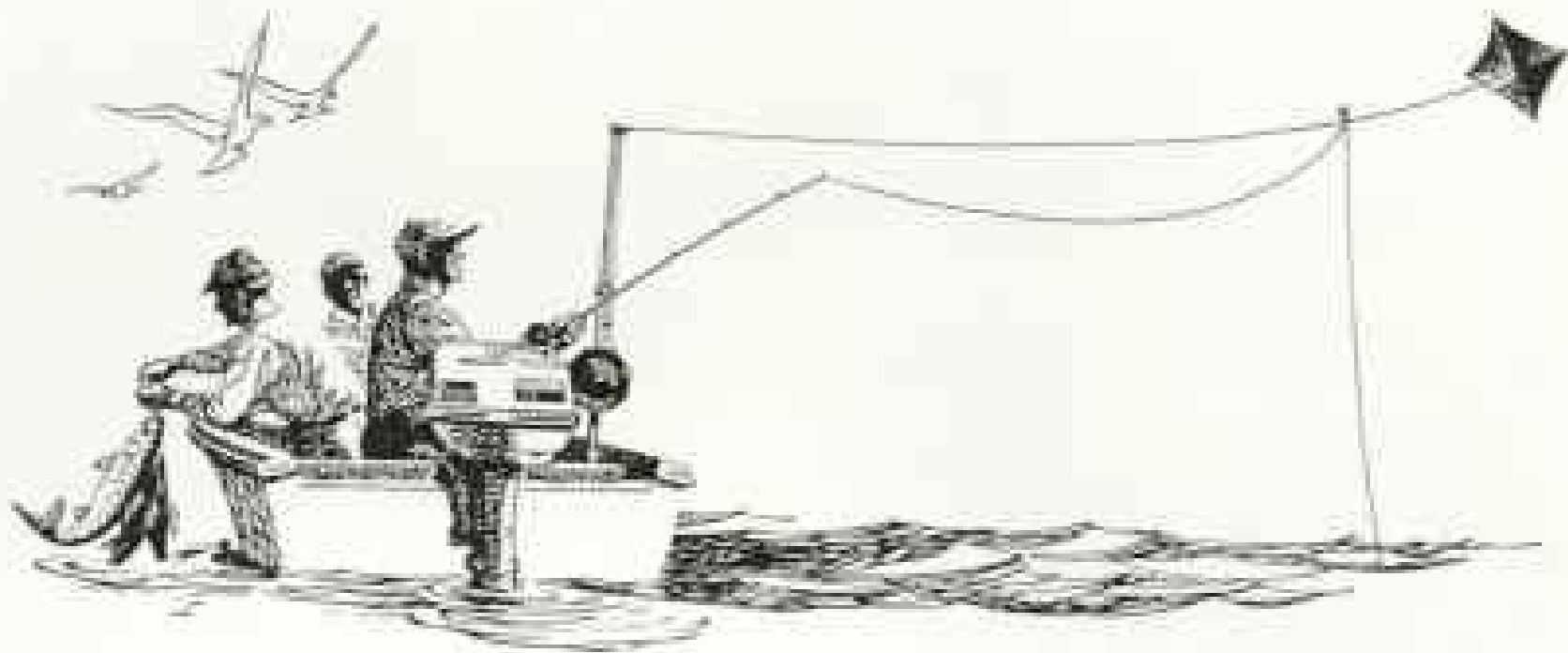
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In answer, the February GEOGRAPHIC will bring to the Society's 5,500,000 members a new wall map, more than three feet long, showing not only Viet Nam but Cambodia, Laos, and Thailand too, with 9,669 place names. Cartographers Athos D. Grazzini (right) and William T. Peele check proofs.

Be sure to renew your membership for 1967, or you will miss this timely map, along with an article on the Vietnamese people and such features as "Alaska's Mighty Rivers of Ice," "The Bahamas," and "Japan's Vanishing Ainu"—all in February. Invite your friends to share these benefits. Nominate them below.

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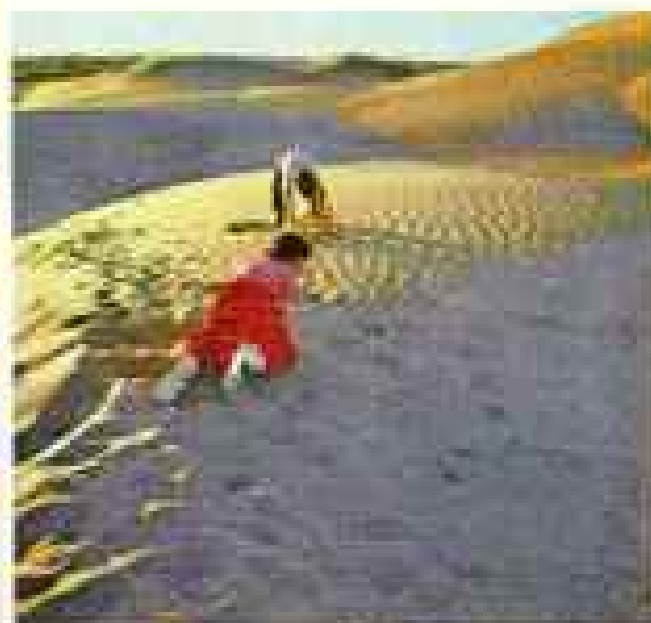
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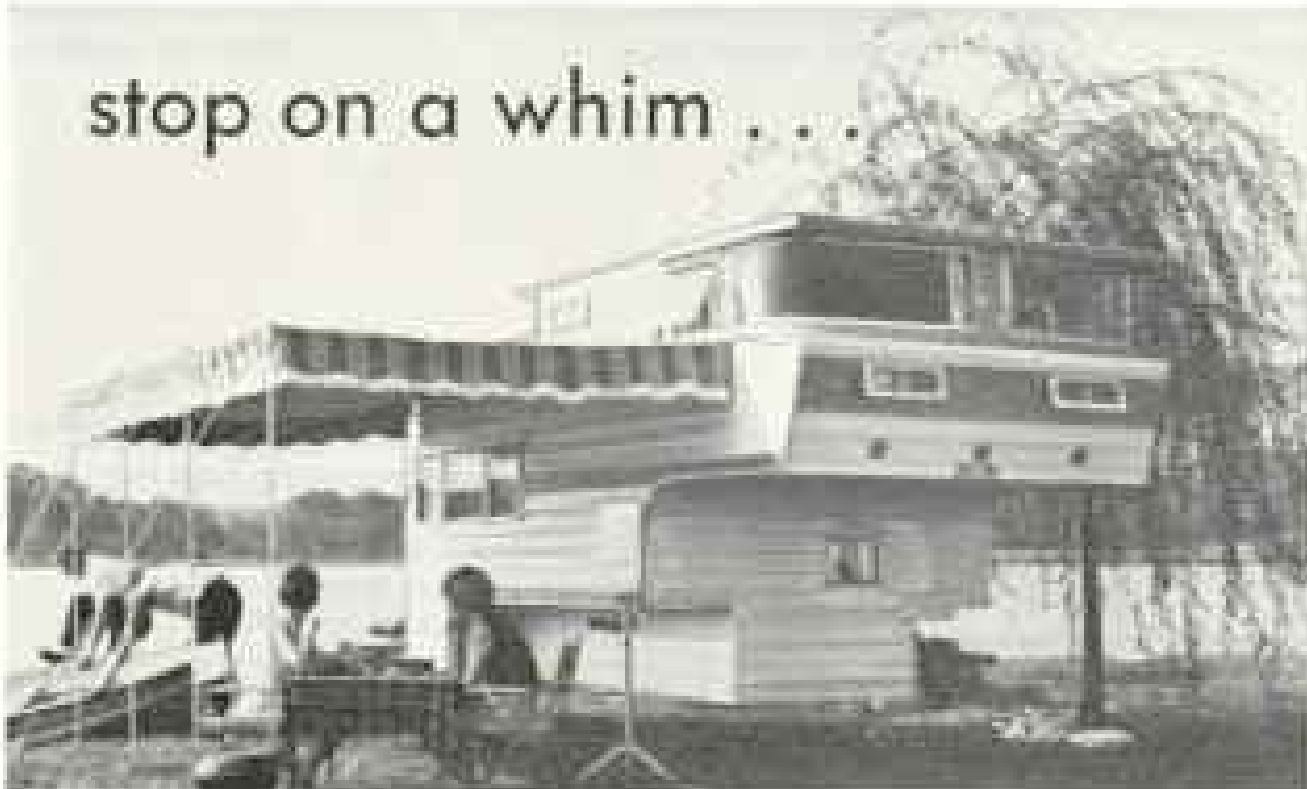
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AFTER A DAY-LONG TOUR of Karachi's booming industries, I eagerly accepted a dinner invitation from my volunteer guide, an engineer I had met aboard the plane on the flight into Pakistan. His pride in his country's industrial progress, in new shipyards, plastics plants, and machine assembly lines, had been infectious. Now he was showing me his country's afterhours life.

While we studied an elaborate hotel menu, the waiter broke the bad news to my host: "Sahib, Wednesday is a meatless day."

My friend's pride collapsed. As he sadly ordered, he explained that the measure was meant to conserve the country's livestock herds, threatened by a hungry population.

"There you have the dilemma of Pakistan," he said. "For every industrial advance we wrestle through, a bursting population devours a bit more of our wealth. We have to run to exhaustion to keep from falling behind."

Expanding Nation Needs More Jobs

At his suburban home after dinner, as we sipped cups of the sweet, milky tea Pakistanis favor, he expanded on his country's crisis:

"Already we suffer from 20 percent unemployment. During the next 20 years we must find new jobs for 28 million more workers—more than the labor force of France or West Germany. Our per capita income now is only \$70 a year, and it will be even less if we cannot find those new jobs. We must control our numbers, or we are destroyed."

I remarked that my host did not appear to suffer from want.

"Not so long as I hold an American engineering degree in a country where not even one in five can read," he said. "But I worry about my countrymen, so many of whom are poor and illiterate. When you finish your tour of Pakistan, give me your impressions. I hope you find me a blackhearted pessimist."

Next day, the government sent me a guide and interpreter, Hasan Imam, a young Bengali whose tailored suit and hairline mustache suggested more the matinee idol than the pious Moslem he is.

"Karachi exists to do business," Imam said, "so let's go to the Stock Exchange."

Silver song of welcome: Turbaned bugler, his uniform a reminder of British colonial days, announces the arrival of the Governor of West Pakistan at Governor's House in Lahore. East Pakistan, the other sector of this divided nation, lies a thousand miles away across India (map, pages 8-9).



January
1967

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PROBLEMS OF A TWO-PART LAND Pakistan

By BERN KEATING

Photographs by
ALBERT MOLDVAY

National Geographic Staff

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Pakistan's largest city, two million strong by latest estimate, lies on a flat, dusty, dun-colored plain. As we drove along, I was struck by its harshly new look. Most of Karachi has been built since the birth of this geographic anomaly, a country split in two by the partition of the Indian subcontinent in 1947.

The city, in Pakistan's western wing, was then little more than a fishing port sweltering on the Arabian Sea. Today it teems with life and traffic.

Brokers' Beards Dyed a Sunset Hue

Under wheeling kites skirling their eerie cries, countrymen in the garb of upland tribes mingled with businessmen in Western suits. Cars bulled through a tangle of sputtering motor rickshaws, creaking camel carts, and even an occasional nickering flock of goats. Though the political capital has moved to Rawalpindi 700 miles northeast, pending completion of a spanking-new capital at nearby Islamabad (pages 20-21), Karachi remains the financial center. The ambitious come to the big city from all parts of the republic.

The floor of the Karachi Stock Exchange, heart of the nation's commerce, presented certain differences from Wall Street. The mouths of brokers shouting bids were stained a wet scarlet from chewing betel. Older brokers had hennaed their graying beards a flaming orange-pink.

From the exchange we went to the street bazaar where the humble retail trader sells his wares. I had left my shaving kit at the previous stop; when I priced replacements at the hucksters' carts, I was staggered—\$5 for an American double-edged razor, \$2.65 for a small pressurized can of lather. Because of rigid import restrictions to save foreign exchange, other overseas products sold for similarly high prices.

Hucksters haggled keenly, however, to sell commonplace domestic items, such as jet-black powdered antimony for outlining the eyelids of men and women, a strap

studded with bells for a camel's ankle bracelet, or a live lizard from which to extract oils beneficial to aging males.

The dust blew thick, and the last rays of the sun played on a phantasmagoria of yellow and blue turbans from the North-West Frontier, red felt caps from the Sind, white puggarees from the Punjab, and a Pakistani soldier's green beret. Here and there a fist fight created a brief swirl of excitement, until peacemakers wrestled the opponents apart.

"Do you Pakistanis always fight like this?" I asked Imam.

"This is the holy month of Ramadan," he said. "During this time we Moslems do not take so much as a sip of water between sunrise and sunset, and tempers wear thin by the end of the day."

Atop a minaret, a loudspeaker sputtered to life. The recorded and amplified cry of the muezzin floated over the marketplace, sounding *adan*, the call to prayer.

SCENARIOS (LEFT AND BELOW) BY ALBERT HOLLAND © N.S.P.



Young eyes focus on a festival.

◀ **Minarets and multitudes:** 300,000 worshipers, overflowing Lahore's Badshahi Mosque, dramatize the challenge facing Pakistan. The Moslem republic, separated from Hindu India in 1947, struggles to meet the needs of an exploding population that already totals some 116 million.

Aurangzeb, last of the great Mogul emperors, finished the marble and sandstone mosque—one of the largest in the world—in 1674. Graceful white domes rise above a prayer chamber and depository of relics of Mohammed. The throng celebrates Eid al-Fitr, the end of Ramadan—Moslem month of fasting.

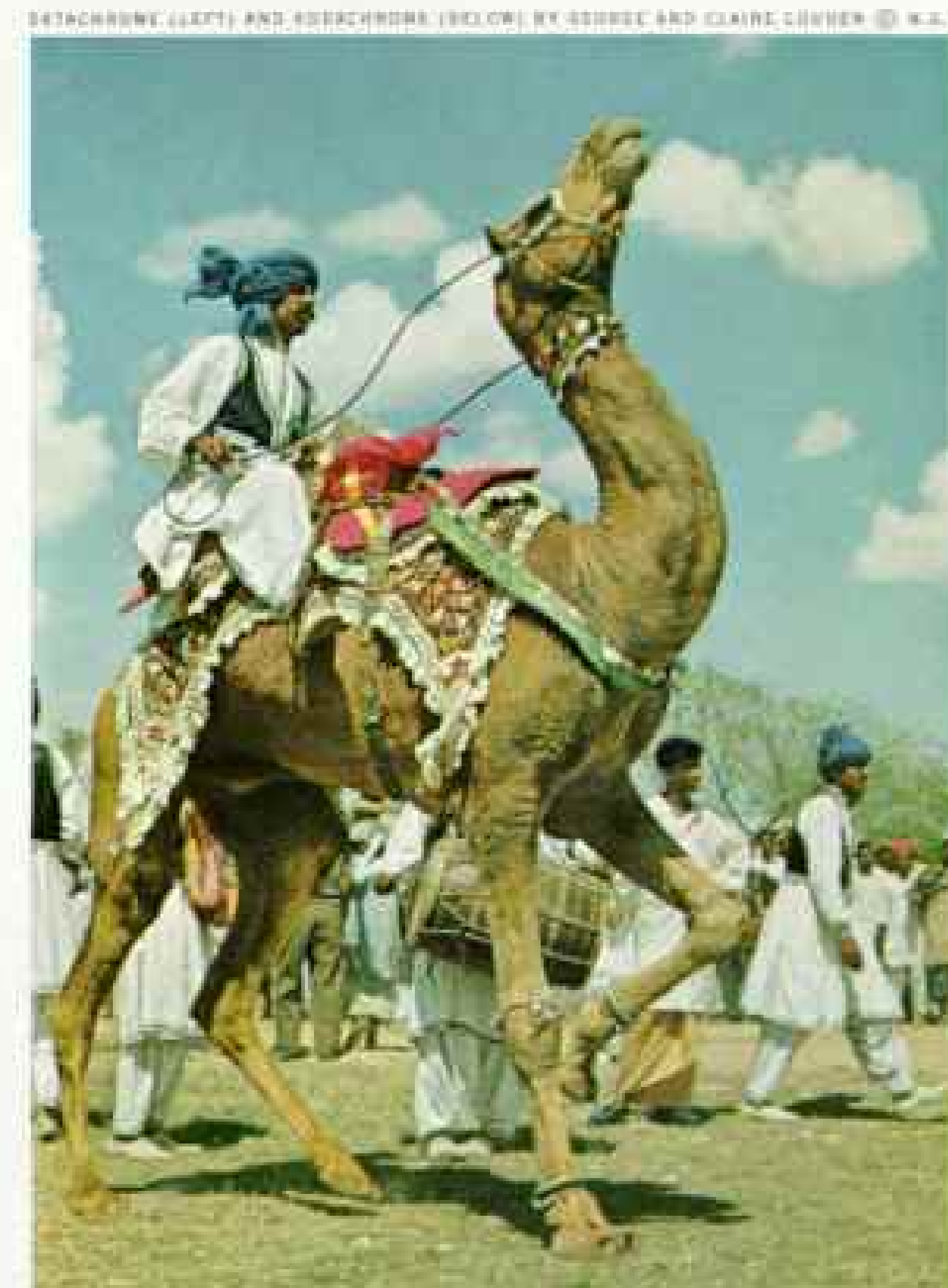


Kalash girl dwells in Chitral.



Mystic strolls a bridge near Dacca.

Garlands wreath victor in Hyderabad.



Dancing camel performs at Lahore.

Pakistan's "NOT Afghans, Turks, or sons of Tartary. But of one garden, and one trunk, are we..." wrote poet Mohammed Iqbal, who in 1930 first voiced the idea of Pakistan as a nation. He envisioned a people united in faith, though diverse in customs





Gas-field workers cross a Baluchistan plain.

and temperament. From a child's festival finery to the shell-studded hood of a Kalash girl or a fakir's robes—Pakistanis display their love of costume. Gaudy trappings adorn a prancing camel, while an election winner in Hyderabad wears a vest of roses and marigolds. Pantalooned Bugti tribesmen work in the Sui Gas Field, but may vanish into the desert when wanderlust strikes. To a turbaned Pathan, his decorated rifle is as much a part of his attire as his white puggaree. A comely student in Lahore shows off a gown of silk embroidery. Shoemaker, his beard dyed bright by henna, cobbles in his shop. Burmese heritage shows in the face of a pipe-smoking matron from Cox's Bazar.

ADDACHRONIES BY ALBERT WOLDVAY © N.S.S.



Coed models embroidery.



Pathan tribesman cradles a rifle.



Cobbler sews a crimson shoe.

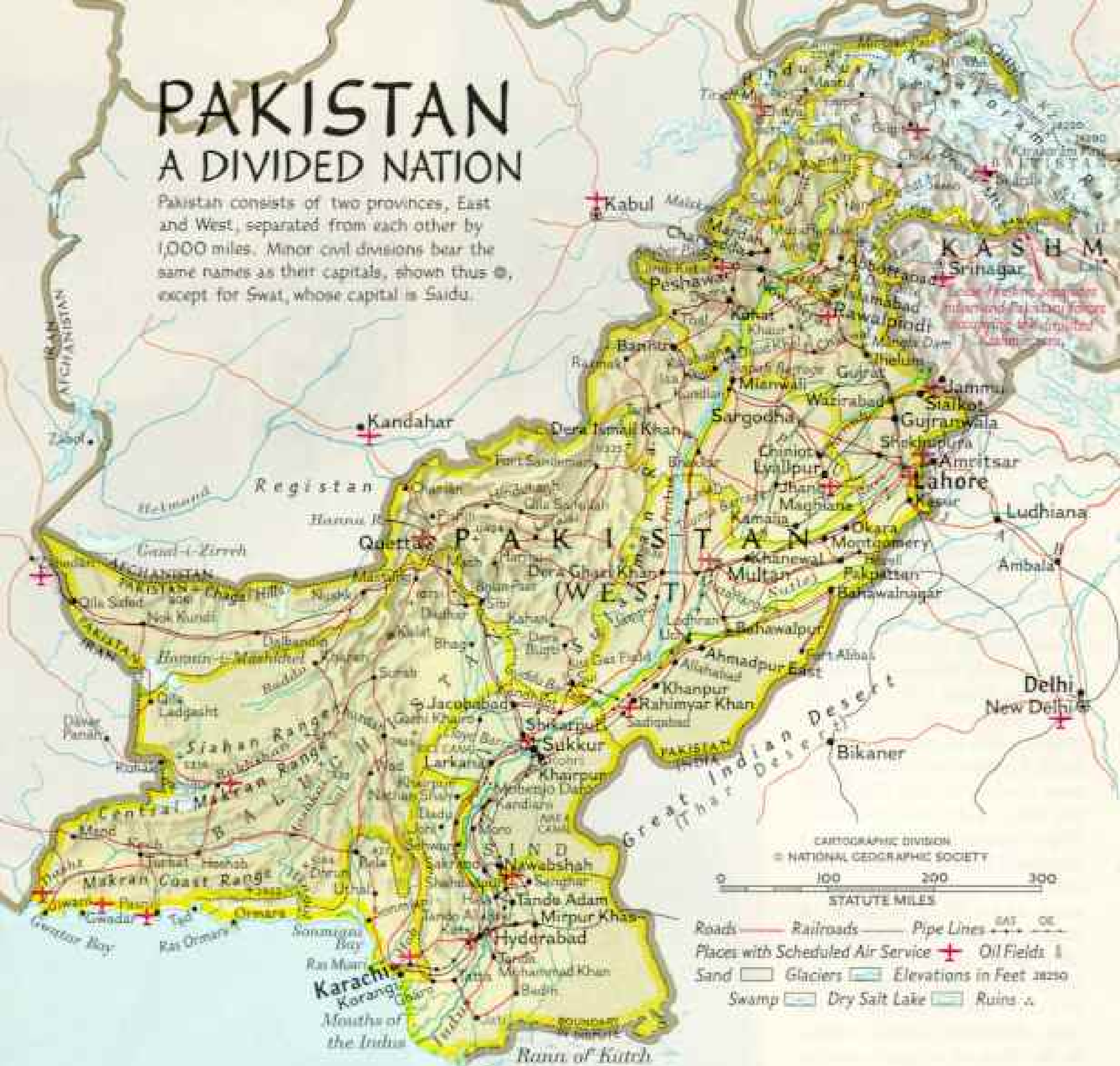


Old woman puffs a pipe.

PAKISTAN

A DIVIDED NATION

Pakistan consists of two provinces, East and West, separated from each other by 1,000 miles. Minor civil divisions bear the same names as their capitals, shown thus ⊕, except for Swat, whose capital is Saïdu.



In a flash the marketplace emptied. Merchant and customer dashed off to gulp a cup of tea and eat a date, traditional first bite after a Ramadan day's long fast.

The very reason for the country's existence is devotion to Islam. When the British, nearly twenty years ago, gave independence to India, those areas where Moslems outnumbered Hindus formed the new nation of Pakistan within the Commonwealth.* Thereby, some 70,000,000 Moslems hoped they could nourish their political and commercial ambitions, religion, and culture better than in an India dominated by 300,000,000 Hindus.

The two-pronged pattern of greatest Moslem influence in the subcontinent resulted in a land divided into two blocks: the western wing in the former provinces of Baluchistan, Sind, and the North-West Frontier, part of

Punjab, and the states of Khairpur and Bahawalpur; the eastern wing in the eastern part of Bengal and part of Assam. The western province (above) is twice the size of California, the eastern (opposite) about as big as Iowa or Illinois.

A thousand miles of hostile India separate the two provinces. Between them also lies the lovely land of Kashmir, a Kansas-size region claimed by both India and Pakistan. Kashmir is divided by a cease-fire line established by the United Nations in 1949 after bitter fighting there. Heavily armed soldiers still patrol near the line, and violence flares up occasionally, as in the full-scale warfare that broke out in the summer of 1965.

More than just real estate separates East

*See "Pakistan, New Nation in an Old Land," by Jean and Franc Shor, *GEOGRAPHIC*, November, 1952.

and West Pakistan. They differ widely in language, terrain, and density of population.

In West Pakistan a desert and a semi-arid plain rise to majestic mountains, much as in the American Far West. This part is peopled by a dozen races left behind by invading armies, and West Pakistanis are therefore of all sizes and complexions. They rank among the world's most martial people; the British Indian Army for almost a century recruited sepoy's from the western Indian provinces that now are part of Pakistan.

West Pakistanis, now estimated at some 53,000,000, speak Urdu, a mixture of Hindi and Persian with heavy borrowing from religious Arabic. East Pakistanis, on the other hand, speak Bengali, a tongue written in a thousand-year-old alphabet totally unlike Urdu. Small, dark-skinned, and fine-featured, they excel in the gentle arts of painting and poetry, music and dance.

Much Smaller East Outnumbers West

Since partition, East Pakistan has swelled to some 63,000,000 people, thus packing more than half the total population into 15 percent of the nation's land.*

East Pakistan's flat, fertile delta was built by three rivers, the Ganges, the Brahmaputra, and the Meghna. During monsoon months, thousands of square miles lie flooded, and much "pedestrian" traffic moves by boat.

Because they make up so large a part of the Pakistani nation, and because their jute crop alone earns more than 50 percent of the country's foreign exchange, East Pakistanis frequently express resentment of what they consider domination and neglect by politicians of the west wing. Mobs occasionally smash government-building windows and overturn official vehicles to work off their frustration.

Though much separates the eastern and western provinces, they share the problem of overcrowding, with births now outnumbering deaths by three and a half million every year. In 20 years, this nation has added 40 million people to its original 75 million.

In my interview with Field Marshal Mohammed Ayub Khan, President of Pakistan, the troubles with India and the problem of overpopulation dominated our conversation.

*The Shors described the pressures of this growth in "East Pakistan Drives Back the Jungle." NATIONAL GEOGRAPHIC, March, 1955.

FFIFTH most populous nation on earth, the Islamic Republic of Pakistan won independence in 1947 as a dominion within the British Commonwealth. A refuge and home for the Moslems of the Indian subcontinent, Pakistan is mountain-hemmed and dry in the west, flat and soaked by monsoon rains in the east.



AREA: 310,403 sq. mi. in the western province, 55,126 in more populous eastern province. **POPULATION:** Officially 100,000,000; latest estimates reach 116,000,000. **LANGUAGES:** Officially Urdu in the west, Bengali in the east, and English in both provinces until 1972. **RELIGIONS:** Overwhelmingly Moslem, with some Hindus, Buddhists, Christians, animists, and Parsis. **ECONOMY:** Predominantly agricultural, growing wheat, rice, sugar cane, and cotton; world's largest exporter of raw jute. Main manufactured products: Burlap and cotton textiles, paper. **MAJOR CITIES:** Karachi (2,000,000), port and commercial center; Lahore (1,500,000), cultural center and west-wing capital; Dacca (600,000), east-wing capital; Rawalpindi (375,000), interim national capital; Islamabad, new national capital, still under construction.





The President towers more than six feet, with a complexion as fair as the British who taught him his soldier's trade (page 18). Striding from behind his massive desk, he tapped his finger on a globe.

"We have fought a bitter war with India," he said, "the world's second largest nation, almost five times larger than Pakistan. Both nations must have peace. We must not fight to mutual exhaustion, for a terrible problem faces the whole subcontinent. Famine already threatens India . . ."

The President strode back to his desk and

leaned on it heavily, his face grave. "If we do not win our race to control our own population, we shall be courting disaster."

The President has reason for his concern. Pakistan packs into 365,529 square miles (excluding disputed Kashmir) one of the world's most crowded populations. Though government statisticians count a little more than 100 million Pakistanis, officials who must deal realistically with population problems peg the figure as high as 116 million.

Since vast areas of West Pakistan are no more hospitable to human life than California's Death Valley, the habitable portions are even more crowded than bare statistics indicate. And still the population grows at a frightening rate, already perhaps as high as 3 percent annually. If that growth rate is not checked, Pakistan's present population will have doubled by 1985.

Chapatties Critical in Race With Hunger

To get an expert's opinion on the President's fear of famine, I dined with an American population specialist. We met at the Hotel Farooq, whose restaurant is the Maxim's of Pakistan. The Pakistani cuisine had been a delightful surprise to me with its richness, variety, and inventiveness, and I sopped up the fiery curry sauces with chapatties, flat wheels of unleavened bread tasting deliciously of whole wheat.

"Lucky for you that you like the Pakistani bread," the research-foundation man said, "because you are going to eat plenty of it. In West Pakistan it forms the basis of every meal. In poor households, the chapatti is virtually the whole meal, and any other food is spread thinly over the bread like butter.

"That makes wheat the critical factor of the whole grim race with famine. Eventually the government's drive to control population growth will succeed, I am convinced, but that happy day is years off. If Pakistan can produce enough wheat to feed the growing population before family planning takes hold, Pakistan can win the race.

"And I have heard good news. At experimental farms near Lyallpur, Pakistani agricultural scientists are growing strains of Mexican dwarf wheat that can double the production of any field in a season. The wheat experts tell a story you'll want to hear."

The journey toward Lyallpur led northeast through the Sind desert, which resembles New Mexico even to the roadside villages.



BOBATH/FORMER BY ALBERT BOLIVAR © A.S.E.

Up for bids, fresh fish from the Arabian Sea sell at auction in the Karachi Cooperative Fishing Society's market.

Remnant of empire, Merewether Tower marks the junction of Bunder Road, left, and McLeod Road in Karachi. The tower honors Sir William Merewether, a former British chief commissioner. Once a small fishing port on the Arabian Sea, Karachi mushroomed after partition as Moslems from India swarmed into the city, the national capital until 1960. Rawalpindi now serves as the interim capital until completion of Islamabad (pages 20-21).



Clustered, sun-baked, round-shouldered mud huts look like Pueblo Indian adobe houses, with projecting rafter ends and rickety ladders leading to the flat roofs.

Typewriter Wallahs Crowd Sidewalk Office

Imam, NATIONAL GEOGRAPHIC photographer Al Moldvay, and I reached ancient Hyderabad in the evening. Next morning, opposite the hotel, 15 typewriter wallahs had set up their machines on the sidewalk and were typing letters, filling in government forms, and completing questionnaires and applications for illiterate clients. Even the literate sometimes must use the typewriter wallah, for court documents and related papers must be typed in English, the one nationwide language. That is why we had no problems on the road: Most signs are duplicated in English.

Excitement ran high in Hyderabad this day, for it was the second election of union council chairmen in the republic's history.

Under the "basic democracies" system of local government introduced by Field Marshal Ayub Khan in 1959, the population is divided into units of about 1,000 in the west and 1,250 in the east. These units roughly correspond to the size of the typical Pakistani village, where each villager is presumed to know all his neighbor's strengths and foibles.

Every village-size cell elects one representative to a union council that administers local affairs for about ten units. Each union council elects a chairman, who represents his region on the next higher council, and so on through district and divisional levels. The 80,000 or so union council members elect delegates to the National Assembly.



AP/WIDEWORLD © N.S.P.

As arranged, Hyderabad's chief police magistrate met the three of us at the hotel with an escort of eight policemen. His men, who normally carry only truncheons in the British tradition, were armed with pistols on this one day, for they were to patrol the streets to prevent election violence.

Hyderabad's population crowds toward half a million, so union councils had to meet in relays in many polling places to choose their chairmen.

In midmorning the victory parades began. Newly elected chairmen, half-smothered under garlands of roses and marigolds, marched at the heads of cheering columns or were borne on supporters' shoulders, while drummers and pipers cavorted (pages 6-7).

Ramadan fast ends in a feast as members of the Karachi Gymkhana club observe Eid al-Fitr with a buffet of curries and kebabs, pilau and fish.

When the British ruled the Indian subcontinent, they established such clubs in all the major cities as places to socialize and play cricket and tennis. Now Pakistan's industrialists, financiers, businessmen, and government officials enjoy the facilities.

Caught in the crush of a parade, our patrol had to stop. Impulsively the victor forced his way to my side, threw half his garlands around my neck, embraced me, and introduced himself as S. M. Razaqatullah. In excellent English he delivered an impromptu harangue to his constituents in praise of Pakistani-American friendship in a world populated by wolves. His speech was not lacking in courage, for the central government at the moment was a bit chilly toward the United States.

At midday Imam said, "If you are ready for another dusty trip, let's go to Hell."

That, he explained, was one meaning of Sukkur, a city supposedly named centuries ago by Arab marauders who found the climate scorching.

Dust Devils Whirl Where Tigers Once Roamed

En route north we stopped at Mohenjo Daro, site of a city that flourished 4,000 years ago as one of two great centers of the Indus Valley culture, first true civilization on the Indian subcontinent. The debris of several ancient cities lies almost 70 feet deep in places, and the carpet of relics is so rich that visitors crunch decorated pottery shards underfoot.

Around Mohenjo Daro the wind pushes whirling dust devils across the gravelly plain, and the heat is stifling. But once a rain forest must have flourished here under monsoon downpours, for the museum exhibits seals bearing engravings of rhinoceroses, elephants, tigers, and other jungle fauna.

We planned to spend the night at the government resthouse in Sukkur, site of one of the world's great dams, the British-built mile-long Lloyd Barrage. The dam backs up Indus River water and sends it down thousands of miles of branching canals to turn the countryside around Hell into a garden. For miles the road runs beside the Rice Canal through an avenue of shade trees. Children play in the canal waters or dutifully wash the family water buffalo.

Sukkur is the market center for this artificial garden in one of the world's worst deserts. Beginning shortly after midnight, with a hideous screeching of wheel and axle, peasants stream into the city in wooden-wheeled bullock carts, identical in design with toy carts of 4,000 years ago found at Mohenjo Daro.

Seventy-five miles north of Sukkur, the desert takes over from irrigated land. The road to Sui, one of the world's largest gas fields, runs across wastelands belonging to Bugti tribesmen, probably descendants of

the Arab raiders who first called the region Hell. They have the Semitic hawk nose, wavy black beard, and piercing eye of the desert Arab (page 7).

Their land is desolate. Years may pass between rain showers. For a few years after partition, the Bugtis followed time-hallowed tribal ways in the fastnesses of their desert with little interference from the central government. Girl children were sold to suitors. Murderers were sometimes punished only by small fines imposed by tribal councils. As often as not, the victim's family then killed the murderer in reprisal, thus unleashing a self-perpetuating blood feud.

But discovery of the Sui Gas Field broke up the tribal autonomy. So effectively does the central government rule the area now that even the autocratic nawab of the Bugtis is serving a penitentiary sentence for murder. And so much have times changed that the victim was killed not for violation of an obscure tribal taboo, but for informing on the nawab to the central government for tax evasion.

Flowers Blaze in a Desert Garden

At the Sui compound, I was taken in hand by the field superintendent, John Baldwin, a Yorkshire-born engineer who speaks the native dialects with a North Country accent. The garden about his cottage was as colorful with hollyhocks, phlox, dahlias, dianthus, snapdragons, roses, marigolds, and pansies as any garden in his native shire.

"More colorful," he said in answer to my compliments. "Here we have only one season—blistering hot and dry. Last year it hit 120° and stayed at 116° for days, so all species of flowers bloom simultaneously as long as we pour the water to them.

"We pipe our water from 35 miles away, which makes us miracle men to the Bugtis. They'd rather have that little water tap than free run of the government mint, for money means nothing to them in this sandy waste, not even the \$80,000 we pay the tribe annually in wages and allowances. When the old nomadic urge strikes one of them, he disappears into that parched waste with his family and flock, and we have to train another worker."

The rest of Pakistan does not take the riches of Sui as lightly as do its Bugti proprietors.

Those crowds in Karachi's bazaars came there to cash in on the city's gas-fed industrial boom, dating from completion of the 347-mile Sui pipeline in 1955 (pages 16-17). When the pipeline first brought gas to industry, scarcely a dozen major factories existed in the city. Within ten years, more than 350 plants were pumping money into the city's economy.

Not only Sui gas spurs Pakistan's growth. On the drive north we talked to Swedes, Germans, Italians, French, and uncounted Americans come to Pakistan as advisers to assist foreign-aid programs. Throughout the Indus Valley, American engineers are sinking tens of thousands of wells to lower the water level in waterlogged fields and at the same time provide irrigation.

Beside the road running 350 miles northeast to Lyallpur lies a dramatic demonstration of the efficacy of those wells. Barren fields, soggy from half a century of inefficient irrigation and poor drainage, lie useless under a crust of sterilizing white salts. Next door, mangoes, oranges, sugar cane, and wheat grow on fields where the basically sweet soil has been simultaneously flushed of salts, drained of standing surface water, and irrigated scientifically by deep tube wells.

On the whim of a British lieutenant governor of the Punjab, Lyallpur was laid out in the form of a Union Jack. At the center looms a massive clock tower. Eight bazaars radiate from the tower like the crisscross pattern of the British ensign. The sound of flipping shuttles permeates the air, for Lyallpur is a textile-mill town.

Mexican Wheat Holds Key to Future

Pakistan's onrushing food crisis has given an exhilarating air of emergency to the West Pakistan Agricultural University and the Ayub Agricultural Research Institute near Lyallpur. The university has grown from 100 to 2,000 students almost overnight, and even its vice-chancellor works at a desk on the lawn for lack of office space. In the fields around Lyallpur, research scientists have rushed through tests of the Mexican dwarf wheat I had come so far to see.

Dr. Muhammad Aslam, the U. S.-trained head of the university's plant breeding and genetics department, explained the urgency.

Like a benevolent jinni, a Sindi day laborer huddles in the glow of a makeshift stove. Poor but not a beggar, he lives in the streets of Hyderabad and earns enough for meager meals and tobacco for his hubble-bubble, or water pipe.



"You can fertilize Pakistan wheats just so much, profitably; then the new growth runs to long, skinny stalk instead of grain. The top-heavy plants fall over, or 'lodge,' making the grain difficult or impossible to harvest. Mexican dwarf wheats, on the other hand, have short and wiry stalks. You can apply much more nitrogen, the new growth runs to grain, and the plants remain upright.

"With fertilizer we can boost wheat production of any given acre from a ton and a half at best to three tons and more, just by sowing Mexican instead of conventional varieties."

Khalifa Anwar Hussain, director of the Ayub Research Institute, told me what this meant in terms of hunger. "An increase of only 164 pounds of wheat per acre would wipe out our present wheat deficit," he said. "Widespread planting of a wheat variety that would increase production ten times 164 pounds would turn us from a hungry, have-not nation to a big-time wheat exporter. Who knows? From these fields we may soon wipe out hunger in my homeland for my lifetime and longer."

300,000 Worshipers Throng Huge Mosque

On the drive to Lahore, the second largest city in Pakistan, with a populace of 1,500,000, we passed buses, trucks, and creaking bullock carts loaded to axle-breaking point with Punjabi peasants. It was the last night of Ramadan, and the next day was Eid al-Fitr, most festive day of the Islamic calendar. Pakistan's Punjab is almost 98 percent Moslem, and the peasantry was traveling all night to say their Eid prayers at Lahore's huge Badshahi Mosque.

Though friends had tried to prepare me for Badshahi, last architectural triumph of the great Mogul emperors, I was staggered when I first saw it in the mist of dawn on Eid al-Fitr.

Four minarets tower 176 feet high at the corners of the vast open courtyard. Through two-story gates in the fortresslike walls, thousands of the faithful streamed into the mosque and took their places for prayer. The courtyard alone covers 6½ acres.

Long before the sun had risen, the mosque was filled, and late-comers formed prayer lines in nearby gardens, streets, and squares, pressing as close as they

Walking to water: Bugti tribesmen follow a gas line across the Sui Gas Field to reach water taps provided by Pakistan Petroleum Ltd. Carried 35 miles from the Indus River in separate pipelines, the water gives these desert nomads their first assured supply. Prospecting for oil in 1952, the company discovered the huge natural-gas field that now supplies new West Pakistan industries.

Feathery plumes of sugar cane toss above a field in the Sind region north of Karachi. Cane covers thousands of acres irrigated by the Indus.





ROBERTSONS BY ALBERT HOLWAY © NATIONAL GEOGRAPHIC SOCIETY



President on parade: Mohammed Ayub Khan opens the National Horse and Cattle Show at Lahore, a spectacle that includes polo, dancing horses, trick riding, camel acrobatics, and a police tattoo. As army commander, Gen. Ayub Khan took the reins of government in 1958, when dissension and rioting threatened the new nation; he was elected President in 1960.

Honoring gallantry, the President decorates the widow of a soldier killed in the 1965 India-Pakistan conflict over Kashmir. The woman wears a tentlike burka, observing the tradition of *purdah*, or seclusion.



could to their house of worship (pages 2-4). More than 300,000 devout Moslems made the journey to Badshahi—a congregation almost as large as the population of Wyoming, all kneeling, touching forehead to earth, and rising as one man.

Eid festivities last for three days. Like their Christian sisters at Easter, Moslem women bedeck themselves and their children in new finery to visit friends and to promenade. Even the women wearing head-to-toe burkas, with only eye slits to peer through, had donned colorful new robes.

Though respecting the letter of the *purdah*

custom requiring women to wear all-concealing garb when forced to leave the seclusion of their quarters, many women had thrown back their face masks to reveal their fine eyes and jewelry-studded nostrils. Few of the educated women of the city paid any respect to *purdah* at all.

Children Now Roam Emperor's Garden

To me the prettiest city in dusty West Pakistan, Lahore offers a welcome splash of leafy green with tree-shaded boulevards, manicured campuses of several colleges, and many beautifully tended parks.



REINFORCED BY GEORGE AND CLAIRE LOUDEN (ARREST AND ELBERT MULHART ©) U.S.A.

Lahore's Shalimar Garden covers acres of tiered ponds and fountains, marble pavilions, shade trees, and a marble cascade, all built between 1634 and 1637 by the Mogul Emperor Shah Jahan, who also built the Taj Mahal. Originally only the emperor and his ladies disported themselves amid the garden's more than 400 fountains, but on the Eid day of my visit flocks of brilliantly dressed children whizzed like hummingbirds through the garden, now open to the public (pages 24-5).

Among the throngs of Punjabis strolled an occasional pair of Pathans, six-foot huskies, many with blue eyes and fair skin. From the

shipyards in Karachi to the dam-construction sites of the Indus River Valley, contractors import these muscular tribesmen of the North-West Frontier to lend their fabled strength to the job of building Pakistan.

To see them on their home grounds, I started at the southern point of Pathan influence at Quetta, near the Afghanistan frontier.

The plane took off from Lahore on a pleasant spring day and landed at Quetta in a freezing dust storm. Fruit trees were in full blossom, but the cutting northwest wind thrashed the branches so that petals fluttered away in a rose-colored blizzard.

The 150,000 citizens of Quetta live in squat concrete-and-adobe houses, designed to be earthquake-proof. Early on a May morning in 1935, more than 24,000 died in the collapse of virtually every building in town during one of history's most disastrous earth tremors.

The day I arrived in Quetta, I visited an institute on a hill outside town and watched a middling-size earthquake some 200 miles to the east write its record in squiggles on seismograph drums. Four more earthquakes reported in before I left two days later.

My guide to Pathan country was Amir Usman, a Pathan tribal official. Though his clothes looked like Madison Avenue and his speech reminded me of an American college campus, Amir said he had never even visited Karachi, but had spent his whole 30 years in his Pathan homeland.

"The Pathan code of honor makes my people distinctive," he told me. "It imposes three obligations—*nanateatai*, or giving asylum to any refugee, even a mortal enemy; *melmastia*, or extending hospitality to strangers; and

"City of Islam," Islamabad rises beneath the Margalla Range, 12 miles from Rawalpindi. Like the United States, Australia, and Brazil, Pakistan determined to build a capital city from the ground up. Tents and donkey carts of construction workers dot



badal, or obtaining revenge for a slight.

"The blood feuds based on *badal* have died down somewhat since my boyhood, but even now Pathans never travel alone for fear of an enemy ambush. When I go home to my village near Peshawar, I change to tribal dress, oil and load my rifle, and then call for five or six village friends to escort me.

"If overwhelming numbers should attack us and we escape to any Pathan house whatever, even a house of the very family attacking us, the householder grants asylum and

protects us. An encampment of Pathans once bloodily fought off a hunting party, including a great Mogul prince, to protect a wild boar that had fled to their huts seeking escape."

Every Pathan Must Have a Gun

On the drive northeast along the Afghan frontier toward Peshawar, most of the men we passed carried a shiny shotgun, a rifle with barrel gaily decorated by a braided plastic sleeve (page 7), or an automatic pistol slung on a bandolier. I expressed astonishment

the fields near L-shaped blocks of government offices. When completed, the 350-square-mile area—five times the size of the present District of Columbia—will include a President's House, Assembly Building, Supreme Court, and a university.



to Amir that the poor shepherds and wheat farmers could afford imported firearms.

"Why imported?" he asked. "You are having lunch tomorrow near Kohat with the Adam Khel Afridis, who for generations have made weapons for the whole Pathan world in Pakistan and Afghanistan."

At Darra, where 2,500 members of the Green Clan of the Adam Khel work, the air hummed with small industrial noises. In adobe huts, turbaned men squatted on mats beside legless lathes and rickety drill presses. On those primitive machines, most of them hand-made and hand-powered, the Green Clan people copy small arms from around the world with incredible exactness (page 26).

Most Pathans of warrior age prefer the *yolas dazze*, or 11-shot, .303-caliber, bolt-action rifle modeled on the old British Enfield. In their great filial piety, however, the Pathans have not forgotten their elders.

"For the man too old to handle the *yolas dazze*," the village headman said, "we make

simpler weapons. Our aging fathers carry sawed-off shotguns, or this little machine pistol which fires 15 shots in one burst. For the bedridden, behold this fountain-pen-type gun loaded with a single .32 cartridge and fired by pulling and releasing this spring plunger. No Pathan need feel defenseless while the Adam Khel people keep their skill."

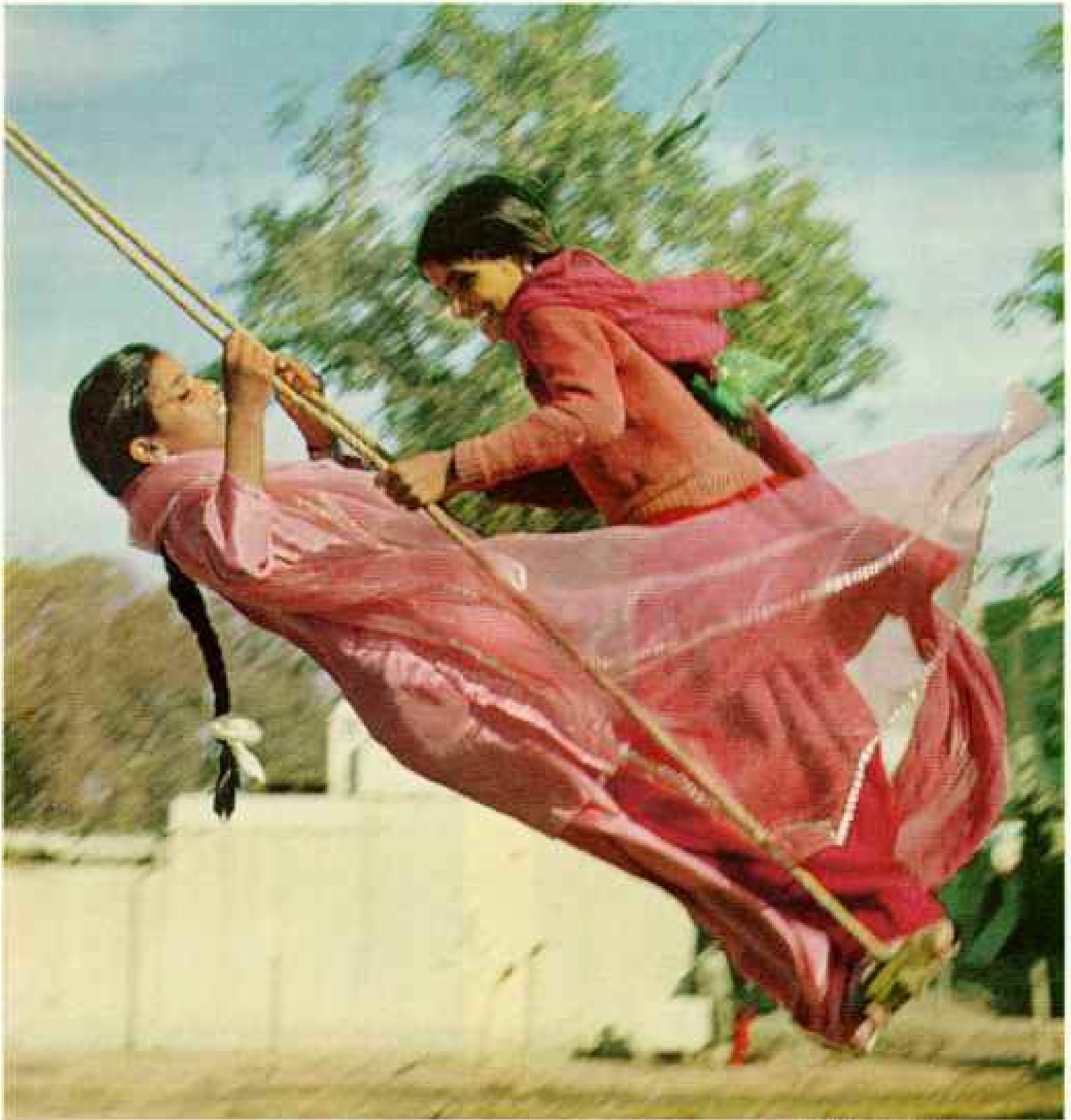
When the British were trying to govern the unruly North-West Frontier, they often made out-of-town Pathans check their weapons at the city limits of Peshawar, the Pathan metropolis (page 31). Since independence, however, tribesmen ramble the city carrying weapons. The Street of the Storytellers and the Bazaar of the Goldsmiths look as if they were patrolled by a conquering army.

Eleven miles west of Peshawar begins the Khyber Pass, nowhere more than 3,500 feet high but with a floor only 40 feet wide in places. Steep boulder-strewn slopes provide near-perfect cover for a defending army (page 30). Nevertheless, for centuries invaders from



PHOTOGRAPHS BY GEORGE AND CLAUDE LULLIER © N.Y.C.

Tinsel curtain shields face of a *naushah*, or new king, as a bridegroom is called. Seeking a blessing, a bride bows her head beneath the Koran, wrapped in green satin. Pakistani parents arrange marriages and agree on the dowry from the groom. Legally no one needs to officiate at the ceremony; the couple can simply consent to be married before witnesses.



ADAMANTINE BY ALBERT ROYER © N.C.S.

Butterflies on the wing, two young girls in flowing gowns bought for the Eid al-Fitr festival spend a holiday hour soaring on a swing. Like Christians at Easter, Moslems celebrate Ramadan's end with new clothes, gifts, and feasting.

central Asia poured across Afghanistan and onto the Punjab plain through the Khyber.

During the late 19th century, when the British in India feared Russia's Asiatic ambitions, they subsidized the Pathan tribesmen of the border country. The tribes, thus kept in testy idleness, spoiling for a fight, acted as a buffer against invasion. Occasionally the tribesmen bit the hand that fed them, with a raid on British holdings in the lowlands. Then a British punitive expedition would sweep the pass clean, raze a few villages as an object lesson, and retreat, leaving the field to the returning marauders.

On rocky walls beside the road, plaques proclaim that this or that British regiment

fought on this frontier. I visited a cemetery in the pass, resting-place of a dozen Britons who fell almost halfway around the world from home. Pathan neighbors tend the graves carefully. They proudly showed them to me and praised the valor of their former adversaries.

Smugglers Thrive in Khyber Pass

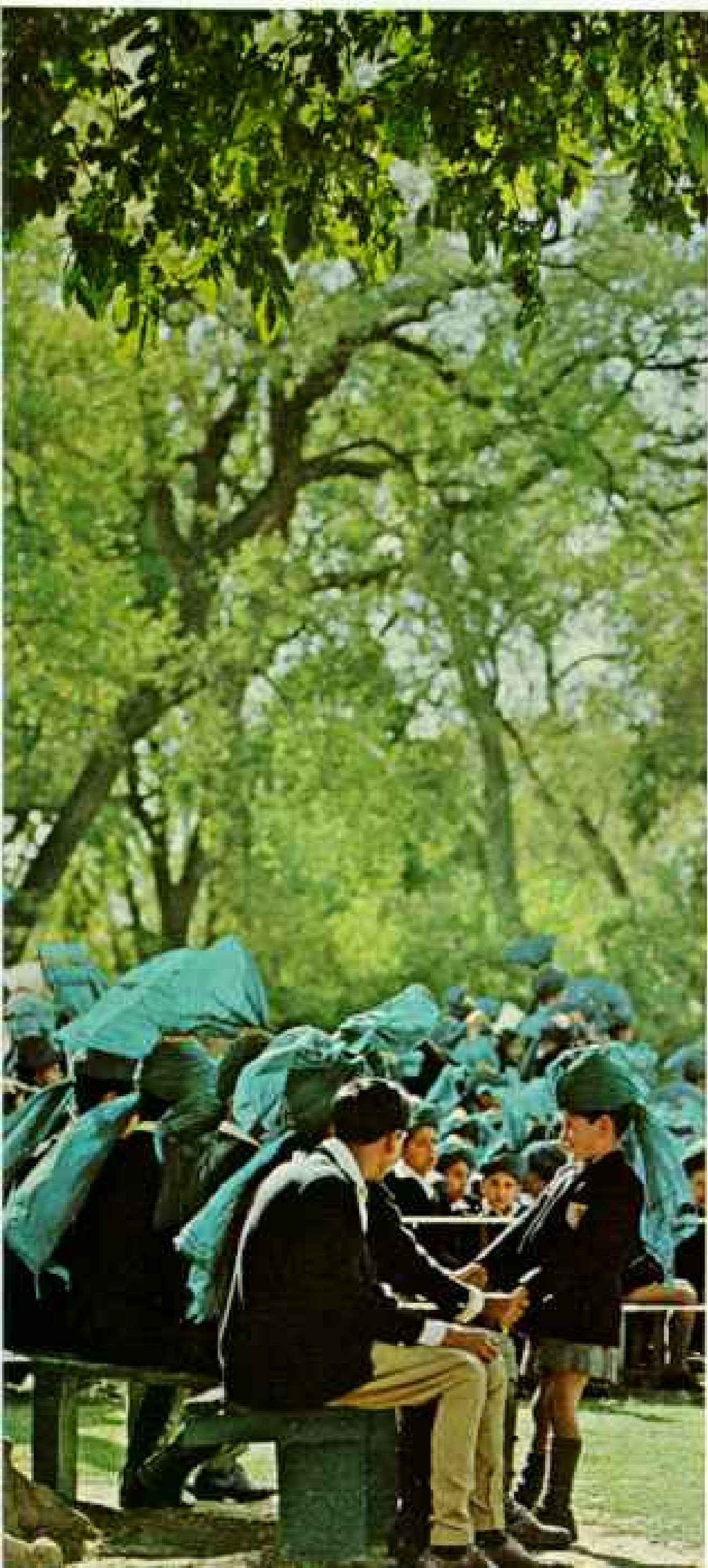
Three-fourths of the way through the pass lies Landi Kotal, the smuggler's market village, where Pakistanis from the lowlands throng to buy cheap Japanese fabrics, hideous neckties, playing cards, bubble gum, rayon scarves printed with the map of Canada, and similar contraband from Afghanistan, seemingly so indispensable that they risk the wrath

of the law to acquire it. A fast-moving item is the dry-cell battery, for young Pathans have added the transistor radio to their more lethal armament for disturbing the peace.

Northernmost of the Pathans are 600,000 Yusufzai who dwell in the beautiful Vale of Swat (pages 28-9). This semiautonomous princely state, twice the size of Delaware, lies beyond the Malakand Pass, where the youthful Winston Churchill once campaigned against the unruly hill tribes. Wheat fields

and fruit orchards rising in mountainside terraces are studded with remnants of a Buddhist civilization that flourished until about A.D. 500. Alexander the Great marched through Swat, and I saw a powerful Greek influence in the artifacts dug from Swat's fertile fields. These relics are displayed in a smart little museum established by the ruling wali at the suggestion of a NATIONAL GEOGRAPHIC writer who visited Swat in 1952.

Between 32 and 35 inches of rain, more



Boys in blue attend Aitchison College in Lahore. Pakistan's well to do send their sons to the private academy, founded by the British. English tutors still head some departments.

than twice the average for West Pakistan, falls on the slopes and valley floor of Swat. Thus the state exports wheat and honey to the hungrier regions southward.

I finished my visit to the west wing by flying almost as far north as you can go in Pakistan, where mighty peaks, 60 of them more than 22,000 feet high, ring the mountain valleys of Gilgit. Gilgit lies in the north of what the Pakistanis call Azad—or Free—Kashmir, that portion of the disputed state which re-

mained in Pakistan's possession when Indian and Pakistani troops laid down their arms in 1949 under United Nations supervision.*

The turboprop planes linking Gilgit with the outer world zigzag through chasms between jagged peaks on a flight that gives even the hardest traveler a few bad moments. Nanga Parbat shrouds its 26,660-foot summit behind an all-but-perpetual cloud cover, yet

*See "The Emperor's Private Garden: Kashmir," by Nigel Cameron, *GEOGRAPHIC*, November, 1958.



DETROIT: (OPPOSITE) BY GEORGE AND CLAUDE LUDEN; RESEARCHING BY ALBERT WELLSBY © U.S.A.

"House of Joy," as Shalimar means, has been a wellspring of delight since Emperor Shah Jahan laid out the garden in Lahore in the 17th century. The famed builder of India's Taj Mahal ordered marble pavilions, brick walkways, and trees of many varieties. Modern Pakistanis, like royalty of yesteryear, saunter amid plashing fountains of the public park.



EXTRACT FROM © 1911-12

Precision guns from primitive tools: Pathan tribesman bores holes in a pistol with a bow drill. These hill men skillfully copy U. S. and European weapons.

row after row of snow-covered ridges and peaks, glittering in the sunshine, stretch away toward Red China's Sinkiang Province.

The plane approaches Gilgit airfield by hurtling head on toward a mountain wall and pitching into a steep bank to the left just before the passengers scream.

Several races speaking unrelated languages inhabit Gilgit. Burashaski-speakers probably descend from Mongols who came across the Karakoram from Tibet and central Asia. Tshin-speakers probably belong to a late-arriving Aryan people from the west who conquered the valley. Many Tshins with blue eyes insist they are descendants of Macedonian deserters from Alexander's army nearly 2,300 years ago.

Scattered here and there are villagers who speak Khowar, an ancient language once

spread over a vast area as far as central Afghanistan and now reduced to a fast-disappearing remnant in the high mountain valleys. In one corner of Gilgit, another language—Domali—lives on among only 50 families, all of them smiths or musicians.

Polo Rediscovered on Gilgit's Fields

We had come to Gilgit to witness a polo match because, according to Pakistani historians, this Persian sport survived in Gilgit and nearby valleys after it had died out elsewhere during the 16th century. British officers posted to India discovered the game and spread it throughout the world. From the airport Maj. S. A. Ghauree of the Gilgit Scouts drove us to the playing field to attend a match played under Gilgit rules between teams from two companies of his troopers.

Gilgitis play six men to a side instead of the standard four, and those oversize teams are often compressed into a field as long, but only half as wide, as the usual standard, with a four-foot wall containing the play.

Thus the action on that narrow field is funneled into long furious charges with little of the complex cross-field passing strategy of the modern Western game (pages 32-3). A player who catches the ball in flight can carry it by hand—but his opponents can unhorse him or force him to drop the ball by any tactic they choose short of biting his wrist.

The players stopped only once during an hour's match. They took only a five-minute rest, and even then they did not change ponies—hence the premium on tough little horses from neighboring north Afghanistan. These ponies are bred at 12,000 feet, and find the air of 5,000 feet in Gilgit Valley as thick and nourishing as pea soup.

Back in Karachi, I boarded a Pakistan International Airlines jet for Dacca, the capital of East Pakistan. The straight-line air distance is 1,400 miles, but because India and Pakistan were still smarting from their recent war, we had to make a 3,000-mile detour around the Indian subcontinent and over the island of Ceylon (map, page 9).

Slightly larger than Louisiana, East Pakistan somewhat resembles it in geography, with a marshy wilderness along the Bay of Bengal coast and a slow rise to low foothills in the southeast and northeast. But unlike Louisiana, East Pakistan teems with people. American foreign-aid officials rate the population density at 1,100 per square mile, among the world's highest.

Dacca is a beehive (pages 34-5). In 1947,



EDDATHROME © NATIONAL GEOGRAPHIC SOCIETY

Daughter beams like a china doll as father shows her off in his home in the Hanna Valley near Quetta. The farmer pushed back his furniture, stacked his blankets, and spread tea and cookies for the occasion—a visit from an American. Photographer Moldvay found the adobe-walled rooms around a courtyard reminiscent of the U. S. Southwest.

the provincial capital was a sad mixture of elaborate mosques and ramshackle dwellings. In 1946 a leopard was shot where a ten-story building now stands. Few industries existed, for the province had sent most of its produce, even its 70 percent of the world's jute crop, to Calcutta for processing.

With Calcutta across an unfriendly border, local industry grew and money came to Dacca. In pursuit of it came the villagers by tens of thousands, until today Dacca's population has reached an estimated 600,000.

Even more than in Karachi, the streets clamor with new construction. Everywhere coolies squat beside piles of whole bricks, laboriously hammering them into walnut-size chunks for concrete aggregate. Alluvial topsoil covers most of East Pakistan, and natural gravel scarcely exists.

One of the world's largest jute processing centers clusters around Narayanganj, ten miles from Dacca. Jute spinning and weaving mills line both banks of the Sitalakhya River there, and spinners and raw-fiber traders together handle more than half the world's jute supply for burlap sacking (pages 36-7).

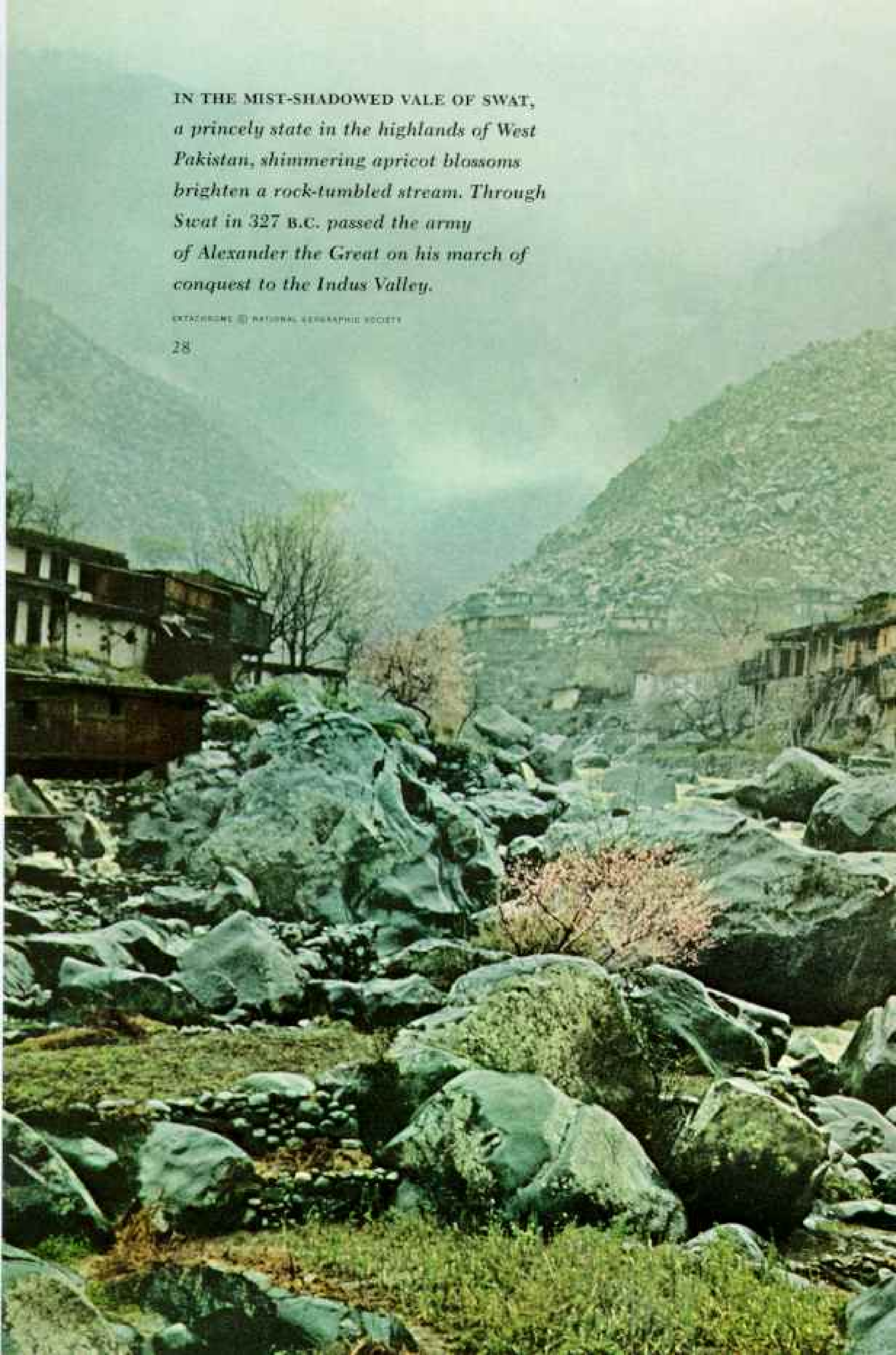
East Confronts West in Dining Room

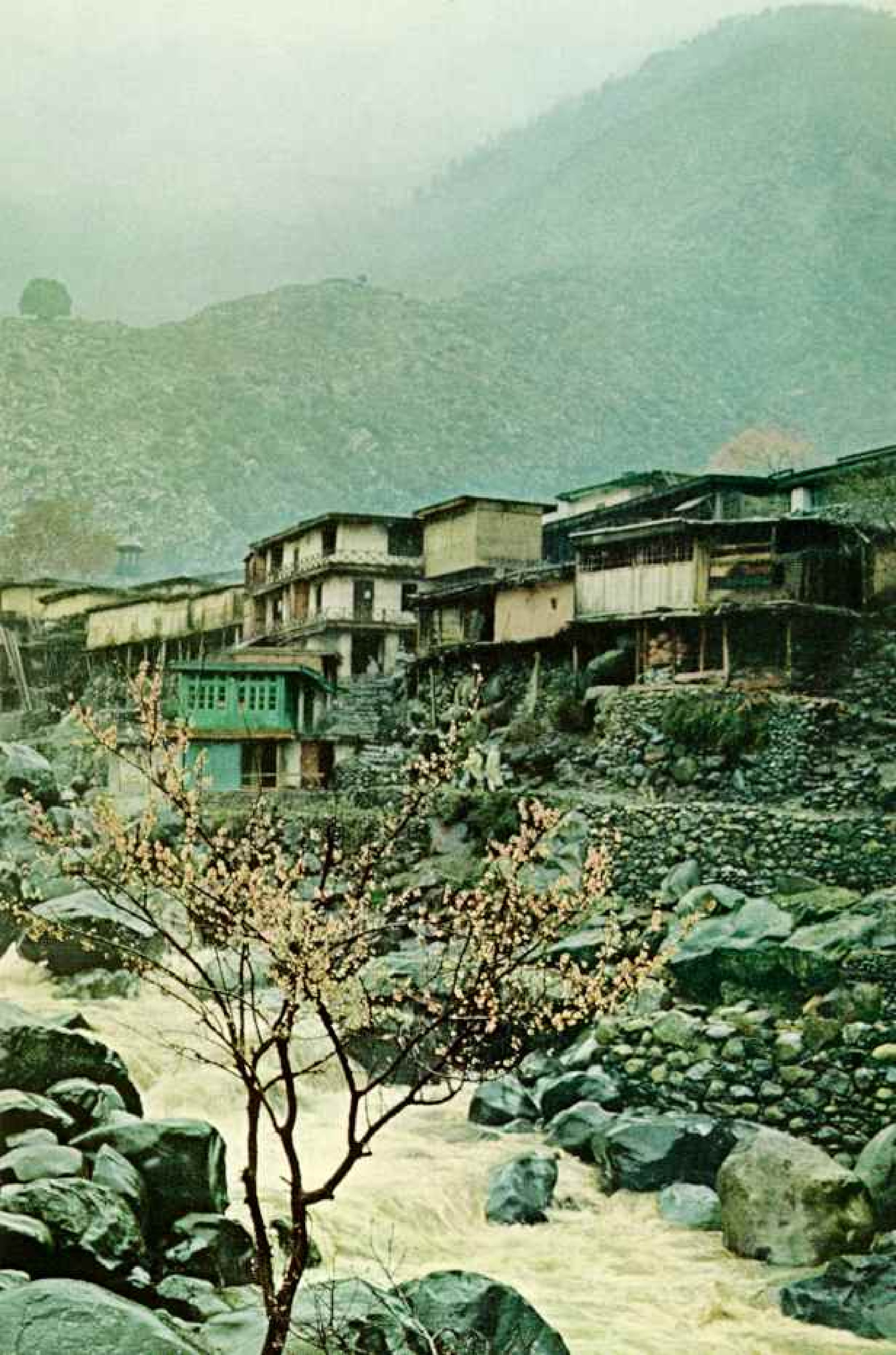
On my visit to the immense Adamjee jute plant, a steady stream of country boats wallowing to the gunwales under incredible loads of baled fiber swept crabwise across the current to unload at the river docks. White-bearded boatmen manning the 18-foot sweeps were muscled like adolescent gymnasts.

Adamjee's company dining room shows the confusion of allegiances in Pakistan caused by the swirling currents of postwar diplomacy.

IN THE MIST-SHADOWED VALE OF SWAT,
*a princely state in the highlands of West
Pakistan, shimmering apricot blossoms
brighten a rock-tumbled stream. Through
Swat in 327 B.C. passed the army
of Alexander the Great on his march of
conquest to the Indus Valley.*

EXTACORNE © NATIONAL GEOGRAPHIC SOCIETY







From opposite walls portraits of Queen Elizabeth and Chou En-lai beam at each other.

I returned from Narayanganj to find Dacca suffering one of its periodic eruptions of resentment against what Bengalis feel is their secondary role in the government.

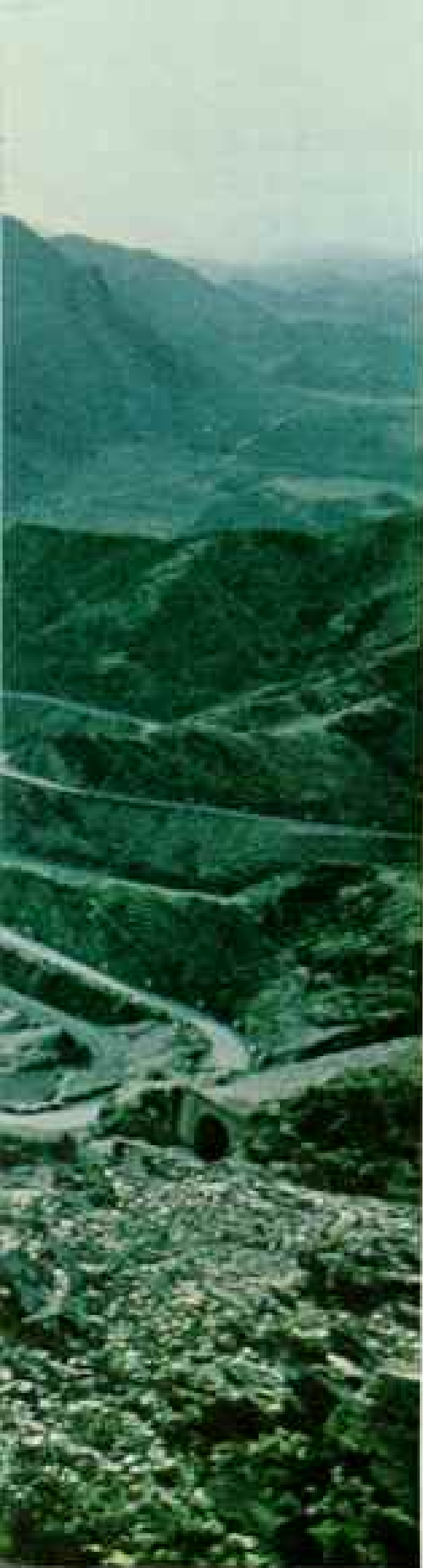
Students blocked the main street, marching under banners and shouting slogans in Bengali. Huda Choudary, my companion for the East Pakistan portion of the trip, explained: "They want Bengali to replace English as the language of education."

In one previous uprising, several students were killed by police in a similar language demonstration. This day the students broke a few windows and roughed up several motorists with conventional rather than Bengali numbers on their license plates. They kept the city in an uproar for the day.

Next morning we drove out from Dacca to Baburhat, center of the cottage weaving industry. Farm laborers were scooping earth from huge excavations and dumping basket-loads onto a mound. Their labor builds the raised platform necessary to lift a new village above the monsoon floods; simultaneously it digs the *pukur*, or pond, needed to carry the village through the dry season by providing a reserve of washing and drinking water and a place for fish (page 40).

Competition Threatens Baburhat's Looms

Around every inhabited mound the villagers had sunk a cluster of graceful dugouts to keep their seams from shrinking. Grown men wielded nets, and children happily splashed in the mud, catching fingerlings with their bare hands. Across the rice fields, great square



EXTREMES (LEFT) AND BODACHROME © NATIONAL GEOGRAPHIC SOCIETY

sails of country boats in invisible rivers and canals appeared to float across the land.

Most of the male population of Baburhat met us at the edge of the village, threw the inevitable garlands over our heads, sang songs of welcome, and gave us rousing cheers. The chairman of the union council introduced himself as the Maulana (a title somewhat like "the Reverend") Nuruzz-aman and led the way across the fields at a half-trot toward the cluster of metal-roofed, mat-sided huts sheltering the looms.

From all about the horizon came the click and whir of flying shuttles. Every banana grove sheltered a one-room textile mill and a cluster of shacks for the proprietor's family. We entered the semidarkness of a weaving shed where four small looms clattered. Squatting on the floor, a ten-year-old boy pulled

Smoky sunlight bathes a narrow street in Peshawar. Nearby, in the town's most famous bazaars, the Street of the Storytellers and the Street of Partridge Lovers, the babble of voices, aroma of spices, and displays of silks, woolens, fruit, copperware, carpets, and jewelry assail the senses.

"Narrow sword cut in the hills," Rudyard Kipling called the Khyber Pass. Two roads—one for vehicles, the other for laden camels—twist for twenty miles through the rugged Safed Koh Range. Forts and sentry posts remain from the days when the British fought unsuccessfully to subdue the mountain tribesmen. Today these same tribes, in agreement with the Pakistani Government, keep watch for bandits as trucks rumble along the corkscrew road through the famous pass.

Ferocious polo game in Gilgit resembles a series of cavalry charges up and down a long and narrow 200-year-old field. Enthusiasts play an anything-goes-except-biting game. The ball may be caught in flight and carried by hand; opponents try to knock a player from his horse or otherwise force him to drop the ball.

Sizzling in a giant frying pan, patties of ground lamb mixed with green onions, garlic, dried pomegranate seed, and salt make *chapli kebab*, popular Pakistani equivalent of the Western hamburger. Sidewalk vendor serves it with *nan*, a leathery disk of slightly leavened bread.

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thread from a primitive spinning wheel, twisting together native white cotton and Japanese synthetic-silver strands to load a bobbin. The boy said he had never been to school.

The council chairman laid out samples for display. Every week 4,000 bales of 400 pounds each are woven within a two-mile radius of this spot. Each bolt is different, for each weaver throws in colors and patterns according to his fancy of the moment. I found some of the effects striking, to say the least. Unhappily, cheap mill-woven fabrics from Japan sell better in city markets, threatening to kill the 200-year-old cottage industry of Baburhat.

At sunset we dashed to catch the last ferries of the day across the several watercourses between us and Dacca. Bengalis crowded



aboard small open boats and set out on the flood with alarming disregard for safety. Passengers even stood on tiptoe around every inch of the gunwale, leaning backward over the water and clinging to the shoulders of those inside. That same day Dacca newspapers carried a story about the drowning of more than a hundred passengers on such an overloaded ferry.

Fertilizer More Important Than Bridges

"It would cost staggering sums to bridge our big rivers," Huda said. "Often, when the Ganges and Brahmaputra and Meghna are in spate, you cannot see either bank from mid-channel. To bridge that kind of raging torrent in even one place would cost more than ten

new fertilizer factories. And Pakistan needs fertilizer for bigger crops to feed the growing population more than it needs the convenience and safety of bridges."

Controlling the monsoon floods is beyond Pakistan's power, for 90 percent of the catchment basin where flood control would be most effective lies in India, Nepal, China, and Tibet.

India is indeed building a dam across the Ganges just ten miles from the Pakistan border to divert water for flushing the Hooghly River, which runs sluggishly past Calcutta. Pakistani flood-control men fear, however, that the loss of Ganges water in the dry season will wipe out a third of the southwestern quadrant's irrigated farms. Thus, even this lone Indian effort to dam the Ganges has

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STYLING BY ALBERT MULLERT, NATIONAL GEOGRAPHIC STAFF © NATIONAL GEOGRAPHIC SOCIETY



only added to the irritations already vexing the two neighbors. So East Pakistanis must content themselves with being possibly the world's best river boatmen and riding out the annual monsoon floods.

Not only river waters are crossed by East Pakistanis. From the Chittagong District, on the northeastern shore of the Bay of Bengal, the people have plied all the Asiatic salt seas for a thousand years, sometimes as shipowners and captains, more often as seamen for alien shipowners—Arabs, Portuguese, British, Hindus.

The lascar seamen of romantic British sea stories came most often from within hailing distance of Chittagong. Even most of the modern Indian riverboats that carried tea from Indian Assam to Calcutta were manned by Chittagong lascars. These promptly mutinied during the most recent flare-up of border trouble between Pakistan and India, taking over the ships and cargoes for their fatherland.

At partition, Chittagong was little more than a seamen's village, but loss of the port at Calcutta forced East Pakistan to build a new outlet to the world. Now 850 ships a year clear the modern docks at Chittagong, carrying almost four million tons of cargo. And as in many another boom town, unplanned downtown



Gay as gypsy carts, cycle rickshaws clog Jinnah Avenue in Dacca. Owners decorate their shiny vehicles with pictures of landscapes, pretty girls, and stylized flowers (left). Film of dust rising from the street (above) all but obscures the new Baitul Mukarram Mosque, built in the style of the Ka'ba—Islam's holiest shrine—in Mecca. Dacca's university, museums, and art academies make the city the cultural center as well as the commercial and political capital of East Pakistan. More than half the nation's population crowds the verdant plain watered by the Ganges, Brahmaputra, and Meghna River systems.



AGACAPROKES © NATIONAL GEOGRAPHIC SOCIETY

streets which just grew to meet haphazard demands are choked with a busy port city's traffic, outmoded before they are finished. I often dismounted from my traffic-stalled taxi and walked back to the hotel.

Cyclone Killed 10,000 at Cox's Bazar

Seventy miles south, at the root of a long tongue of Pakistan pinched between Burma and the Bay of Bengal, lies Cox's Bazar, a port untroubled by Chittagong's mad bustle. Virtually the only harbor traffic is the rhythmic daily coming and going of a fishing flotilla.

Terrible storms plague this coast. A cyclone had ravaged the area just weeks before my arrival, and the town was only partly re-

built. Some 10,000 persons died in the storm, and homeless refugees occupied brush huts in the yard of my hotel.

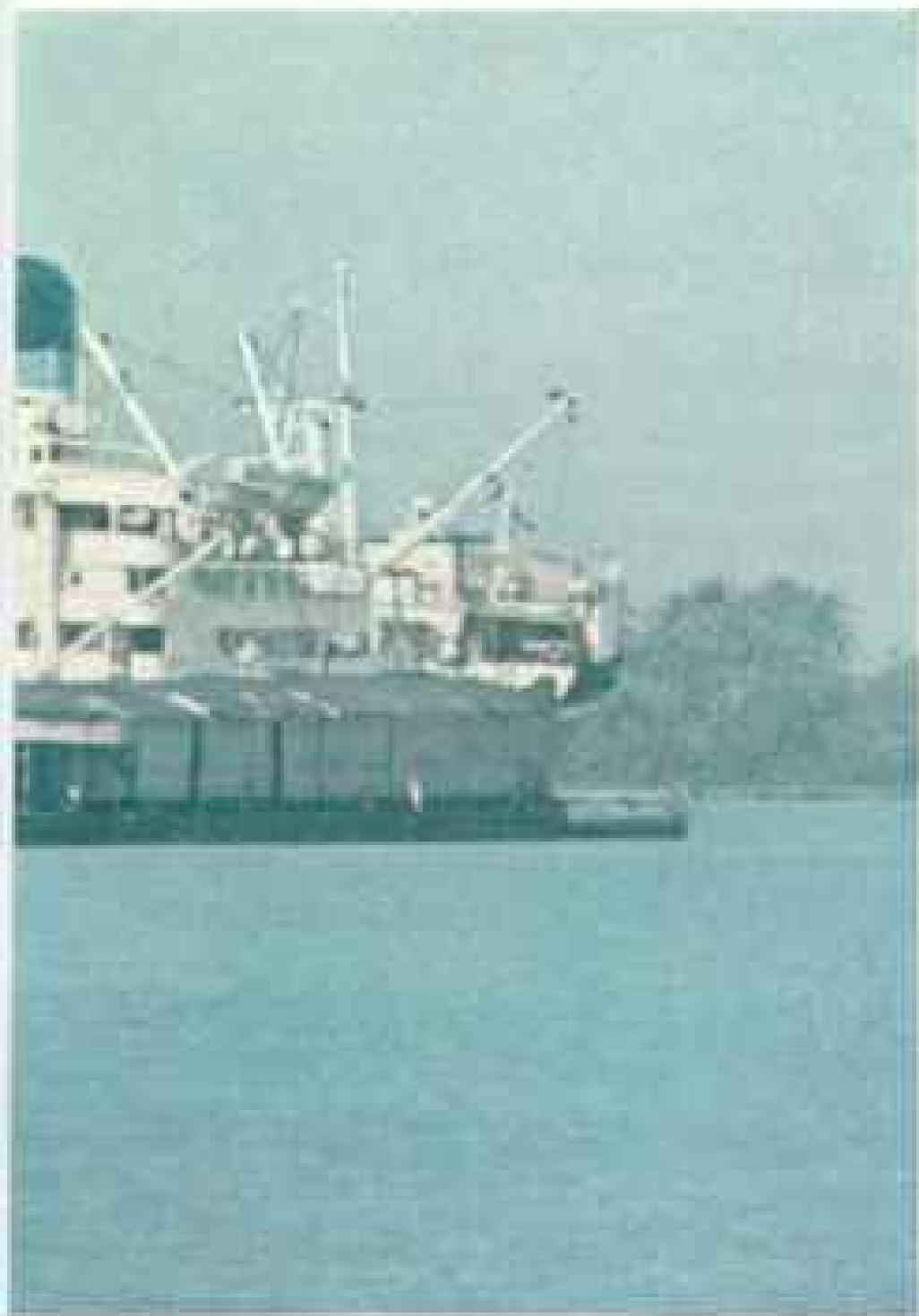
The town itself was founded in 1798 by British Capt. Hiram Cox to house immigrants from Burma's Arakan region, so most of the populace speak an Arakanese dialect. Many practice Buddhism, and a Buddhist temple (topped by an aircraft beacon) dominates the town from a nearby hill. I found the most striking evidence of Burmese presence in the sight of pretty little brown-skinned women strolling the streets a-smokin' of whackin' white cheroots, as in Kipling's poem about Mandalay.

When we drove from Cox's Bazar toward



Gigantic wig of jute rides the head of a field worker near Dacca. He will load it on a small river craft for shipment to the mills.





KATZCHPORES AND BODACHHURE (LEFT) © N.A.S.L.

Ships link the split country. Ocean freighters off-load in midstream at the port of Chalna in East Pakistan. They bring raw cotton as well as textiles, machinery, and other manufactured goods from Karachi to East Pakistan. From east province ports such as Chalna, the country's largest cash crop—jute—travels to world markets. Small square-rigged boats like the one in the foreground carry local cargo in this riverine land.

Crude fibers make colorful carpets at the Amin Jute Mills in Chittagong. Long known as the raw material of burlap, jute now also combines with cotton to create patterns and colors resembling those of Persian rugs. Here artisans inspect completed carpets, correcting errors and snipping off excess threads.

Jute grows well in the wet, alluvial soil of East Pakistan. When retted in deep water, the fibrous covering separates from the stem. Women wash the fibers in clean running water and lay them out to dry on bamboo frames. Carded and sorted according to type of yarn, jute mixed with silk, flax, and other fibers also goes into linoleum, upholstery, cable, twine, and dress material.



Chimbuk in the Chittagong Hill Tracts, Huda buckled on a revolver and carried a rifle. The day before, a leopard had killed and partly eaten two villagers along our way.

The road into the Hill Tracts was a spine-shattering string of potholes and rocks around blind hairpin turns, usually taken on two wheels by our driver. At one blind turn we skidded to a halt just four inches from a head-on collision with a Land-Rover full of Russians. They were geologists exploring for oil and gas as part of the Soviet aid program.

Learning that we had arranged to attend a dance by the primitive Murung tribe, the Russians followed us to the Chimbuk rest-house near the tribal bamboo-hut villages.

As we stopped in the dooryard, a Murung stepped from the dark jungle into the sunlit clearing. He wore only a breech clout and beaded earrings. His long hair was dressed in a topknot, and he showed his bachelor status by a brightly rouged mouth and red spots on forehead and beardless cheeks (page 45).

Mandroi, he said his name was, but we immediately called him Romeo when we found he was returning from an all-night prowling to kidnap a bride. He had a certain girl in mind, he said, but her parents kept too close an eye on her. His father had the routine 110 rupees saved to placate the girl's parents should he succeed in stealing her, and he had the ritual spear and square-tipped machetelike *dao* ready to give her father for his personal consolation, but the parents would not cooperate.

Clearly, the girl was ready to be abducted any time. She would have to be willing, for women of most of the hill tribes are stockier and more powerfully built than the graceful men, and invariably a bride must be older than the groom because she must be physically mature enough to do most of the hard manual labor. A Murung beau seizing an unwilling belle risks a bad thrashing.

Murungs have virtually no religion, only a vague belief in good and evil forest spirits. They say they once had a fine religion written

on banana leaves, but a cow devoured it. Her descendants have been accursed since that day, condemned to regular sacrifice for her impious act.

Periodically, Murungs gather to drink a delicious but stunning rice wine, and then do a shuffling two-steps-forward, one-step-back dance around a doomed and drug-dazed cow to the weird organlike strains of a band of bamboo and gourd bassoons (pages 44-5).

While waiting for the villagers to assemble for the dance, our Russian guests shared our lunch with us, and when the dancing started they, too, photographed the show. Only after the Murungs had danced seven times around



Ten mouths to feed: Ekra Mullah divides a large bowl of rice for breakfast. More rice, plus vegetables and fish, will make their supper. An East Pakistani *bargader*, or share cropper, Ekra Mullah raises potatoes and beans and earns three or four rupees a day—less than a dollar. Relatively well off, he keeps two cows, a calf, five goats, and eight chickens on his 2½-acre farm.

the sacrificial cow, stabbed it to death—and presented us with a bill to pay for its slaughter—did the Russians show any shyness. Then they quickly leaped into their Land-Rover and disappeared down the trail.

Fields Planted Once, Then Abandoned

In the Hill Tracts, a jungle-covered area about the size of Connecticut, live 300,000 non-Bengalis. They belong to alien tribes that probably wandered into these hills during the upheavals in nearby Burma late in the 18th century. Their religions and customs overlap in a bewildering fashion.

The lowlanders call themselves Khyoung-

tha, or Children of the River. Among them are the largest of all the tribes, the gentle and intelligent Buddhist Chakmas, who number about 125,000. Next are the Moghs, numbering 66,000. These comparatively advanced people scorn the primitive Toungtha, or Children of the Hills, including the Tipperas, Murungs, Pankhus, Lushais, and Kukis.

All the tribes, except for most of the civilized Chakmas and Moghs in recent years, practice an extraordinary form of slash-and-burn agriculture locally called *jhum*. Before the coming of the monsoon, they slash the bamboo and undergrowth on a chosen hillside and leave it on the field to dry. When the

ETHAN ROSE © NATIONAL GEOGRAPHIC SOCIETY





Citadels against storms of the monsoon season, mounds of earth hold bamboo homes of the Khulna region above watery plots. Here in the "dry season," raised pathways lead to moored boats, the usual transport of these farmers.



PHOTOGRAPH BY ALBERT MOSELEY © NATIONAL GEOGRAPHIC SOCIETY

From June to October rains cascade, rivers leap their banks, and much of East Pakistan becomes a huge lake. When a cyclone adds to the deluge, thousands may lose their lives. But the water also brings rich harvests of rice and jute.



ESTABLISHED JARDIN AND KURCHANE © N.S.S.

Swift as grasshoppers, Hindu women pluck tea flushes—the tender bud and first two leaves—at the Rajghat Tea Estate in Sylhet District; about 3,500 flushes make a pound of processed tea. Tea gardens spread like a tapestry across the hills of East Pakistan.

Keeping step with mama, a baby elephant accompanies her to work on a tea plantation in Sylhet. The elephant boy uses his charge like a bulldozer in clearing land.

first monsoon rains threaten, they set fire to the tinder-dry mass. The layer of ashes, several inches thick, mulches and fertilizes the soil.

In shoulder baskets, tribesmen mix seeds of rice, cotton, maize, sesame, pumpkin, melon, tobacco, and yam. They walk through the powdery ash, stabbing a hole here and there with their machetes and dropping in whatever seeds come to hand.

Maize ripens in August, vegetables in September, cotton, tobacco, and rice at year's end. When the monsoon rains are right, each family can raise three or four times its own needs, a happy excuse for trade and an annual gawk at the wonders of the outside world.

Jhum cultivation so exhausts the soil, however, that the tribal villagers each year abandon their fields and move along to another tract. Recently the government, instead of allowing the abandoned field to revert to bamboo as formerly, has been paying the tribesmen to plant teak seedlings.

Eventually, the tribesmen are going to exhaust all available space for jhum, and when they return to the long-abandoned field to resume the cycle, they are going to find a

valuable stand of teak timber awaiting them. On that day they will become day-labor lumberjacks instead of carefree woods runners, and one of the last of the world's truly primitive societies will be gone.

Little Tea Left for Export

Far different are the farming methods on the tea plantations of the Sylhet District, in the northeast corner of East Pakistan. On the gentle slopes of hills rising into Assam, 146 plantations cover 90,000 acres with orderly rows of tea bushes, shaded by avenues of trees with whitewashed trunks. The bushes are trimmed as neatly as the hedges at Versailles by the nimble fingers of female pickers who pluck each terminal pair of leaves and bud as they form (above). Small wonder such a farm is called a "tea garden."

Tea ranks behind jute as East Pakistan's second largest export—far behind, for of the 60-million-pound crop Pakistanis themselves drink all but three or four million pounds.

I visited the Rajghat estate, owned by a Scottish syndicate in Glasgow and managed by A. Z. M. B. Mozumder, a gentleman of







KODACHROME BY BERN KEATINGE (RIGHT) AND ALBERT MOLOYAN (LEFT) N.S.S.



Cloud-cloaked valleys of the Chittagong Hill Tracts near the Burma border resound with drumbeats and the drone of bamboo pipes as Murung tribesmen celebrate their annual cow sacrifice. Carrying their bassoonlike instruments as if they were pikes, they blow into the shafts and dance a shuffle step. The setting sun flaring in the camera lens creates a pattern of reflections.

These isolated hill people declare they once had scriptures written on banana leaves, but a cow ate them. Since that day a cow has paid the penalty each year at harvest time. Youths and unmarried girls revel through the night, drinking rice wine and dancing. In the morning they kill the cow and all share in the meat. A self-sufficient people, they raise what they need—rice, maize, cotton, pumpkins, melons, and tobacco—from burned-over bamboo and brush fields.

Mandroi, or Romeo as the author christened him (above), meets the Murung maiden's standard of manly beauty, long hair tied in a knot, rouged forehead, cheeks, and lips, and gaudy earrings in his pierced ears. In this tribe, a swain usually acquires a wife by kidnaping her. Romeo had selected a bride, but her parents gave him no opportunity to whisk her away. He courted her with a love song: "Your face, my sweetheart, is as beautiful as the lotus."

Edwardian elegance of manner. His 3,110-acre tea garden is one of the world's largest. In 1964 it produced an average 1,200 pounds to the acre, the highest yield in Pakistan and one of the highest in the world.

"Even in this crowded land we suffer from a labor shortage," he said. "We are testing a kind of hedge clipper to replace the girls' fingers, and so far it works first rate, boosting production and income for the pickers. But even widespread mechanization will not throw anybody out of work; it will merely fill the labor vacuum."

This curious shortage of farmhands in a nation suffering from chronic unemployment springs from the fact that supposedly only women have a touch delicate enough to pick tea—and few Bengali Moslems permit their women to work in farm fields. Tea pickers are virtually all Hindus, first imported more than a century ago when tea gardens were established. With partition and the hostile confrontation with India, further importation of Hindu laborers became difficult.

A more immediate crisis plagued Mr. Mozumder. He excused himself from a sundown tea I was enjoying with his family to hunt a leopard that had already mauled nine workmen and was terrorizing the area.

Floating Palaces Ply the Ganges

During the month I had spent crisscrossing East Pakistan, I had ridden in jet planes and bullock carts, Land-Rovers and jeeps, tiny motor rickshaws and horse-drawn gharries. But in a land with twice as many miles of navigable waterways as railroads, the only boat I had ridden had been a ferry.

Now, from Dacca, Huda and I took a scheduled commercial helicopter flight to Khulna, fourth city of East Pakistan, where at last we were to have a taste of river travel. At this booming mill town far to the south near the mouths of the Ganges, we boarded a side-wheel steamer like a Mississippi River packet for a ride upstream to the superb new glass-and-concrete boat terminal in Dacca.

On these floating palaces, the cabins ring a sumptuous dining saloon, and forward on a broad canopied deck, first-class passengers sip tea and watch the teeming river traffic.

The ship's master heard that I am a former naval officer, so after dark he invited me to the wheelhouse where the *sarang*, or pilot, and I chatted about ships and sailing matters. He spoke no English and I no Bengali, but we had a satisfactory conversation, for sailors telling sea stories rarely listen to each other.

Meanwhile a searchlight swept the river ahead, and the ship roared up the twisting, traffic-choked channel at a speed to terrify a salt-water man used to oceans to maneuver in. Sampans and dugouts splashed frantically to clear the way for the rushing giant.

Through an interpreter the *sarang* proudly informed me that as senior pilot of the line he earned \$100 monthly. It was truly a princely salary in a province where unlettered laborers and farmhands earn from \$4 to \$7 a month, and even university graduates often settle for half the *sarang's* income.

Future Hangs on Peace and Population

While I traveled the east wing, Pakistan and India grudgingly made some small steps away from war and back to their normal touchy state of armed truce. My flight back to the international airport at Karachi took the short route across India.

The night before my departure from Pakistan, I dined again in Karachi with my gloomy engineer friend of the first days of my visit. And I gave him my promised report on the state of the nation.

"I believe you *are* a blackhearted pessimist about Pakistan's future," I told him bluntly, to his delight. "Your problems are serious, but Pakistanis understand them. Everybody seems determined to control the population and continue building for a new day.

"If you and India can keep the peace, your government and your people will solve your other problems. Dwarf wheat may feed you till your population growth is under control. From then on, the discipline and determination that have made you most improbably survive your first two decades may pull you through to a prosperity undreamed of today."

After three months and 16,000 miles of travel through both wings of Pakistan, this was both my belief and my fervent hope.

THE END

"God is greatest . . . Mohammed is his prophet." The wailing cry of a muezzin calls Pakistanis to prayer from Chittagong's Chandanpura Mosque, whose onion domes suggest old Moscow. With the Moslem faith as a foundation, the nation survives its first 20 years and faces its problems—a shortage of food, a surplus of people.





Sailors of the Sky

By GORDON YOUNG

National Geographic Staff

AHEAD of me, the climbing towplane sinks into level flight. Time to release. I jerk the cable-release knob on my instrument panel, and suddenly we are alone, my sailplane and I, whispering through the clear Virginia sky.

No engine roars in my ears. Silence—glorious silence. Only an instrument needle tells me that we are moving at 45 miles an hour. We seem to be poised, motionless, 3,000 feet above

ALONE WITH THE WIND, seven-time national soaring champion Richard H. Johnson of Dallas, Texas, rides the flowing mantle of a summer storm in his Skylark 4 sailplane. Like a bird in his engineless craft—one of a thousand in the Nation's skies—he revels in the freedom of solitude and space.

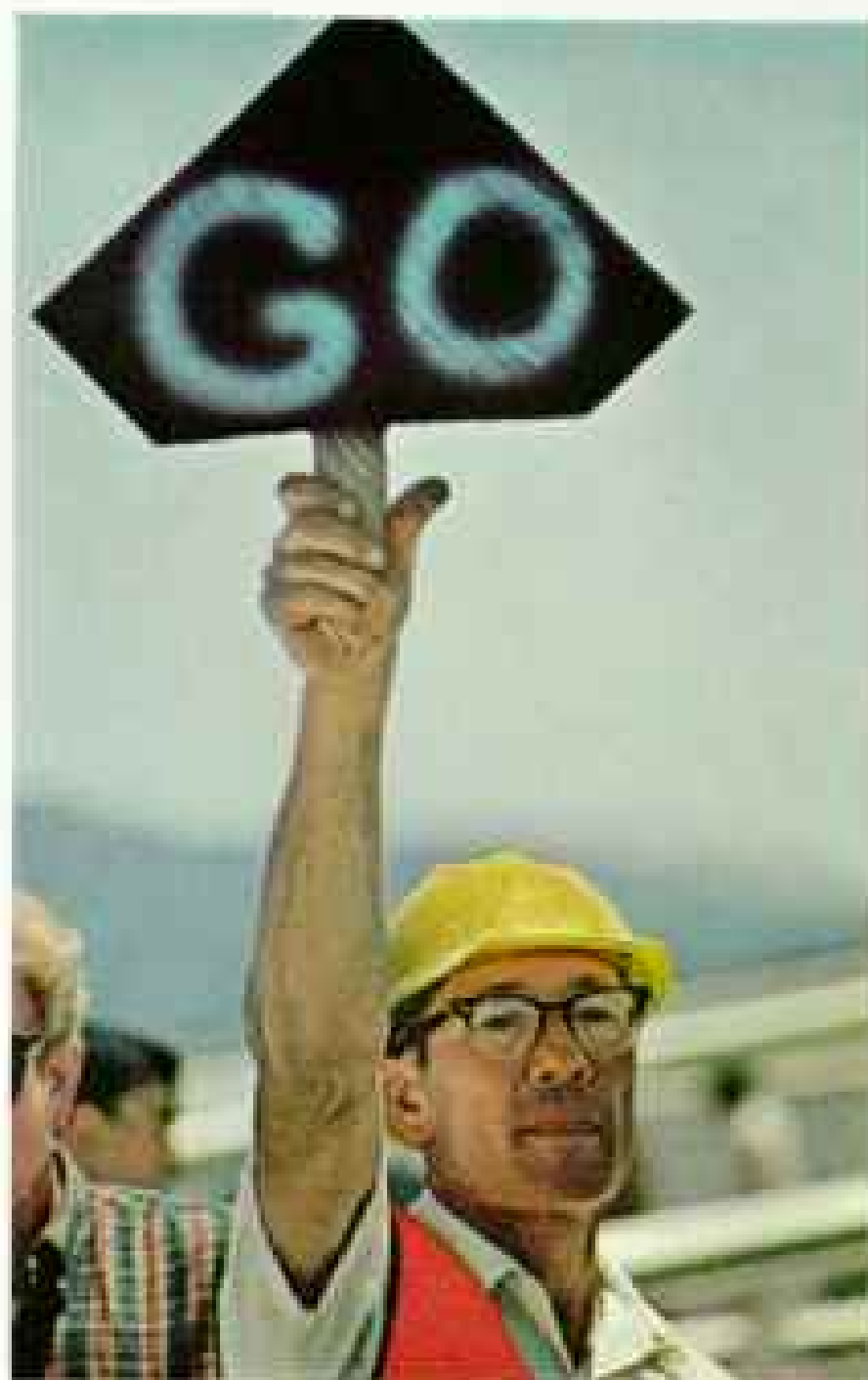
the green-and-brown checkerboard called earth.

Exultation comes, as it always does after that red cable-release knob has set me free. Now there is just the muted murmur of flowing air and the magnificent feeling of being lord of the skies. This is the pure flight men dreamed of as they stared up at wheeling hawks and eagles.

Lord of the skies! I put my sailplane into an exuberant turn and watch a tilted horizon parade past the nose. I move my control stick and a rudder pedal, but these are unconscious things. This beautiful bird is part of me. Its wings are my wings.

Off to the left, the town of Leesburg rotates slowly with my passing. The silver ribbon of the Potomac River twists near it. Faintly, the sound of a train whistle drifts up.

But enough of this joyful daydreaming. Three hundred feet of precious altitude have already



Goodbye, ground! Chief starter Herman Stiglmeier signals a towplane to take off. He officiates at the 1966 U. S. National Soaring Championships in Nevada, won by Richard E. Schreder of Bryan, Ohio.

Steady as she goes. A crew chief lopes along as wing runner for Dave McNay's sailplane. The runner lets go when airflow over the wings gives the pilot control. During take-off, the glider lifts off the ground before its towplane—but not too high, lest it hoist the plane's tail skyward.



"Running the wing," Marina Beebe steadies the sailplane of her husband Bruce as he is towed aloft. She then chased him with a car and retrieving trailer 400 miles from Reno across the Nevada desert and into Idaho.

Line to the sky, a 200-foot towrope loops toward a pilot as he waits for crewmen to close the canopy and hook the rope under his sailplane's nose. A runner then lifts the lowered wing tip, and the towplane takes up slack. When ready, the "glider-guider" wigwags his rudder.



slipped away. Gravity pulls my sailplane like a sled sliding downhill. It is time to begin the hunt for rising air.

I look around and pick a group of plowed fields two miles away, where sun-warmed earth may be a source of updrafts. My bird and I head there in a flat glide. Our trip will cost less than 500 feet of altitude, for we move forward 23 feet for every foot we sink.

The brown square lies below now, and suddenly the air around me comes to life. Turbulence tugs at the controls, telling me that an updraft is nearby. And then the sailplane surges under me as we enter the column of rising air.

To stay in the updraft, I bank the bird into a tight circle. From somewhere, a hawk comes to join me in this airy escalator. Casually he

accepts me as a peaceful brother and drifts into a spiral 40 feet inside my own. Together we soar upward at 500 feet a minute. . . .

Sailplanes Gather in a Gaggle

Only a year earlier, "gliders" had been vague, mysterious machines to me. Then one April day in Florida I drove past a cryptic sign: SEBRING SAILPLANE GAGGLE.

Sailplane gaggle? Half a mile down the highway, I pressed the brake pedal. Gaggle? I backtracked to the airport.

Half a dozen specks wheeled high overhead, flashing in the sun as they turned. A tanned family trio hurried past me, carrying a long tapered wing toward a fuselage that had the sleek look of aerodynamic perfection. Above me a two-place trainer sighed softly



PHOTOGRAPHER BY JACK FIEBEL (BELOW) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER ERIC ROSTER © N.G.S.



ONLY A MOMENT FROM FREEDOM, *a sailplane banks behind its turning towplane. At soaring altitude the glider will release its cable and sail off to find rising air. Below, a drainage channel winds through evaporating salt ponds beside San Francisco Bay.*

EXTRASOURCE BY JACK FIELDS © A.S.A.



past and circled back to an incredibly delicate landing.

I stayed until twilight—until all those magnificent man-made birds had come to earth. When I drove off, I was promising myself at least a taste of this captivating sport.

But how does a would-be birdman get started? And where? Just how dangerous is it? Back home in Arlington, Virginia, I began my research.

52 First I would need a student glider pilot's

license. A trip to the nearest office of the Federal Aviation Agency put one in my wallet. To earn my private glider pilot's license, I would have to log ten hours of instruction and solo flight time combined, pass a written test on flight rules, and finally demonstrate my proficiency to a check pilot.

The Government calls them gliders—and soaring pilots often use that term, too, in a general sense. But technically the correct word is sailplane—a ship so aerodynamically



efficient that it can rise even in gentle upcurrents. A glider, strictly speaking, is any airplane without an engine; a sailplane is a glider that can soar.

Students Solo Before They Can Drive

Reading over the regulations, I realized that soaring couldn't be *too* hazardous. A glider student may solo at 14—two years before he may legally fly a power plane alone or, in many states, even drive the family car.

Other surprising facts turned up. The United States ranks only fifth in number of glider pilots, yet holds seven of the 16 world single-place records. There are more than 220 soaring schools and clubs in the United States today. Their parent organization, the Soaring Society of America, has grown fivefold in less than a decade.

To get started, I traveled to the pleasant town of Elmira, New York. There Harris Hill, site of America's first national soaring contest, 53



overlooks the lush Chemung Valley. An airport stretches concrete runways among the farms in the valley floor, and nestled close to it is the Schweizer Aircraft Corporation, where most U. S. production-line sailplanes are manufactured (pages 60-61).

Schweizer's soaring school, operated in conjunction with its plant, has a safety record that puts soaring's dangers in perspective. In more than 45,000 training flights, the most serious injury has been a strained back caused by a rough landing!

Article Launches a Career

On a bright April morning the school enrolled a new student. All three Schweizer brothers—Ernie, Paul, and Will—met me. Rather a heady reception for a student soaring pilot, but a few minutes later in Paul's office the warm greeting was explained.

Paul handed me a familiar magazine: NATIONAL GEOGRAPHIC, June, 1929. It fell open to a well-thumbed article, "On the Wings of the Wind," by Howard Siepen, that told of the early days of soaring.*

"Back in the late twenties," Paul said, "the three of us were all ready to go into the restaurant business. Then this article came along. When we finished reading it, we started building our first glider."

He gestured toward the open shop door, where rivet guns clattered and welding torches cast dancing shadows on the wall. "We're still building them."

That evening at Paul's home, I got a back-yard briefing on soaring principles—and evidence that the restaurant

*Other NATIONAL GEOGRAPHIC articles on gliding include "Men-Birds Soar on Boiling Air," by Frederick G. Vosburgh, July, 1938, and "Gliders—Silent Weapons of the Sky," by William H. Nicholas, August, 1944.

Swirling vortex of farmland seems staked to the wing tip as Bernie Carris of Horseheads, New York, circles in a Schweizer 2-32. NATIONAL GEOGRAPHIC photographer Emory Kristof, in second seat, captured the effect by mounting a camera on the wing and triggering a one-second exposure. The metal sailplane weighs more than half a ton with its passengers, yet sinks only 2½ feet a second in a flat glide.

business had lost a capable chef. Paul laid the proof on my plate, then pointed a fork at the fragrant smoke curling upward from the grill.

"There is a miniature thermal," he said with a twinkle behind his glasses. "And that flake of ash drifting up in it is a sailplane. It's heavier than air, so gravity pulls it down. But the smoke is rising faster than the sinking speed of the ash, so the flake goes up."

I watched our tiny "sailplane" climb, then drift off to a landing as Paul covered its thermal source with another steak.

"Any fixed-wing aircraft must move forward to keep flying," he continued. "Powered planes use engines. Sailplanes use gravity; they continuously coast downhill through the air. But the sun's heat furnishes altitude-gaining lift—'green air' to a soaring pilot. Solar energy warms the earth, and the ground heats the air above it. That leads to convection—the lifting of the air in rising warm currents."

As any airline passenger knows, this world is a multicolored patchwork quilt when viewed from aloft. A dark patch—a plowed field, for example—grows hot in the afternoon sun. The air over it begins to rise in a huge, invisible column.

The thermal cools slowly as it rises, but so does the surrounding atmosphere. Often the atmosphere cools faster with altitude than the thermal does, so the rising air becomes progressively warmer in relation to the air around it.

As a result, the thermal's upward speed increases; it may exceed 1,000 feet a minute. The warm air may rise 20,000 feet before dissipating.

Unless the air is quite dry, a point
(Continued on page 58)

Swooping over the Chemung Valley near Elmira, New York, Carris and Kristof perform exuberant acrobatics for the remotely controlled camera. Sailplanes have shared Elmira's skies since German glider pilot Wolf Hirth made the first U.S. cross-country flight from there in 1930. In the valley below, the Schweizer Aircraft Corporation builds more sailplanes than all other American manufacturers combined.





Graceful search for “green air”—soaring’s term for updrafts—leads a pilot over a town where dark roofs and warm streets give birth to a thermal. Banking into the column of rising air, he joins a hawk in a spiral ride up to a cloud base. In the distance a dark square of plowed earth promises another thermal, and the cumulus cloud above confirms the promise. Such clouds form when the air, cooling and expanding as it rises, releases excess moisture.

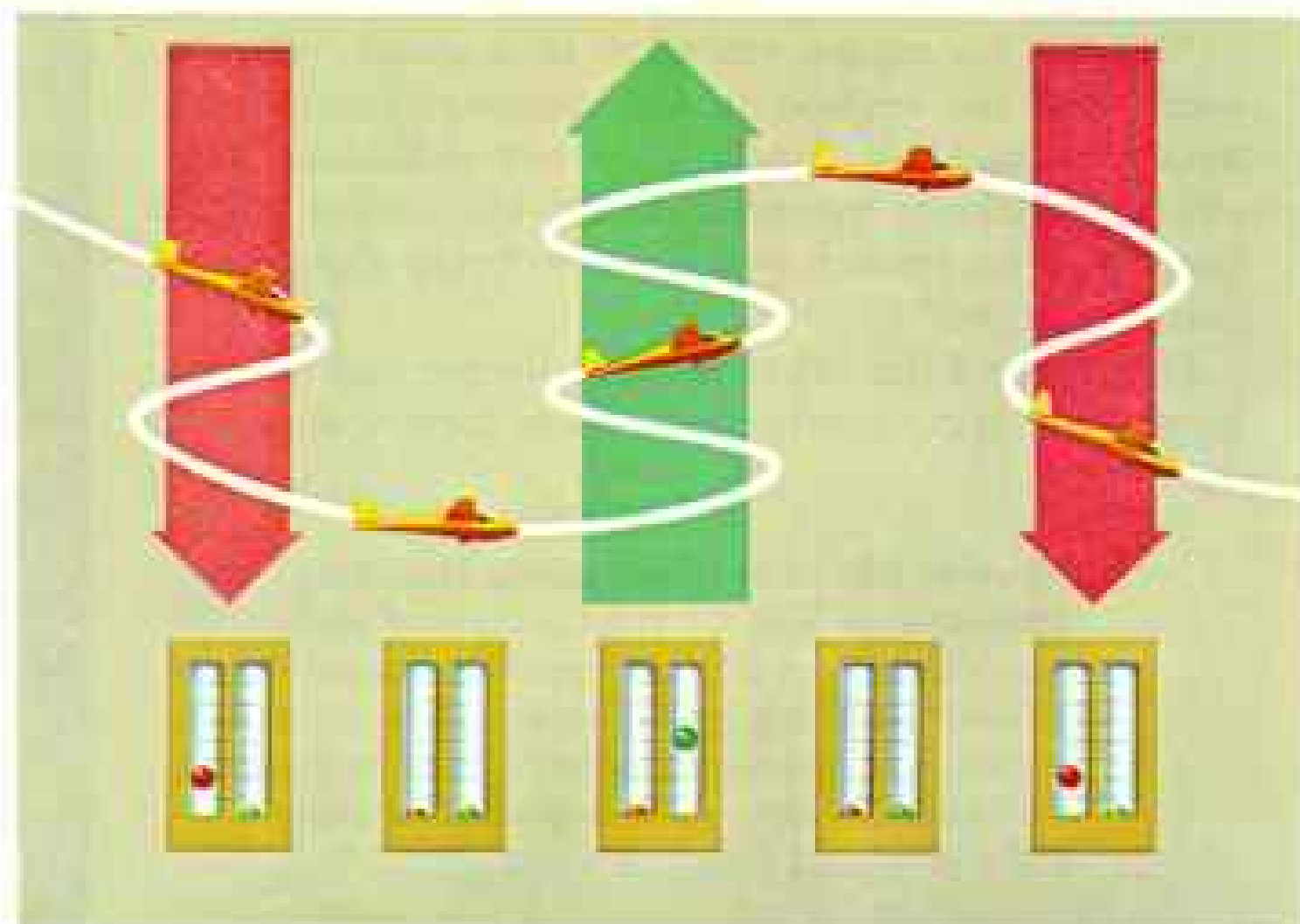
Where next? On the downwind side of a hill,

surface air has been sheltered from the cooling breeze; perhaps the ground has heated the stationary air long enough to start a thermal. The pilot glides over this “wind shadow” and indeed finds an updraft—too subtle to register on human senses, but strong enough to lift the sailplane in its free-floating course across the sky.

The pilot watches his variometer (inset) to tell when his plane is rising or descending. The simple device made thermal soaring feasible, although success still rests on the pilot’s skill.



Red for down, green for up—the variometer records a sailplane's vertical motion. As the plane descends, increasing atmospheric pressure pushes air through a tube into a storage flask, raising the red pellet. It drops back in level flight. In a climb, pressure drops and air leaks out through another tube, lifting the green pellet.



will come when the cooling thermal can no longer carry all its moisture. When this dew point is reached, the excess moisture condenses into a fleecy cumulus cloud. Soaring pilots are ever on the watch for these visible signs of updrafts (painting, preceding pages).

Next day Paul Schweizer left me in the capable hands of rangy, soft-spoken Bernie Carris, chief flight instructor at the school. As I strapped myself into the front seat of a training glider, Bernie identified instruments on the uncluttered panel: altimeter, airspeed indicator, turn-and-bank indicator, variometer.

I understood the first three—but what was a variometer? It consisted of two vertical glass tubes, side by side. One tube contained a tiny green pellet, the other a red one.

"The variometer will tell us when we've flown into a thermal," Bernie explained as he climbed into the rear seat.

But the rest of the explanation would have to wait. A towplane was taxiing into position ahead, trailing 200 feet of resilient polyethylene rope (pages 50-51).

Glider Leaves Ground Before Towplane

With a muffled clatter, the towplane revved its engine and moved forward. "Now let's see if we can make a 'glider-glider' out of you," Bernie drawled.

As we started to move, a ground crewman trotted alongside, holding our wing level. Then he dropped back out of sight, and we jolted down the runway alone, balancing on the glider's single wheel.

Sudden smoothness made me look down. We were three feet above the runway, towed by an airplane still on the ground. Bernie explained: "The glider gets off first but stays only a few feet above the runway. If we climbed now, we'd pull the towplane's tail so high that it couldn't take off."

The towplane was off and climbing, and we fell in line behind it. Airspeed, 60 miles an hour. Rate of climb, 500 feet a minute.

Bernie asked me to give the altimeter a gentle tap. When I did, its needle jumped from 2,900 feet to 3,000.

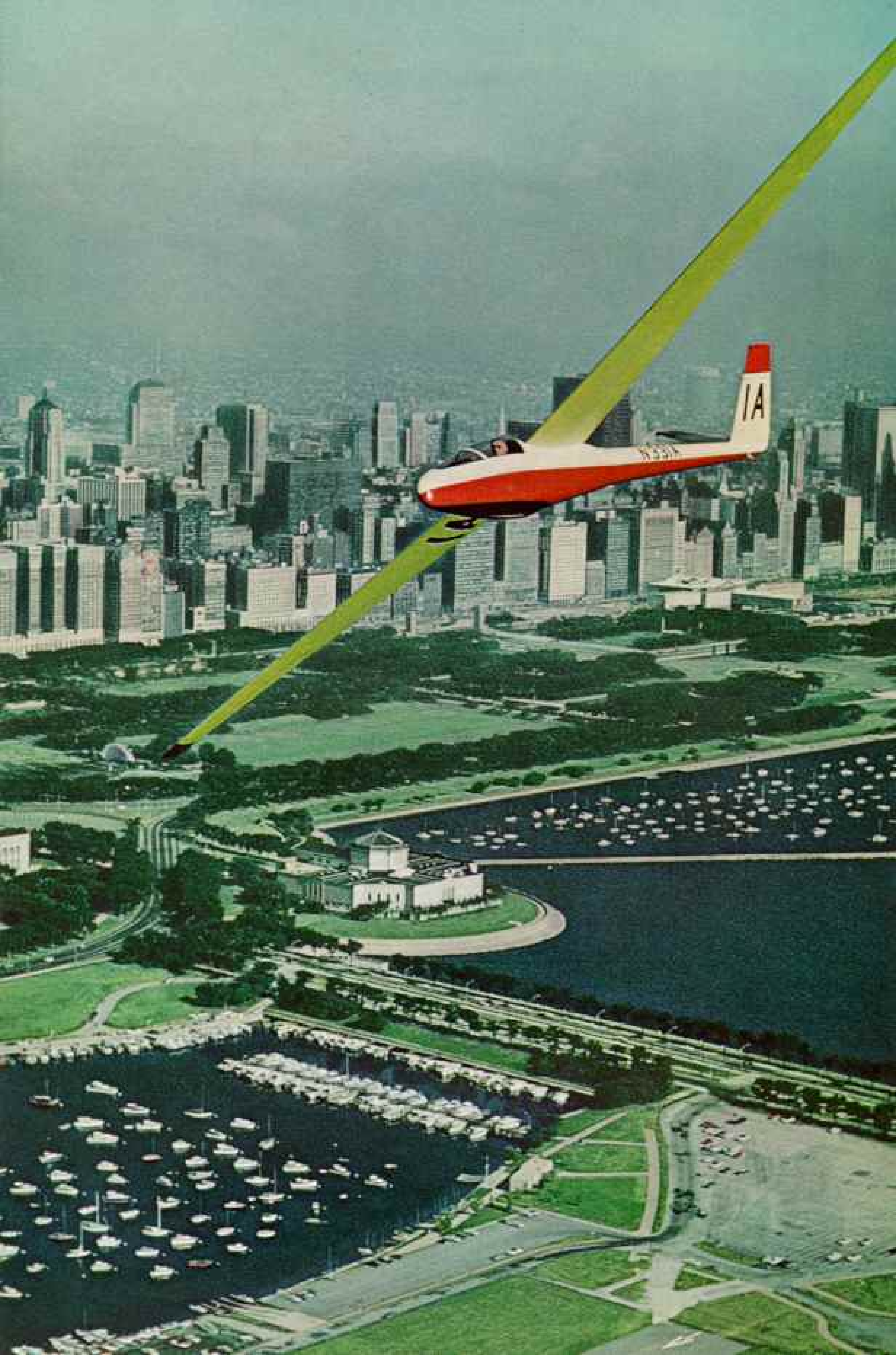
"There's no engine vibration in a glider," Bernie said, "and the friction in the altimeter mechanism makes it lag a bit. You'll see many sailplanes with electric vibrators mounted on the instrument panel. Soaring is so smooth you have to bring along your own vibration!"

We released the towrope then. Bernie had already briefed me on the control movements for maneuvering

Skirting a bluff of skyscrapers, Dale May's high-performance Sisu 1A rides a thermal above Chicago's lakeshore. The Chicago Museum of Natural History lies at left, Shedd Aquarium at center. Sailplanes have much in common with the sailboats in the marina below. Both depend on moving air—but a becalmed sailplane sinks.

ILLUSTRATION BY SANDOR BLUETT © NATIONAL GEOGRAPHIC SOCIETY







Mild blue yonder beckons as Boy Scouts from Troop 106 of Hornell, New York, assemble their own sailplane. It will fly only after a careful Government inspection. The boys may soar alone at fourteen—two years before they may drive. Young lass at right finds the V-tail of a parked sailplane makes a comfortable seat as she waits for Daddy to come back to earth.

Metal birds are born at the Schweizer Aircraft plant near Elmira. Technician in foreground equips a 2-32. The firm sells gliders ready to fly or as kits for back-yard builders.





the glider. Twenty-four years before, I had taken three short instruction flights in a power plane, so the stick and rudder pedals weren't total strangers to me. Now he let me try my hand at flying the ship, and we wobbled unsteadily along.

Above us, patches of mist were developing into cumulus clouds that resembled giant cauliflowers. Sudden turbulence jostled the controls, and I felt Bernie's firm hand take over.

"Watch the variometer," he said as he put the ship into a circle. The green pellet rose in its tube and hovered halfway to the top.

"We're circling in a thermal now," Bernie commented. "As long as the green pellet stays up in the tube, we're climbing. If it sinks and the red one pops up, we'll be descending."

Thermals come in all sizes. Judging from our wide circle, this one must have been more than half a mile across.

Instrument Reveals Invisible Air Currents

As we spiraled up, Bernie stressed the importance of these two glass tubes to a soaring pilot.

Until the late 1920's, sailplane pilots were confined to riding the rising winds that swept up slopes. They could not locate thermals, because neither the altimeter nor the pilot's sense of vertical movement was precise enough to register thermal lift, second by second.

Then the ingeniously simple variometer came along (page 57). It freed soaring pilots from ridge flying, for it could tell them when they had flown into an invisible updraft.

"There's an air flask behind the instrument panel, connected to the variometer," Bernie explained. "As we climb, the outside air pressure drops and air leaks out of the flask, blowing the feather-light green pellet up in its tube. Going down, air leaks in through another tube and lifts a red pellet."

Bernie pointed out that high-performance sailplanes use more sophisticated variometers, including electric versions. "But they're all based on the same simple principle—measuring air that leaks into or out of a flask.

"Competitive soaring pilots add an audio unit, so they can hear their variometer without having to look at it. The unit sends out an audible tone that varies in pitch as the lift changes. With one less instrument to look at, the pilot can concentrate on precision flying in the thermal."

Early gliders were designed on the natural assumption that the slower a glider descended, the longer it would stay aloft. Minimum weight and large wingspan—those were the goals of early sailplane builders.

But thermal soaring brought a whole new concept. Sailplanes must be able to circle slowly in a thermal—and then speed miles across stable air to the next



PAINTING BY DAVID REUTER, ILLUSTRATION BY JACK FIELD © S.A.A.

Skating on a breeze, sailplanes fashion figure eights as they play along the upwind side of a ridge. This pattern—banking out of the lift and picking it up again—keeps them aloft as long as the wind blows. Before invention of the variometer, pilots seldom ventured beyond the safety of slope soaring.

Launched into the sky by winch, a Schweizer 2-22 drops its tow cable over Torrey Pines, California, and heads off to soar the wind that sweeps up the ocean cliffs. Motor-driven winch reels in the cable at 50 miles an hour, lifting the sailplane much as a boy hoists a kite. Parachute at end of the 1,500-foot cable keeps it from snarling as it drops back to earth.

updraft. So, no more featherweight giants, efficient at one low speed. Although a modern ship may sink a trifle faster than those old-timers, it can glide flat and fast between thermals—showing “good penetration,” in soaring parlance.

Thermal circling, I discovered, calls for precision flying. “Change your angle of bank or your airspeed too much,” Bernie warned, “and you’ll find yourself flying right out of the column of lift.”

I proved his point immediately.

Twenty minutes later we came down to earth. Correction: Bernie and the glider did. I was still up there, somewhere, being a bird. Now I knew I’d be soaring the rest of my life.

First Solo Ends in Unexpected Company

On that first day I acquired a slim maroon ledger. The gilt lettering on its cover has dimmed after many trips aloft in my hip pocket. But the title is still readable—Glider Pilots Log Book—and no volume in my library tells me a more exciting story.

April 29: My first flight. “Towing, turns, pattern and landing.” During the next few

weeks many more entries were marked alike.

May 18: Flight number 20. That day the seat behind me was empty for the first time.

Bernie slouched off with studied nonchalance as I fussed with my shoulder harness. How many times in the past 18 years had he played that role? How many other students had fumbled with clammy hands to fasten this strap, not daring to look back at the vacant seat behind them?

A ground crewman squatted under the glider’s nose to snap the towrope ring onto my release hook, then trotted over to raise my wing-tip level. He stood there, incredibly unconcerned, chewing his gum.

On my panel, the cable-release knob loomed enticingly. Pull me now, it seemed to say, and forget about this silly business of being a bird. Instead, I seesawed the rudder to give a “let’s go” signal to the towplane.

Three thousand feet up, I released. All my fears fell away with that towplane, and at last I could look back at the empty seat.

I’ll never forget that flight. I’ll never forget that landing!

Coming into the landing pattern at 700



feet, I made the routine radio request for clearance. "Elmira Tower, this is sailplane Five Eight Romeo on downwind leg."

The reply stunned me. "Can you hold, Five Eight Romeo? You're third to land after the two airliners."

I tried to comply, but the altimeter needle continued its inexorable sweep toward zero. As I watched it, my urge to cooperate fled before something close to panic.

"Elmira Tower, this is Five Eight Romeo on first solo—coming in!"

One airliner lumbered patiently out of the

pattern to circle again, but the other was already on final approach. As I glided toward the grass strip beside the runway, my radio crackled with reassurances from the tower operator and warnings to the airliner to watch out for that little glider.

I touched down then, and a giant silver wing tip flashed by less than 100 feet away.

Bernie chuckled as I chronicled the great adventure. "Legally, gliders have right of way over everything but free balloons and aircraft in distress. But airliners use up fuel and schedule time when they have to break out of the landing pattern to circle again. Next time, check the field traffic while you still have a few hundred feet of altitude to spare. Then I won't have to watch you make formation landings with Viscounts."

Forgotten Barograph Spoils a Flight

Flight 34: Duration, 52 minutes—a glorious thermal flight right up to cloud base. Since the cumulus clouds and I had met at last, I could put things on a first-name basis. Soaring people call them "cu" (pronounced cue).

By now I was flying a Schweizer 1-26, a single-place intermediate sailplane. Its clean shape and 40-foot wingspan gave it a gliding ratio of 23 to 1, and a sinking rate of only 2½ feet a second.

I had already qualified for an "A" badge and a "B" badge, the first for soloing, the other for proving myself ready for cross-country flights. This thermal flight gave me the right to wear a "C" pin on my jacket.

The "C" . . . the Silver Badge . . . the Gold Badge . . . the Diamond Badge—those successive proficiency ratings give soaring one of its big appeals. Pilots the world over must meet identical tests to qualify for the last three ratings.

The coveted, elusive Silver Badge. I needed three things to earn it: an altitude gain of 1,000 meters (3,281 feet), a cross-country flight of 50 kilometers (31.1 miles), and a duration flight of five hours.

Flight 42: Duration, nine minutes. That one could have been my altitude gain, for the thermals were booming—if I had remembered to switch on my barograph before I took off.

Unforgivably, I didn't. A thousand feet up, still trailing the towplane, I remembered. That spring-wound machine should be ticking away, scratching a record of my altitude onto smoked foil. But it was silent!



STYLING BY ERIC S. HAYES © N.G.S.

Stuffed into the cockpit, Richard Delafield lies down to fly a Swiss-built Diamant. Wife and crew chief help him prepare for a flight at the 1966 national meet at Reno.



ILLUSTRATIONS BY JACK FIELDS © NATIONAL GEOGRAPHIC SOCIETY

Jack-in-the-box engine solves the launching problem for this two-place Nelson Hummingbird, based at Fremont, California. The engine retracts into the fuselage (right) to reduce drag while soaring. The pilot can restart it in flight. Wing-tip wheels and a steerable nose wheel let the plane taxi onto a runway and take off without help from a ground crew.



Flying awkwardly with my left hand, I groped behind me to find the barograph switch. In the process, I managed to wedge my elbow so securely between fuselage braces that I couldn't withdraw it.

For another thousand feet I flew one-handed behind the towplane. Then I jerked the cable-release knob in disgust and headed down, managing on the way to free myself.

Flight 49: On June 23 I started west in weak lift toward my Silver Badge target—Dansville, New York. Two hours later the thermals let me down, far short of my goal, on a field of new wheat. I learned that sailplanes generate considerable interest when they drop in unexpectedly.

Two fields away a farmer was plowing. He came to the rescue at full throttle, his plow carving a furrow as he came. Scrambling out of my sailplane, I managed to reach the edge of my wheat field before his plow did. Soaring

pilots are responsible for any damage that occurs as a result of their landings.

The next trying hour was spent defending the wheat against heavy-footed sightseers. At last the retrieving crew arrived, and my plane, resting on its trailer like a bird with folded wings, headed back toward Elmira.

But my aerial misadventure pales beside that of Elmira soaring pilot Tony Doherty. On a cross-country flight, he mistook a long, grassy field for an airport—and landed in the fragrant leaching field of a sewage plant!

"Forced" Landings Planned in Advance

About this landing business: Mention gliders to the unacquainted, and visions of forced landings pop into their minds. In a sense, most sailplane landings are "forced," but they are also planned thousands of feet in the sky.

Even on a cross-country flight, the soaring pilot always keeps a landing site in gliding



PRINTING BY DAVID BELTZER © N.A.A.

Waves of air lift a sailplane high over a mountain range. Strong winds sweeping up and over mountainsides form a series of waves, like those that build up behind a rock in rushing water. Entering the ascending part of a wave—ideally the first one downwind of the mountain—a sailplane is swept upward at speeds as high as 3,000 feet a minute on eerily smooth air.

Wave-soaring pilots look for characteristic formations—cap cloud on a mountain peak, lenticular (lens-shaped) clouds, and, at lower elevations, turbulent rotor clouds.

California's Sierra Nevada ranks as the world's most famous wave maker—but even a lower range such as Virginia's Blue Ridge creates waves when the wind is right.

range. If necessary, he will alter his course to stay within reach of a meadow, or work thermals to a higher altitude so he can glide to a distant field if he runs out of lift.

He always plans to arrive at his landing area with more than enough altitude. Coming in, he aims at a spot far down the field. Then he pulls a lever marked "spoilers," and long panels swing up from the wing. They reduce the lifting power of the wing—spoil it—so the gliding angle of the aircraft steepens.

The pilot uses his spoilers to control the rate of descent and bring himself down with the full length of the landing strip ahead of his plane. It settles gently on its single wheel, usually at a forward speed of about 45 miles an hour.

Full spoilers, then, which also activate the wheel brake. Push forward on the stick to bring the broad landing skid in front of the wheel into contact. Chances are, most of the landing strip will still lie ahead when the sailplane comes to a stop—generally within 70 yards of touching down.

Flight 59 in my log reads, "Cross-country . . . Elmira to Dansville . . . Silver distance

and altitude gain. . . ." Now only a five-hour duration flight stood between me and the Silver Badge. But it was time to leave Elmira and see more of soaring America.

Mainspring of the movement is the Soaring Society of America. The SSA publishes *Soaring*, the sport's monthly magazine, and ties most U.S. pilots together through loosely affiliated clubs. The headquarters is in California. So are some of the country's best soaring conditions. Perhaps my five-hour flight waited out there.

Government Certifies Homemade Planes

In Los Angeles, the executive secretary of SSA, Lloyd Licher, briefed me on the organization's place in the world soaring scene.

"Let's start at the top," Lloyd began. "The Fédération Aéronautique Internationale, in Paris, is the world control center of sporting aviation—private power flight, sport parachuting, model building, ballooning, and soaring. In America, the National Aeronautic Association represents FAI—and the Soaring Society of America, in turn, is the soaring division of NAA.

He soared nine miles high: Paul F. Bikle (right) became, literally, America's top soaring pilot when he reached 46,267 feet above sea level over Lancaster, California. Though still in strong lift, he was forced to leave the wave at that height—he could not have survived without a pressure suit if he had continued upward. Mr. Bikle's flight, made February 25, 1961, set a world's altitude soaring record that remains unbroken.



REPRODUCED BY HOWARD HARRMAN (RIGHT) AND JAMES R. HOLLAND © N.Y.S.



Laboratory in the sky, this research sailplane, *The Explorer*—sponsored by the Explorers Club of New York—investigates clear-air turbulence, a hazard to airliners. Capt. Kim Scribner checks the sailplane's oxygen system.

"SSA has 5,800 members now. Ten years ago, we had only 1,000. Things are picking up. Currently, there are about 1,000 licensed sailplanes in this country—more than a third of them homemade, either from plans or kits, or actually designed by their owners."

Surprised, I asked how the Government felt about all those do-it-yourself gliders flitting about the sky.

Lloyd grinned. "If they aren't safe, they can't fly. Every home-built ship has to pass rigid inspections to qualify for an air-worthiness certificate."

So add another appeal to soaring's list of benefits—the joy of creation. It's comforting to know that, in this age of sophisticated jets and missiles, there are still aircraft that can be produced by lone craftsmen.

Economy is an additional motive for home building. A factory-built 1-26 costs in the neighborhood of \$4,000. A home-builder can buy a 1-26 kit and get it in the air for at least a thousand dollars less—plus gaining a lot closer acquaintance with his plane.

Soaring on a shoestring? Perhaps not. But when half a dozen pilots pool their cash and

building skills, they can fly at reasonable cost.

Eying Lloyd Licher's cluttered desk, I asked him when he found time to soar.

"I have a sailplane in the garage at home," he said rather wistfully, "but my wife uses it more than I do these days."

Later, I found that Rose Marie Licher uses it very well indeed. She holds the American women's distance record of 273 miles!

Sea-going Seagull Bests a Glider Pilot

Seagulls and sailplanes intermingle on the wind that sweeps up the ocean cliffs at Torrey Pines, 12 miles north of downtown San Diego (page 72). I went there, eager to try my first winch launch and join the gulls.

The winch gleamed bright yellow 1,500 feet away, near the cliff edge, as I climbed into a glider. Walt Mooney, of the Associated Glider Clubs of Southern California, climbed in behind me. Strapped in, we waited. Off to the left, someone held a signal flag aloft, then flashed it downward.

We surged forward as the winch operator started his cable drum spinning, gobbling up the wire at 50 miles an hour. In seconds we



Sailplane turns spaceship and Nevada becomes a distant planet—as seen through a bulging Fisheye lens. Attached to a boom on the 2-32's nose, the



were climbing, our glider's nose pointed up at a 45° angle.

An impossibly steep angle, I thought, but it turned out to be standard practice during a winch launch. The idea is to get up as high as possible before cable-release time comes.

On a winch launch it comes soon. We dropped the wire 600 feet above the cliffs (page 63). Back in Elmira, my landing approaches started at higher altitudes than this!

But after I convinced myself that this cliff wind could be trusted, enjoyment came. We swept back and forth along the upper edge of the 320-foot precipice. A seagull moved ahead of us on motionless wings, then banked out to sea, still soaring. I started to turn after him, but Walt pulled us back on our cliffside course.

"I know a pilot who followed a gull out there, figuring that the bird would show him where the updrafts were," Walt said. "He rode the air currents five miles out to sea, doing everything the bird did. Then the seagull turned toward shore and started flapping his wings!"

Something in his voice gave me a clue.

"Did you get wet?" I asked.

"Not quite," he answered. "But I didn't have enough altitude to make the clifftop, so I had to land on the beach below."

Desert Thermals Show Bad Manners

There was still no five-hour flight listed in my log as I headed for El Mirage Field. Surely there must be acres and acres of green air over the shimmering Mojave Desert.

William Briegleb—Gus to his friends—has owned this wartime training field since 1946. He spends much of his time designing sailplanes and preparing kits of his creations for do-it-yourself builders.

"Too bad you weren't here a few days ago," Gus greeted me. "Soaring was terrific. But now the forecast is for stable marine air."

Stable marine air? A few miles away, dust devils were turning into white tornadoes as they whirled the sand thousands of feet high. And so, unbelieving, I climbed into one of Gus Briegleb's rental ships.

Desert thermals turned out to differ greatly from the gentle, well-bred eastern updrafts. Sometimes the green pellet of my variometer registered 12-feet-per-second lift as the sailplane and I rocketed upward. The down-drafts, too, were rough. They shoved me hard against my shoulder harness and sent the altimeter needle unwinding at a dizzying rate.

For an hour I struggled. Then I noticed that the white tornadoes had disappeared.

DETAILS OF REGIONAL GEOGRAPHIC PHOTOGRAPHER EMERY KRISTOF. HIS CAMERA WAS TRIGGERED REMOTELY BY PHOTOGRAPHER KRISTOF WHILE PILOT CARRIS SOARED NEAR RENO.



Storm's icy breath churns up warm air as a massive cold front advances (right), giving expert pilots like Richard Delafield (above) a chance for long-distance flights. Soaring straight and fast through the warm air ahead of the front, sailplanes pick up extra miles as the stormy wall moves on. Only experienced pilots venture to danger's edge, as lightning flickers and an anvil-shaped thunderhead signals turbulence.

Not long after that, the skies above El Mirage were empty of sailplanes.

As I climbed out, Gus peered at me quizzically. "Didn't you say something about a five-hour flight?"

"Stable marine air," I mumbled.

Thin Air Cuts Short a Record Climb

My days at El Mirage were filled with launches and stable marine air and landings. But the evenings were less frustrating times, spent hangar-flying with Gus about soaring in general. I asked, one evening, just how he would rate soaring conditions in America.

Instead of vague superlatives, Gus answered with examples. "Take the case of Philip Wills, one of the top British soaring pilots," he said. "For years he tried to earn a Distance Diamond, which takes a flight of more than 310 miles. He came over to ride the Texas thermals in 1960 and won his diamond—two days in a row!"

And then Gus nodded toward the west. "About 30 miles from here, Paul Bikle, one of America's best pilots [page 67], tried for an altitude record on a mountain wave back in 1961. He reached 46,267 feet, to set a record



that still stands. Actually, his ship was still in strong lift, but he had reached the limit of safety without pressurization. Someday, someone will build a pressurized sailplane and reach 60,000 feet or more. No one knows how high such waves go.

"Twenty years ago, we didn't know much at all about mountain waves [painting, page 66]. Just that they contained fantastic vertical currents that could send an airplane shooting upward at 3,000 feet a minute—then send it plummeting down again. Such turbulence has peeled the wings from a fast-moving powered plane.

"In 1949 the Air Force, the Navy, and the

Weather Bureau launched a three-year project to investigate the Sierra Wave. They used instrumented sailplanes as research tools. Because of their light weight and slow speed, sailplanes are well suited to probing turbulent air. They can ride the very wave currents being studied and measure them more simply without engines."

Gliders May Bring Men in From Space

Mighty mountain waves, surging desert thermals, cold fronts shoveling warm air aloft as they sweep across the country—pilots in the United States can choose from a wide range of soaring conditions.

PAINTING BY BRUCE MELTZER; ILLUSTRATION BY SMOKY BRISTOL © N.S.A.



Sailplanes, I found, have made many quiet contributions to the study of aerodynamics—a science that started with kites and gliders back in pre-power days. Soaring's contributions have aided in development of high-lift wing airfoils—and in drag reduction, for soaring pilots are a race of wing-polishers.

"Gliders are back in fashion, too, as 'space hardware,'" Gus pointed out. "Some of the re-entry vehicles that NASA is trying are just sophisticated gliders."

Stable marine air kept hovering over El Mirage, so I drove to Sky Sailing Airport near Fremont, on the southeastern shore of San Francisco Bay.

Les Arnold, poultry farmer turned airport operator, established this trim gliderport seven years ago. Les still wears his pinstriped overalls, and no flock of prize Leghorns ever received the mothering that his fleet of sailplanes does. After listening to the sad saga of my five-hour attempts, he waved toward a range of crumpled hills in the distance.

"Go up there and soar the updraft along the ridge," he said. "You'll have your five hours by the time you come back."

Eight Planes Crowd One Updraft

Soon, in a 1-26, I tested Les Arnold's guarantee. Back and forth on the upwind slope I went, my wing not 50 feet from the hillside to catch the strongest up-currents. Nervously, at first, I watched trees and fences flash by my vulnerable wing tip, but the responsive bird soon showed me that I could stay out of trouble.

Two hours to go. Another sailplane drifted over to work the ridge. Another, then another. By the fourth hour, eight sailplanes were playing follow the leader on that ridge!

It took some getting used to, this lively game. But soon I was smiling and waving to my new neighbors.

Our pattern was a tilted figure eight. Each ship would climb steadily as it swept along the hills, then circle outward at the end of the ridge and head back. A few hundred feet of altitude would be lost in the turn—so each plane went back to the lift on the lower slope to repeat the process (painting, page 62).

Five hours and ten minutes! I bounded out of the 1-26 and raced to the office to locate a Silver Badge application form.

And now, as I soar over the Virginia countryside, there is a Silver Badge pin on my jacket. My companion, the hawk, has left the Leesburg sky to me. But I am content to be alone.

The sky is blue above, and as I look up through the canopy, fragments of a dimly remembered poem drift through my mind. It was written by another pilot, the late John G. Magee, Jr., who also loved the sky:

*Oh! I have slipped the surly bonds of Earth . . .
Put out my hand, and touched the face of God.*

GAGGLE OF GLIDERS sweeps over the Pacific shore near Torrey Pines. The grace and challenge of soaring draw ever-growing numbers of enthusiasts, who develop the skill and intuition to sail the ocean of air.

PHOTOGRAPH BY JACK FIELDS © N.E.S.



THE END





Searing dunes, soaring pinnacles, sweeping surf—nature's many moods stood revealed before the authors during their survey by plane, boat, automobile, and train of five South American nations. Near Pisco, Peru, a young rider and his dog track the wind-patterned coastal desert. Glaciated peaks of the Paine Range tower 8,760 feet over Torres del Paine National Park in southern Chile. Across the continent, a solitary bather slips into the surf at Rio de Janeiro's Ipanema Beach. The authors found a quickening interest in preserving both the continent's human resources and its natural treasures.

HOW SOUTH AMERICA
GUARDS HER GREEN LEGACY

Parks, Plans, and People

By MARY and LAURANCE ROCKEFELLER

*Illustrations by National Geographic
photographer GEORGE F. MOBLEY*



EDDACHRONES BY GREGG F. MORLEY AND WILLIAM ALBERT ALLARD (ARROW) © N.A.S.

ANY YOUNGSTER who has ever read *Robinson Crusoe* might envy my friends Luis and Raúl. These two lads, aged 10 and 14, live on the same romantic South American island where the original Crusoe was marooned some two and a half centuries ago. The whole island is a Chilean national park, and my young friends have free run of it.

I met the boys on a mountain trail. They cut a hiking staff to help me through the ferns and aromatic myrtles, then volunteered to be my guides. Together we climbed the same slope where signal fires were lighted by Alexander Selkirk, the castaway who inspired Daniel Defoe's adventure story. We shared some suntan lotion, some halting conversation, and a classic view of the Pacific.

While we watched, a white Norwegian

cruise ship slid into the bay and cut a lazy arc.

"Our first this year," explained Luis.

"But they never stop," added Raúl. After all, this island has no hotel, restaurant, or even a place to buy curios. We ourselves had flown here on a plane that usually carries lobsters to the mainland.

As the white ship moved away, I thought about the opportunities everyone had missed: fun for the passengers, income for the islanders. But in that ship's frothy wake, I also glimpsed the opportunities that may open for Luis and Raúl when they are men. In a way, that was a purpose of our South American trip: to take a conservationist's view of things as they are—and as they might become. My wife Mary concentrated on human conservation—visiting YWCAs to see how each group



meets the needs of young women, and how members grow in leadership and learn to improve their own communities.

We were making our first visit to five of the coastal countries south of the Equator: Chile, Argentina, Uruguay, Brazil, and Peru. Our interest had been whetted by thirty years of conservation activity in spots as diverse as Wyoming and the Congo. For years, friends and relatives had urged us to see the southern part of the Western Hemisphere.

New Awareness of Conservation Needs

This seemed an opportune time. Since the formation of the Latin American Committee on National Parks in 1964, the concept of conservation has perhaps grown more dramatically here than in any other part of the world.

During the past four years, Uruguay has started a true national-park system for the first time, and Peru is actively at work on a similar program. Throughout the region, conservation budgets are increasing. Scholars are making studies of soil and water resources and organizing nature conservancies. New wildlife refuges are being set aside from Amazonia to Tierra del Fuego. And all five nations are rewriting laws for forestry and other natural resources.

For my own part, I hoped to gather impressions on how we in the United States can better preserve our heritage of nature and its beauty—and enjoy it in such ways as to enhance our lives physically, culturally, and spiritually.

Mary serves as Chairman of the International Division of the Young Women's Christian Association of the United States, so her visits to YWCA organizations along our way

would help YW's around the world to understand our neighbors better.* Thus our travel routes took us into the hearts of great cities and to the most remote rural scenery.

By day, while Mary saw YWCA projects in hospitals, slums, and schools, I followed a green-space itinerary in city parks and nature preserves. We reunited for trips to national parks, monuments, and scenic areas. Doing all this, we covered 22,000 miles—12,000 within South America—by plane, boat, train, motorcar, and pickup truck (map, page 81).

Fortunately we had help. Mary's sister and brother-in-law, Elizabeth and Ethan Allen Hitchcock, joined us, as did two friends from the National Geographic Society, photographer George Mobley and Bart McDowell of the Senior Editorial Staff.

Our itineraries merged and diverged, providing a variety of views. South America is a continent of incredible extremes and superlatives. On its Pacific Coast, it has the world's driest desert. The Andes, the world's longest mountain range, support the world's highest towns. Great, green Amazonia is the world's largest jungle—half again larger than Africa's rain forest. But we must not think of South America as totally tropical; the continent's tip curves closer to Antarctica—only 600 miles away—than any other inhabited land.

Packing sweaters as well as swim trunks, we observed a bit of each environment. We also took with us what African travelers call "a safari spirit"—a wonderful expression that lets you enjoy doing without things you don't have. And for only minor inconveniences

*See "YWCA: International Success Story," by Mary French Rockefeller, *GEOGRAPHIC*, December, 1963.



ESKACHRONES BY GEORGE F. WISLEY © NATIONAL GEOGRAPHIC SOCIETY

Robinson Crusoe Island, now a Chilean national park, rises from the sea 400 miles west of Chile's coast. Early in the 18th century it sheltered marooned seaman Alexander Selkirk, whose adventures inspired Daniel Defoe's classic. The island lacks visitor facilities, but soon lodgings will welcome tourists who come to explore Selkirk's cave and 3,002-foot El Yunque—the Anvil—here climbed by the author's party (right). An end to the island's isolation will bring a brighter future to its 500 inhabitants, including the tousled blonde below.



we were rewarded with spectacular scenery and uncounted personal discoveries.

Our trip began with a jet flight to Santiago, Chile, where we laid plans to visit Robinson Crusoe Island in the Juan Fernández group, 400 miles out in the Pacific Ocean.

"Weather is our problem," explained Gen. Roberto Parragué. "The island is too hilly for a landing strip, so we use an amphibious plane on Cumberland Bay—a tricky harbor. Sometimes we wait weeks for good luck."

And when could we get a reliable weather prediction?

"Never," said the general. "Be at the airport by 5:30 a.m. If the sea is calm, we try."

General Parragué inspires confidence. A retired Chilean Air Force flyer, he pioneered a new route to Easter Island and Tahiti for the Chilean National Air Line. His 1945 PBV carries many of the 120,000 spiny lobsters exported annually from the Juan Fernández Islands. ("When they go by boat, male lobsters fight—and 10 percent are killed. By plane, the altitude makes them sleep.") So we reserved his lobster plane for the next morning.

Early Starts Become "Expeditions"

George, Bart, and I awoke at 4:30 for the airport run, feeling sleepy, hungry, and heroic. But we bolstered our safari spirit with a rule for the whole trip: Whenever we rose before 6 a.m., we would call ourselves a National Geographic Expedition.

"Good news!" shouted the general. "So far the sea is calm."

We climbed aboard the venerable Catalina flying boat for a journey just long enough for us to dig into books we had brought.

"September 30, 1659. I, poor miserable Robinson Crusoe, being shipwrecked during a dreadful storm in the offing, came on shore on this dismal unfortunate island, which I called 'the Island of Despair' . . ."

So wrote Defoe, basing his book on the experiences of Alexander Selkirk, the Scot who was stranded here from 1704 until his rescue in 1709. The gifted writer also borrowed tales from various shipwrecks and changed the locale to a Caribbean spot. Eventually, fiction won still another triumph over fact. By a 1966

decree, the landward island was officially named Isla Robinson Crusoe; Selkirk is honored by the name of the farther isle, 100 miles west—land he probably never visited.

As we flew westward over open ocean, I turned to Richard Henry Dana's travel epic, *Two Years Before the Mast*. To Dana, who came here on the 180-ton sailing brig *Pilgrim* in 1834, this island was "the most romantic spot of earth that my eyes had ever seen." But, of course, this was young Dana's first port in 103 days. Sighting the isle for the first time, he found it "so high and so blue . . . that I mistook it for a cloud . . ."

The general interrupted my reading. "Come forward—we can see it now!" he shouted.

I climbed to the cockpit, looked over the copilot's shoulders, and saw Dana's own blue cloud, Robinson Crusoe Island.

Park Encompasses an Entire Island

The abruptness was unbelievable. Without beaches or slopes of any sort, the island stands like a fortress tower 3,000 feet high. We approached swiftly, then looped around bare, pink cliffs and over vegetation of an extraordinary green. We rounded a point where lobster boats bobbed on the tide, then noisily skimmed Cumberland Bay for a landing near the only village, San Juan Bautista. Most of the 500 residents were waiting on the pier.

"We don't have any cars here," said the island's governor, Fernando Rojas Gallardo. "I can offer you only one horse, and he is dangerous." We did our sightseeing on foot, strolling among brightly painted houses, clambering over the rocky ruins of a Spanish fort, and—with young Luis and Raúl—scaling El Yunque, the steep 3,002-foot peak.

Since 1935 the whole island has been officially a national park. And in a way, Isla Robinson Crusoe illustrates the challenge faced by Chilean conservationists. The island had never had a park ranger or even a park budget. Private exploitation was never questioned—commercial fishing, grazing, hunting, and cutting of trees. Thus a local species of sandalwood—*Santalum fernandezianum*, found nowhere else on earth—has become extinct.

Another indigenous species—the chonta, or

Baby vicuña, only minutes old but full of spunk, gets a lift to its mother's side on the Cala Cala vicuña ranch in Peru. The still-damp fleece will thicken into fine wool prized for expensive coats. Hunters have decimated the once-abundant herds of the high Andes, but now Peru, Bolivia, Argentina, and Chile seek to protect the vicuña and its relative the guanaco, the only wild members of the camel family left in the New World.



"hard-wood," palm (*Juania australis*)—is severely threatened; only 1,000 survive here. I could understand the temptation to cut them when I studied the chonta wood—starkly striped with grain of black and white. Laws now protect the wild chonta palms, and the Chilean Government has recently provided funds for two men to supervise the park.

Officially, Chile has 18 other parks. One is Fray Jorge National Park, 310 miles north of Santiago—a desert-girt forest of great botanical interest and well worth any nation's pride.

"But others are 'parks' only on paper," a leading biologist told us. "We need to stake out realistic park boundaries, rewrite our laws, and enforce them."

I come from the nation that exterminated the passenger pigeon and almost killed off the buffalo, so I hesitate to offer advice. Every nation, of course, must work out its own pattern for conservation. The Japanese have

devised multiple uses for their limited land. The Swiss provide field laboratories in the Alps for scientific research. Africans emphasize game reserves. We North and South Americans, blessed with vast areas, go in strongly for wilderness and scenery.

Whatever the style, most countries find that, indirectly, parks more than pay for themselves. Kenya is a case in point: Tourists attracted by the lions and elephants leave about \$25,000,000 there each year; annual park maintenance costs only \$420,000.

Furthermore, some analysts tell us that tourism is the world's fastest growing industry. We have less than a decade to prepare airports, hotels, and other facilities for the era of supersonic jet airliners in the 1970's.

To take advantage of such trends, the governor of Robinson Crusoe Island wants to start with a hotel and improved transportation. Other thoughtful Chileans hope to work



Partners in conservation, Mr. and Mrs. Rockefeller, left, depart from Ushuaia, Argentina, the world's southernmost settlement large enough to be called a city. With them ride Mrs. Rockefeller's sister and brother-in-law, Elizabeth and Ethan Allen Hitchcock.

As Chairman of the International Division of the Young Women's Christian Association of the United States, Mrs. Rockefeller found YW members "helping people of great need, with joy and real friendliness." Her husband, a world authority on protecting natural resources, was impressed by South America's expanding commitment to conservation.

Laurance S. Rockefeller served as Chairman of President Dwight D. Eisenhower's Outdoor Recreation Resources Review Commission. Currently he heads President Lyndon B. Johnson's Citizens Advisory Committee on Recreation and Natural Beauty and is Chairman of the New York State Council of Parks. Since 1957 Mr. Rockefeller has been a Trustee of the National Geographic Society.

AMAZON BASIN (AMAZONIA)

12,000 miles through
SOUTH AMERICA



Highway from
Brasília to Belém
1,370 miles

- AUTHORS' ROUTE**
- BY AIR ———
 - BY ROAD - - - - -
 - BY RAILROAD + + + + +
 - FOREST [Green box]
 - FARMLAND AND PRAIRIE [Light green box]
 - DESERT AND WASTELAND [Orange box]

FINISH

START

ENLARGED ABOVE

CENTRAL AREA OF LAKE DISTRICT ENLARGED AT RIGHT

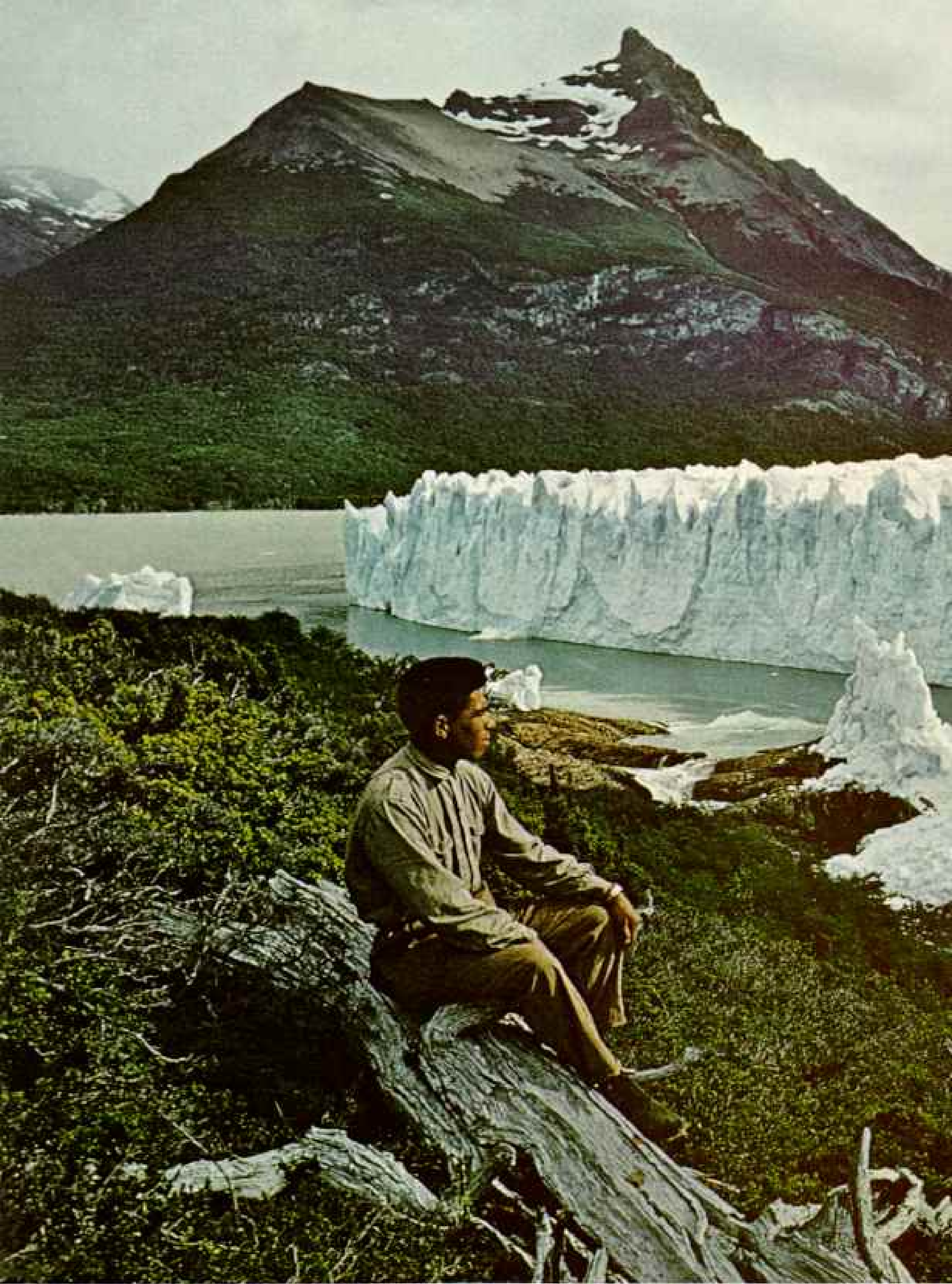
Pacific Ocean

Atlantic Ocean

Atlantic Ocean

Pacific Ocean

ENLARGED AT RIGHT



Titanic struggle at world's end: Two years ago Moreno Glacier's 200-foot-high wall of ice plugged the channel draining Lago Rico, left, into Lago Argentino in Argentina's Los Glaciares National Park. Slowly Lago Rico rose—20 feet, 40, 80. Suddenly, in March, 1966, it popped its glacial cork and spilled like a tidal wave into Lago Argentino, flood-



STOCKHOLM © H.S.P.

ing lakeside ranches. Stoic Patagonian, above, witnesses the torrent a week before lake levels drew even. Two months later, the relentless glacier closed the channel once more, setting the stage for another cataclysmic drama. Drawn to the spectacle in a steady trickle, summer visitors pitch tents at a wooded campsite nearby.

out a balance here and elsewhere between nature and man's enjoyment of it.

On our return to Santiago, our parties compared notes. Ethan Hitchcock had concentrated on the capital city and its 2,270,000 people. "The green space comes in all shapes and sizes," he said, pointing out antique rectangular plazas, new serpentine walkways along the Mapocho River, "and even perpendicular parks"—Santa Lucía Hill, a 230-foot cone rising from downtown Santiago like a forested skyscraper, and 1,200-foot San Cristóbal north of town. "But one thing I miss here," he added. "The city has fewer old churches than I expected."

"Because of earthquakes," said Mary. She and Elizabeth had learned some seismic lessons that day at the port of Valparaíso, 90 miles west. "The YWCA building was badly damaged in the quake of 1965," Mary added.

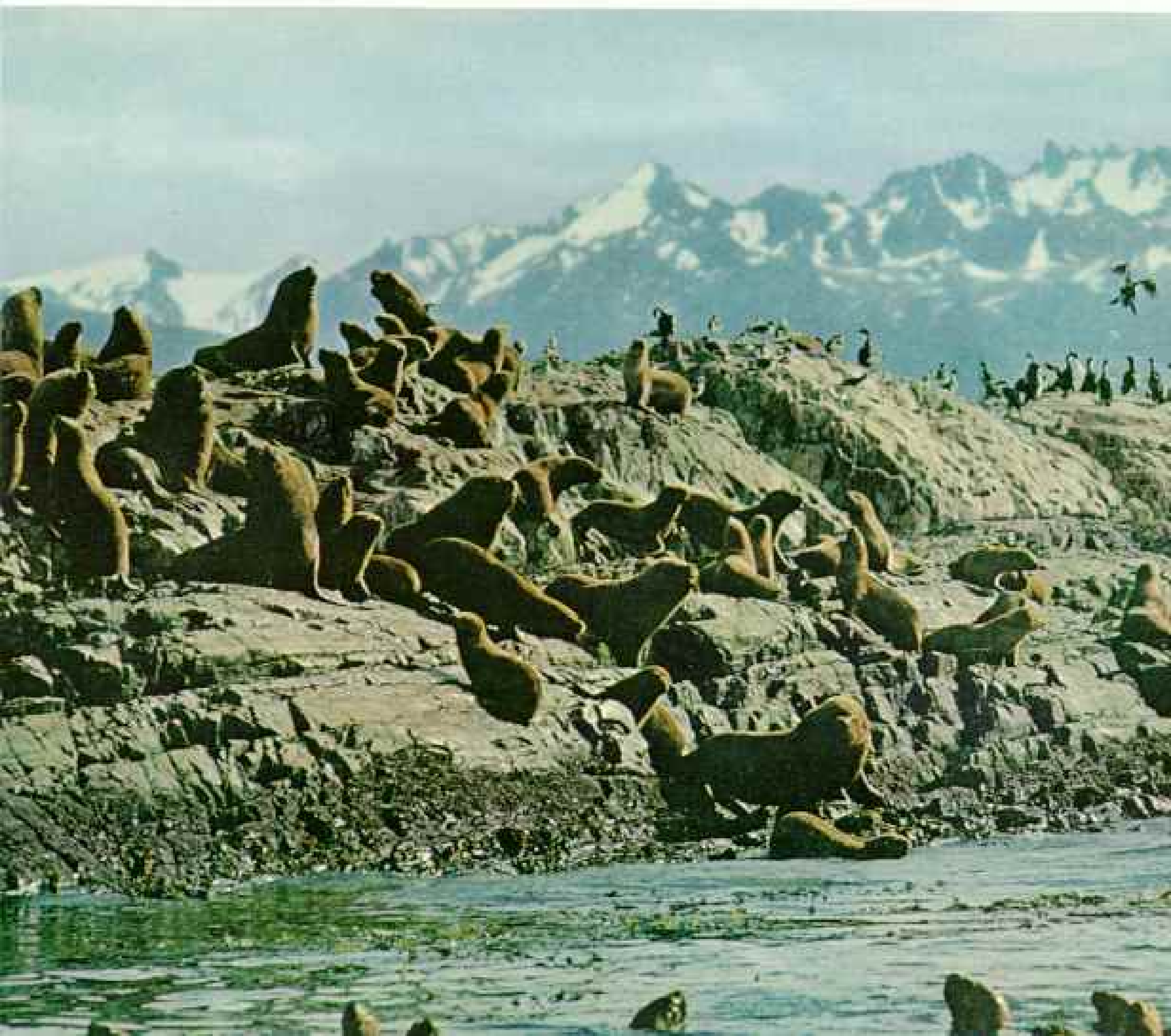
Yet from this very headquarters, the 84 YWCA had launched ambitious projects of

human conservation. The YW sponsored a U.S. Peace Corps project to help teach children and adults—and to meet other community needs. "And we have some green space of our own—National Camp Olmué near Viña del Mar," said Mary. "This was the first day at camp for a group of crippled Santiago and Valparaíso children, whom we saw start on the first treasure hunt they ever had."

Botanist Names His Girls for Grasses

Ethan and I hunted scenic treasures in the same area next day with Dr. Carlos Muñoz Pizarro, of the National Museum of Natural History. The eminent Dr. Muñoz is so devoted a botanist that he christened his three daughters with the Latin names for grasses: Mélica, Nassella, and Aira. "We name girls for flowers—Rose, Lily, Violet," he says logically, "so why not grasses?"

With Dr. Muñoz we drove around the port area of Valparaíso and coastal cliffs of the



thickly settled resort of Viña del Mar. Then we headed inland to inspect a majestic palm forest at Ocoa, a site proposed for park status because of the dramatic appearance of the rare palms in a setting of rugged beauty.

"You should see this grove in the snow!" said Dr. Muñoz. "Few palms in the world live in such a cool climate as these *palmas de coquitos*—'palms of little coconuts.' Some may be 500 years old. Of course, we can't be sure; palms don't have growth rings."

Yet, as ever, a forest's greatest threat is man unrestrained. Exploiters have cut this palm to make a syrup from its sap, and whole forests have vanished.

"We are now preparing a new forest law," said Dr. Muñoz. "And it should help our forest problems. After all, timber is one of our major industries, and forests cover 26 percent of Chile's land surface."

Dr. Muñoz showed us a remarkably varied countryside. But the view I remember best

lay along an unpretentious country road deeply shaded by sycamores. An irrigation ditch flowed beside the trees, and beyond it stretched an emerald pasture. The whole scene gave such a fine and forthright feel of pastoral life that we stopped to enjoy it.

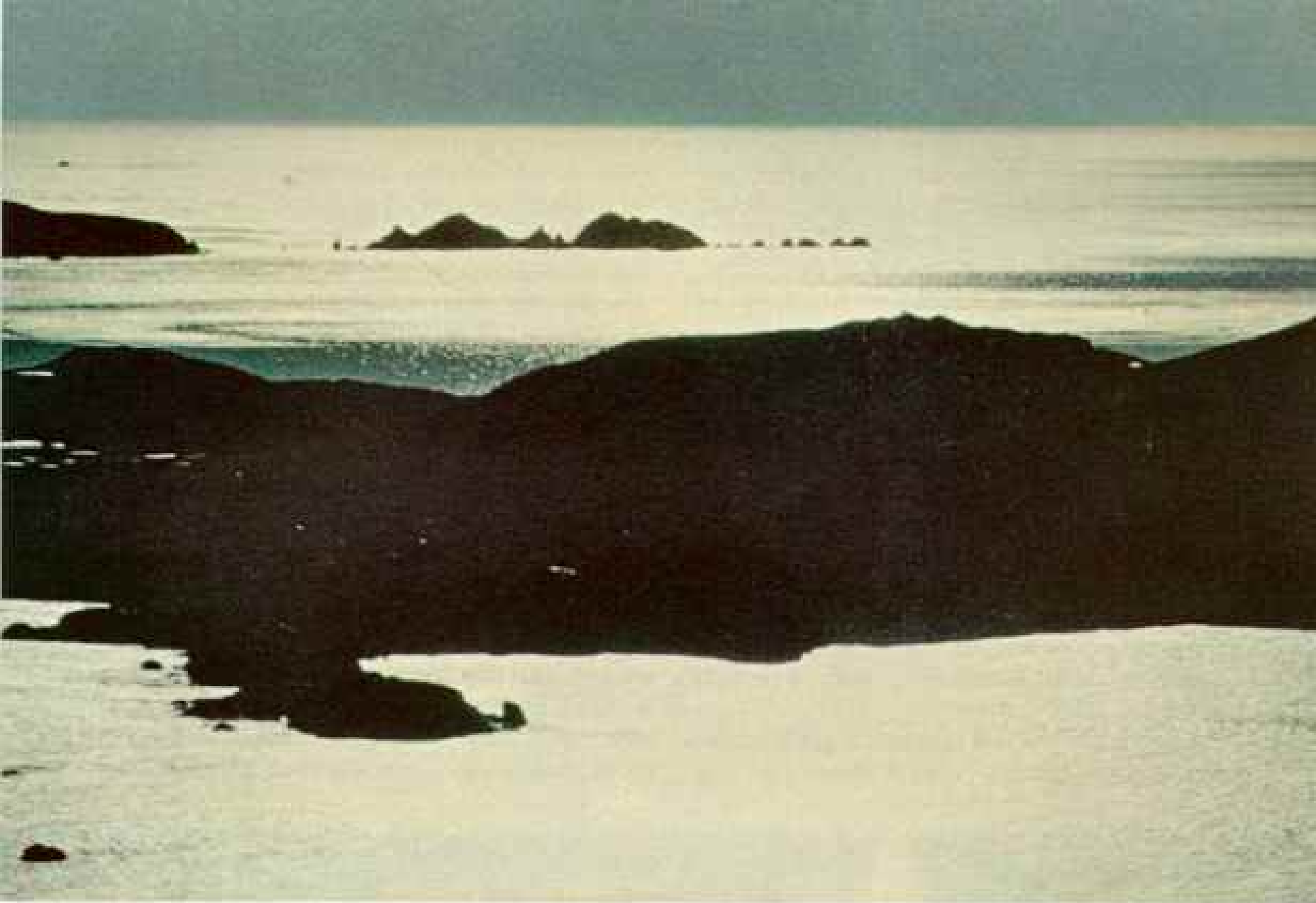
A little girl led a cow past us, headed home for milking. A wagon rattled by. Then two *huasos*, those famous cowboys of Chile, trotted up, greeted us, and let us examine their saddles, padded thick as mattresses with woolly sheepskins. They finally rode off to rope a colt in the neighboring field. We would see grander views in this nation of great scenery, but none with greater charm.

Next morning, in fact, we sampled the grandest of that scenery. We left Santiago, temporarily, flying south toward Chile's bitter end. Our trip that day covered 2,000 miles within Chile—a reminder that, although narrow, it is still larger than any European country west of Russia. As we watched, archipelagic



"We sailed amongst many unknown desolate islands," wrote Charles Darwin as he threaded Tierra del Fuego's Beagle Channel, named for his ship. More than a century later the authors retraced the English naturalist's wake. Cormorants and splashing sea lions on Seal Island (left)—a sight that must also have delighted Darwin—gave them "an intimate view of nature, remarkably close and detailed."

Magellanic penguins peer from a dead-end ledge. Nesting by the thousands on Isla Magdalena in the Strait of Magellan, these flightless birds honeycomb the rocky soil with shallow burrows.



Chile unfolded, a wild pattern of isles and fiords, trees, water, and white peaks.*

"That glacier," our pilot said, pointing to a bristling mass of bluish ice, "the San Rafael, has moved as much as 13 inches a day."

Inland, we could see the serrated profile of the Paine Mountains, a curious geological sandwich of white granite wedged between layers of gray shale—and an extraordinary national park (pages 74-5). Gradually the mountains abated, islands flattened, and we came down for a landing at Punta Arenas.

Beyond the airport stretched a wide body of indigo water. "We saw an opening like unto a bay," wrote Ferdinand Magellan's pilot Alvaro on October 21, 1520, when the expedition first sighted this passage. One can only admire Magellan's courage—of his five ships, one foundered and the crew of another deserted. But he ordered the rest on, "even if we have to eat the leather" on the ships' yards. They made the 360-mile passage in 38 days. Though his men did live to eat the leather of the rigging, Magellan was speared to death in a Philippine Island battle 13 years before any chart bore the name Strait of Magellan.

"The water here is still dangerous," said Nádice Skarmeta, the attractive travel agent

who met our plane. "If a man falls overboard in winter, he can survive the cold for only seven minutes." No wonder Isla Magdalena, lying long and brown on the horizon, is a popular sanctuary for penguins (preceding page).

Mary and Elizabeth took a special interest in these waters. Their grandfather Fred Billings had sailed through the strait in the mid-19th century on his way to California.

"Grandfather was fond of fresh milk," Mary recalled, "so he took a cow on the ship."

Prize Sheep Wear Canvas Coats

Our destination lay on the Argentine portion of Isla Grande de Tierra del Fuego, where the 3,000-foot-high mountains cast a rain shadow and men raise sheep on a dry, treeless prairie. We stayed, in fact, on a sheep ranch, the Estancia Maria Behety.

Big and busy, the estancia is an honest working ranch. The main house—a sprawling one-story structure with a bright blue roof—has grown, wing by wing, to fit the needs of a growing family. The flower garden—as marvelous a mixture as a grandmother's bouquet—stands behind a 15-foot-high wooden fence for protection against the prevailing high winds.

During our stay we even learned a bit about local ranching: That ranchers here use

*Kip Ross described "Chile, the Long and Narrow Land," in *NATIONAL GEOGRAPHIC*, February, 1960.



NOVEMBER BY GEORGE F. WOODLEY © N.E.S., THE EVERETT SUN (BELOW)

an acre of land to support one sheep, that the animals are sheared only once a year, and that the larger estancias keep from 40,000 to 60,000 sheep. During storms the herds must be protected.

"We can put 7,000 head inside our largest shearing shed," said our hostess, Señora Marucha de Menéndez Behety. And, indeed, this shed ranks among the largest in the world.

Here prize Corriedales wear canvas robes and hoods to protect their wool—to me, something new in sheep's clothing. We watched shepherds and dogs expertly work the herds.

Elizabeth Hitchcock was the first to notice "that strange animal cavorting in the pen near the house." This was Nena, a pet guanaco—that wild camel-cousin of the domestic llama and alpaca—and a shameless show-off.

"Be careful," warned Marucha. "If she doesn't like you, she'll spit." But Nena merely nibbled at our cameras, then at our hands, and finally romped away.

"Guanacos used to be plentiful here," Oliver Bridges told us as we drove south in his pickup truck. "Indians used to hunt them with dogs."

Mr. Bridges knows Tierra del Fuego as do few other men. His grandfather Thomas Bridges came here from England as a missionary in 1871. He lived among the Yahgan Indians, compiled a highly regarded dictionary

Grim nether tip of the Americas, Cape Horn raises its granite bulk 1,390 feet above the sea in an extraordinary view of the usually cloud-covered promontory. Mountainous seas and howling gales claimed a cruel toll here when sailing ships clawed their way between oceans. Alan Villiers captained the *Joseph Conrad* (below) on the perilous voyage only three decades ago.





ERIC NEW J. LUTTK. © N.Y.C.

Romping children make a picture for Mrs. Rockefeller at a new YWCA center in Valparaíso, Chile. The building, loaned by the government, bears the familiar YW emblem with the initials ACF, for Asociación Cristiana Femenina.

Dazzling Aladdin (right) in Rio de Janeiro takes center stage at a YW benefit featuring costumes from the city's carnival.

JOSE C. B. SILVA



Kiss and a bouquet greet Mrs. Rockefeller at Embu-Guaçu, a suburb of São Paulo, Brazil. "Being international opens our hearts," a Paulistana member told her visitors.

Under a bridge of arms, children put on a YW-sponsored *carnavalito* in Martínez, near Buenos Aires; thus the YW reaches out from the cities.



ERIC NEW J. LUTTK.



Adventure of the heart

"EVERYWHERE WE VISITED, from swarming slums to rural crossroads, we found dedicated women dealing with great problems of education and health—and doing so with wonderful spirit." Thus Mary French Rockefeller reported on her journey to Young Women's Christian Associations in Argentina, Chile, Uruguay, and Brazil. As a YWCA official, she found her journey to South America especially gratifying; there, in the past six years, 16 new associations have joined 10 older ones under the YW banner.

In Valparaíso, Chile, Mrs. Rockefeller met members teaching sewing, knitting, and ceramics under ceilings cracked by a recent earthquake. In San Carlos de Bariloche, Argentina, volunteers of a year-old YW run the children's room of the only hospital in Patagonia. YW members in Uruguay's capital, Montevideo, operate a nursery school and children's summer camp. A suburb of São Paulo, Brazil, has proudly proclaimed a roadway "YWCA Street." Everywhere Mrs. Rockefeller found members combating illiteracy, giving vocational training, helping the handicapped, encouraging women to take leading roles in community life. "The magnificent scenery we passed through was inspiring," she said, "but the sympathetic dedication of YWCA members to their work was even more so."

Office in her car trunk, Mrs. Léa Araujo de Pina guides a new YW in Brasília. Mrs. Marly de Barros and Mrs. Rockefeller, at right, inspect her plans.



GEORGE F. HOOLEY



GEORGE F. MOBLEY © N.A.A.P.
JENNIFER L. VOTTA



Uruguay's oldest YW member, right, still spry in her 90's, greets Mrs. Rockefeller and Mrs. Hitchcock (left) in Montevideo.

Dreams on paper engross Mrs. Rockefeller and sponsors of the San Carlos de Bariloche YW.



GEORGE F. MOBLEY

of their language, and became the first permanent settler in Ushuaia, "the world's southernmost city." Our road led us there.

For years Ushuaia (population 3,900) has vied with Chile's Puerto Williams (population 350), eight miles farther south. Argentinians concede Puerto Williams the title "southernmost town." Be it town or city, Ushuaia has the unfinished look of a new Alaskan community. Behind it rise white mountains. Its freighters sail the Beagle Channel, named for the British survey brig that carried young Charles Darwin on his voyage in the 1830's.

With a touch of prophecy, Darwin wrote of the "parklike scenery" of "peculiar and very magnificent character." At the doorstep of modern Ushuaia ("what a remote corner of the world"), he saw "several huge whales spouting in different directions."

Vistas Resemble Maine and Wyoming

Instead of whales we saw sea lions. Bundling ourselves aboard an Argentine Park Service launch, we cruised the channel to a rock called Seal Island (page 84). A thunderhead of cormorants screamed overhead as we watched two dark-brown bulls lift their heads and roar a warning to their harems. It was a noble scene: Women and children first, the sea lions splashed into the water.

Our launch moved up the narrowing Bahia Lapataia, along a forested shore that brought to mind a cove in Maine. We stepped ashore at Tierra del Fuego National Park, most southerly of Argentina's 12 parks and the only one touching salt water. Before us loomed the Hotel Alakush, a handsomely rustic structure of fieldstone, timber, and glass. Beyond stretched forest-rimmed Lake Roca and a view that reminded us of Jackson Hole in Wyoming. Local Park Director Jorge Reynoso pointed out some of the features in the 130,000-acre domain: trails, campsites, an old Yahgan Indian settlement.

Most of all, we enjoyed the sweep of the false-beech forest—a reminder of the days when Antarctica and this land shared the same flora.

At the lakeshore we paused to watch the long-necked great grebes. The setting was idyllic. But at this moment, we came upon a soldier's foxhole. We counted 40 such holes, relics of Argentine Marine maneuvers and a recent border dispute with Chile, two miles away.

Conservationists on both sides of the frontier deplore such incidents. Both nations have much to gain by joint promotion of Tierra del Fuego and its wild geography. Besides, as one Argentine conservationist put it, "Foxholes encourage erosion."

For days George Mobley had been talking about the picture he hoped to make of Cape Horn. "Any photograph of the cape is rare," he said, "and I've never seen a good one."

The reason, of course, is the notorious Cape Horn



REPRODUCED BY ALBERTO SCHYFFER R. ARDÓN, E. JACK MILLER (CENTER), AND GEORGE F. HUBLEY © N. A.

Fuji of South America, Osorno Volcano lifts its perfect cone above the azure mirror of Lago Todos los Santos—Lake of All the Saints. An excursion steamer plies this gem of Chile's Lake District, an alpine realm of groaning glaciers and chaletlike resorts, many built by Swiss settlers. The vacationland lies at the southern terminus of the Pan American Highway.



Carillons of fragile *copihue*, Chile's national flower, grow wild on tangled vines along Lake District shores.

Latin amigo of Smokey Bear, Don Puma spells out his message: "The forests are the future of Chile. DO NOT DESTROY THEM!" Valuable expanses of false beech, tree laurel, conifers, and eucalyptus plantings, covering two-thirds of the productive land, give Chileans good reason to protect their timber.

weather. Young Charles Darwin saw sea spray hurled 200 feet high. "One sight... is enough to make a landsman dream for a week about shipwrecks, peril, and death," he wrote.

Naturally, we wanted pictures. With considerable optimism, we chartered two Cessnas to stand by for good weather. But on our first sunny afternoon, pilot Meliton Juan Boehler refused to go.

"We must try early in the morning," he said. Our goal was worth an "expedition." So we rose by starlight, ready for a take-off in the lens-clear dawn.

South America Ends "With Dignity"

"Good," said Boehler. "We now fly to the end of the map." The plane rose over Tierra del Fuego; bare hills grew into glaciated mountains dimpled with cirques. And over the noise of motors, our captain exclaimed, "Isn't this a beautiful earth!"

He was part pilot, part poet. Once he called our attention to Fuegian oil-field flares: "Indian fires gave Magellan the name for Tierra del Fuego, the Land of Fire. History burns before our eyes."

We crossed Beagle Channel, skirted Navarino Island, and saw South America break up into rugged fragments. Remarkably, our weather remained clear.

"Now you see Cape Horn," said our poet-pilot. "A large stone. The South American Continent finishes with dignity."

The granite cape slants gradually out of the water on its northern side to a crest some 1,390 feet high—then it falls away sharply, its cliffy face to the south.

We watched the other plane. George couldn't open a window, but he was determined to get perfect pictures. In some alarm, we saw him open the small cargo door and brace his shoulder against the 140-mile-an-hour blast.

The plane swerved. But George inched out until his head, camera, and both arms were visible. In that position, he took his historic Cape Horn picture (pages 86-7). That night we toasted our expedition's success—in milk, to honor the shipborne Billings cow.

Our weather luck faltered when we returned north to the Chilean Lake District. Rain clouds obscured the top of Mount Osorno, the Fuji-like volcano that dominates this region (opposite). Remarkably, the scenic values here do not dissolve in the 200 inches of annual rain. Recent showers had swelled the Petrohué Falls for added drama.

We crossed Chile amphibiously, by motor launch and motorcar. Ethan, an inveterate sailor, even took to a rowboat briefly when we reached Lake Todos los Santos. Theodore Roosevelt, a lover of wilderness, considered this one of the world's most beautiful regions.

To Elizabeth, the lonely mountainside farms looked Swiss.

"Naturally," said our guide, Irmgard Reichert. "The Swiss were early settlers here—just before the turn of the century."

Once more we crossed into Argentina through the log portals of Nahuel Huapi National Park, oldest preserve in the Argentine system—"and the world's first national park to be donated privately," as Argentinians proudly proclaim.

So it is. In 1903, a farsighted naturalist-explorer named Francisco P. Moreno presented his nation with a staggering gift—a "beautiful piece of Andean land where Mount Tronador joins two nations at its summit." This land—25,000 acres in all—had been given Señor Moreno by the Argentine Government as a reward for his patriotic efforts in settling a border dispute with Chile. By returning the same tract to Argentina as a wilderness preserve, he put his country in the vanguard of the world's national-park movement.

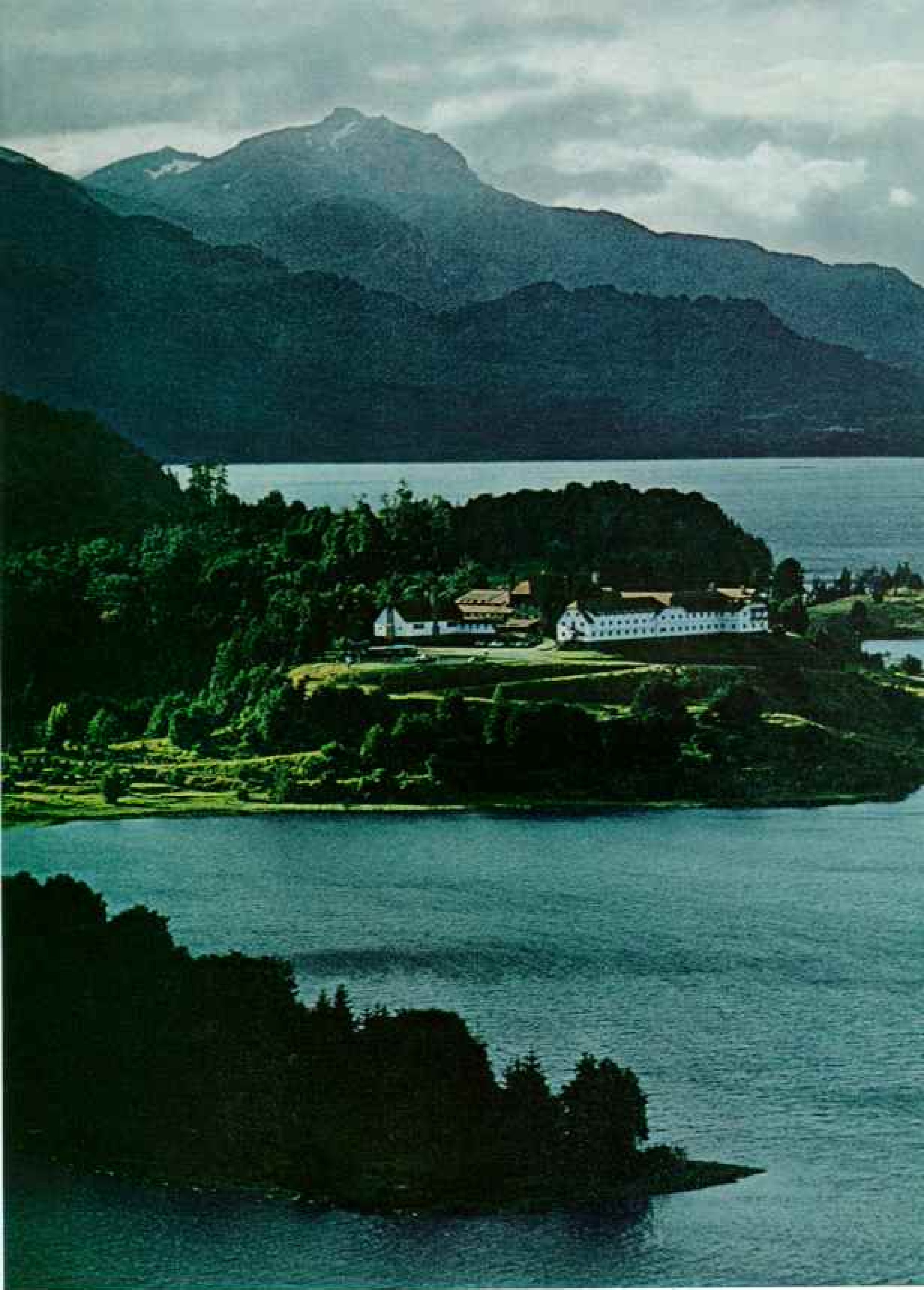
As any visitor can observe, Argentinians patronize their parks and support conservation generally. The Argentine National Park Service even gets 7½ percent of the revenue from the new national lottery.

The forests of Nahuel Huapi are fascinating. Curious orange-barked *arrayán* trees reminded me of the setting for Walt Disney's motion picture *Bambi*. Nearby stands a plantation of California coast redwoods, now grown 30 to 45 feet high since their introduction here some 70 years ago.

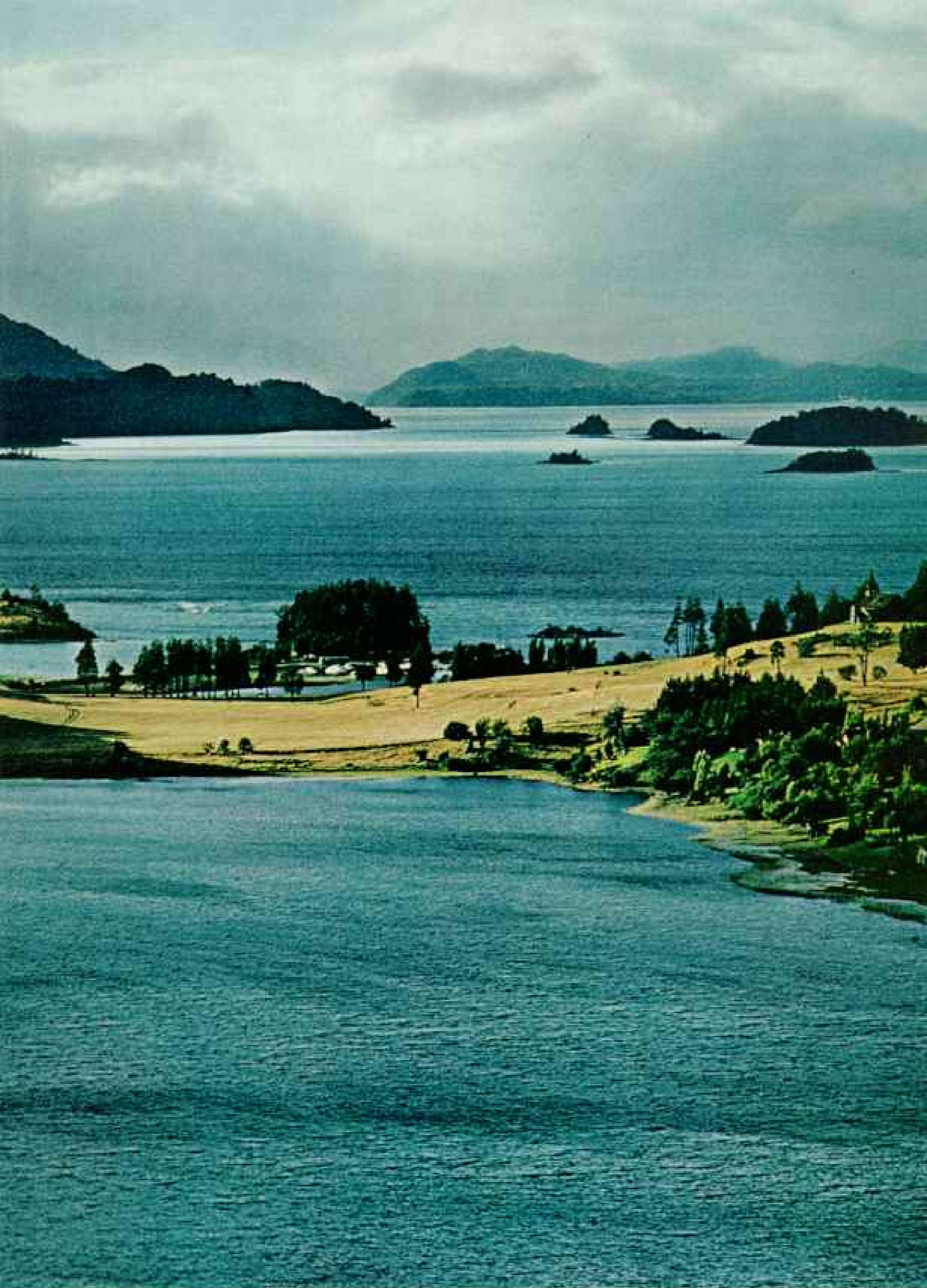
Wary Salmon Shun the Limelight

One afternoon we played golf on the course of the luxurious Hotel Llao Llao. The setting was superb: a green saddle of land on a peninsula in spectacular Lake Nahuel Huapi (following pages). But *tero tero* birds—sturdy, black-and-gray spur-winged plovers—played tag with our caddy's collie and screeched wildly each time I tried to putt. We had more birds than birdies.

We also fished beside Victoria Island—then got an expert demonstration a few miles away. A television crew from the American Broadcasting Company had come to film a sequence on fishing for huge landlocked



World's first privately donated national park, Argentina's Nahuel Huapi protects nearly two million acres of trout-filled lakes, dense forests, and vaulting Andean peaks laced in winter with ski trails. Rambling Hotel Llao Llao (pronounced yow



REPRODUCED BY GEORGE F. WORLEY © N.A.S.

yow) perches on a peninsula thrusting into lake Nahuel Huapi. Granted 25,000 acres by Argentina for settling a border dispute with Chile, naturalist-explorer Francisco P. Moreno dedicated the land in 1903 as the nucleus of today's public park.

salmon. Hip-deep in water stood fly-casting expert Joe Brooks. As cameras whirred Mr. Brooks made an inspired cast. The technique was faultless, but the results were consoling to amateurs: That morning the salmon stayed far away from all the confusion.

In recent years, Nahuel Huapi, with its excellent skiing, has begun to build an international winter tourist season. "A good thing for the community," said Mary. "People here need a year-round industry."

She had seen the results of seasonal unemployment on her rounds of YWCA projects in San Carlos de Bariloche, the adjoining town. The YWCA supervises the children's room at the regional hospital, and members generously give their time to educate mothers in matters of literacy and health.

"The greatest problem is tuberculosis in rural areas," said Mary. Poverty, of course, is a basic cause. A greater income from tourism, winter as well as summer, will help buy better food and health conditions. Thus can sce-

nic beauty help conserve human resources.

From Nahuel Huapi National Park, our schedule called for a northbound flight to Mendoza. So, for lack of any scheduled flight, we ended our rustic stay in the forest with another touch of luxury: a chartered DC-3. The comfort lasted less than one airborne hour. Then our pilot emerged from the cockpit with news of a bad storm ahead.

"Severe winds," he explained, "even ice."

Grapes for Commerce, Parks for Joy

This was flat, dry Patagonia, but along the Rio Negro stretched a checkerboard of irrigated land. It was a curiously formal landscape; towering poplars rimmed rectangular plots of smaller trees. Mary and I consulted our map to find the nearest airport, at Neuquén.

"Well," said the pilot, "Neuquén is famous for apples and peaches—but it isn't listed in our guidebook."

Nevertheless, the green orchards encouraged me. "I'll bet they have wonderful food,"

Squirt of wine marks the Festival of Vendimia as Argentinians gather for the annual blessing of the fruits in the prosperous wine center of Mendoza. Mediterranean vines brought by Italian and Spanish immigrants yield fine grapes in vast hillside vineyards.

RODOLFO © NATIONAL GEOGRAPHIC SOCIETY



Flood of Mendoza grapes cascades into a picker's cart. Sunshine drenches the arid land all but a few days of the year, giving the province in the foothills of the Andes a resemblance to southern California. And like Californians, Mendozans harness streams plunging down from mountain snowfields to irrigate verdant vineyards, truck farms, and orchards.

I told Mary. "Besides, I like places off the beaten path." We landed and found lodging in the 16-room Residential Neuquén.

While Mary unpacked, I registered—names, passport numbers, profession. But something bothered the manager, and I asked Bart what the trouble was.

"Nothing serious," he said. "You listed your profession as self-employed, and the manager was a bit worried about the bill. I explained that you were really a writer for NATIONAL GEOGRAPHIC."

Neuquén's 17,500 people may rarely see an alien tourist, but they need no lessons in hospitality. As we walked about the streets, baggy-trousered gauchos greeted us with sweeping gestures. Our dinner—juicy beef and orchard-fresh fruit—was excellent. Most of all, we marveled at Neuquén's parks; noble eucalyptus trees shaded miles of walkways and streets.

The same green atmosphere prevailed in Mendoza, where we arrived next morning.

"The most tranquil peace reigns in this province, thanks to its good and peaceful inhabitants," wrote Gen. José de San Martín, the "Liberator of the South." His affection for Mendoza was well merited. Here he raised and outfitted his army. And from Mendoza in 1817 he launched his crossing of the Andes to free northern Chile of Spanish rule (page 97).

Though San Martín's landmarks have long been erased by earthquake, the city's good and peaceful inhabitants "cultivate grapes for commerce and parks for their joy," as one Mendozan told us. Great sycamores arch the



KUBACKOWICZ © NATIONAL GEOGRAPHIC SOCIETY

streets where San Martín once rode his prancing horse. The city's most impressive monument crowns Cerro de la Gloria, a hill just out of town. There we saw a dramatic statue made from San Martín's own melted cannons. To build and landscape its base, rock was brought from the mountains he crossed and soil from his great battlefields.

As an old man, San Martín wrote, "... the crossing of the mountains can only be imagined by those who have actually gone through it." We made that crossing by automobile and *autocarril*, a bus that runs on railroad tracks.

With a great rattle we headed west, past neat, well-irrigated vineyards and flares from the local oil fields. Time and again we crossed the wandering Mendoza River, pursuing it



into deep canyons and narrow, sterile defiles.

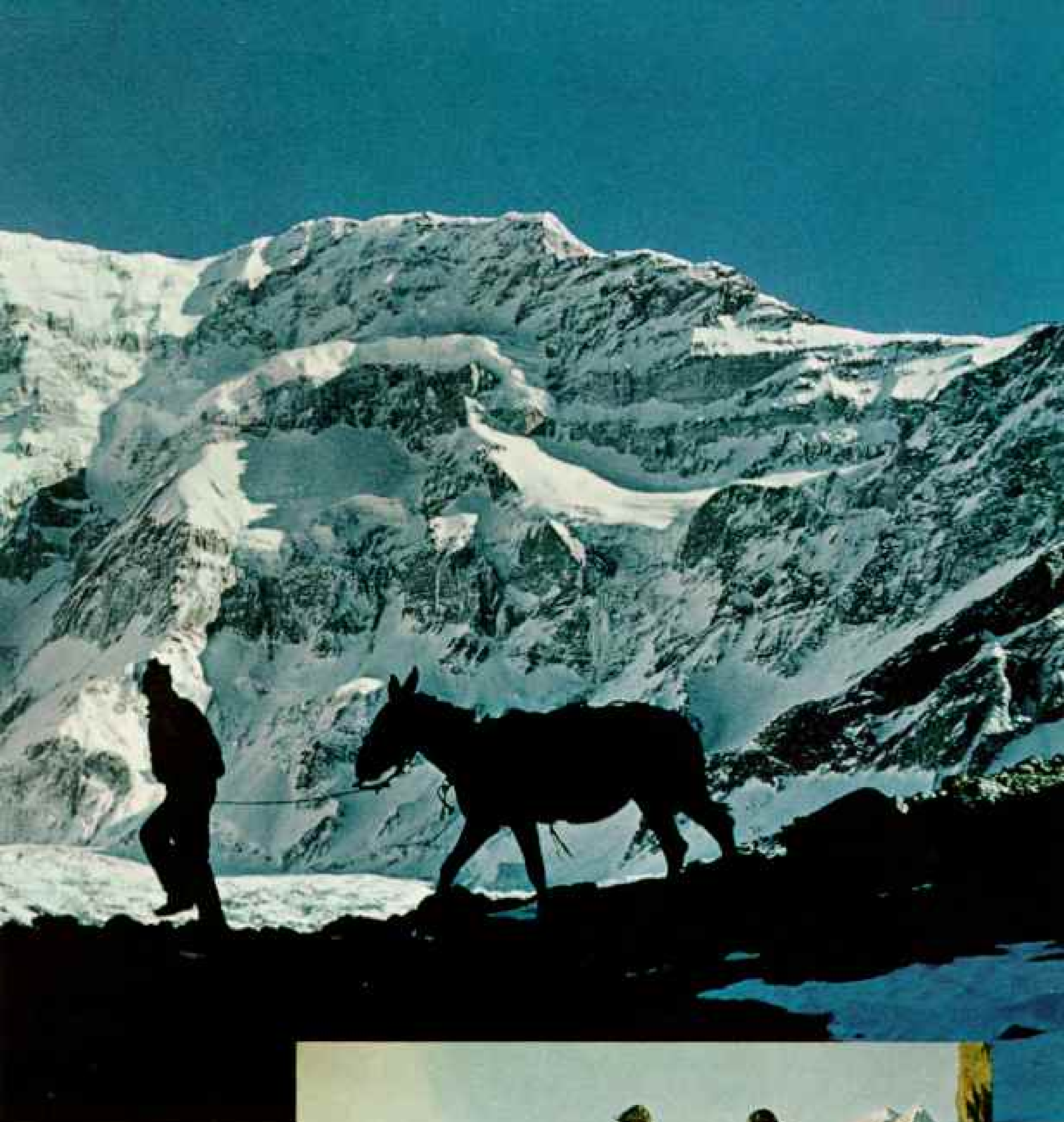
The grassless earth had not changed since San Martín's day, but our route differed as the railroad led us through dark tunnels. We climbed through thinning air to 13,000 feet, and Mary said wanly, "I feel as though we've crossed the continent by covered wagon."

At last we viewed Mount Aconcagua, at 22,834 feet the highest peak in the Western Hemisphere (above). Then we descended to Portillo, Chile—a mere 9,400 feet.

Our daughter Lucy had urged us not to miss Portillo. A skiing enthusiast, she had come here three times; during the Northern Hemisphere's summer, Portillo is the ski capi-

tal of the world. We found engineers and carpenters busily refurbishing more than two miles of lifts for the world ski championships.

Half an hour from the hotel stands a landmark more famous than the skiing: the Christ of the Andes, a statue raised after Chile and Argentina settled their long-standing border dispute at the turn of the century. By sunrise, our expedition found an icy panorama. The sun's first rays strike Aconcagua itself. Gradually, the rosy glow spreads downward until it lights an inscription at the foot of the Christ: "These mountains will fall before the people of Argentina and Chile break the peace sworn at the feet of Christ the Redeemer."



Lord of the Andes, Mount Aconcagua rears its snowy mane to 23,834 feet—highest point in the Western Hemisphere. Argentine troops thread a frozen defile near the one braved 150 years ago by Gen. José de San Martín (right), who led the Army of the Andes on the campaign to liberate northern Chile from Spanish rule. Seven thousand of San Martín's horses and pack mules perished on the torturous crossing.



KODACHROME BY GEORGE F. NORLEY © N. S. S. PAINTING COURTESY OF CLUB MILITAR, SANTIAGO, CHILE





By railroad track and highway, we jolted for nearly two days to follow San Martín across the Andes—a 15-day march for the general. On our way to Buenos Aires we retraced the journey by jet, from Santiago to Mendoza, in just 24 minutes. An hour later, we landed in the Argentine capital. A recent storm had left the airport area half submerged.

"That storm you dodged hit Buenos Aires," Elizabeth told us. "You're just in time to see how quickly the YWCA has come to the aid of the city's flood victims."

Elizabeth and Ethan had come here straight from Bariloche to establish our beachhead. Now Mary and Elizabeth visited YWCA headquarters, where they saw volunteers collecting bags of clothing for the homeless.

The Buenos Aires YWCA, oldest in South America, was founded in 1890 as a hostel for English working girls, then took firm root among local citizens. Today the YW trains volunteers in social work, holds classes in adult education—everything from volley ball to flower arranging—and works actively with children in redevelopment areas. At the suburb of Martínez, YWCA volunteers were working in a recreation center, helping children with schoolwork and arts and crafts.

All of us were charmed by Buenos Aires' people, shops, restaurants, and art galleries. But with all its urban pleasures, Buenos Aires offers much to admirers of country life: more green space, insist its residents, than any other city of similar size. The city, third largest in the Southern Hemisphere after Rio de Janeiro and São Paulo, claims 3,000,000 residents—called *porteños*, or "port people." Our hotel room overlooked the Plaza San Martín, so I can personally testify that *porteños*

Muffling the bustle of Buenos Aires, Palermo Park brings lakes and an elaborate "rose plantation" to the heart of Argentina's vibrant capital and port city. Ardent park users, *porteños* flock to bridle paths, outdoor theater, race track, polo fields, and a golf course in Palermo's 1,100 acres lining the Rio de la Plata.

Buenos Aires claims more open space than any other city—at least 150 parks and public gardens. Nevertheless, massive traffic chokes its streets.

Marble maiden takes a peek as magazine swappers contemplate a deal. Each Sunday morning *porteños* gather at the Parque Rivadavia to exchange books and magazines. Parks also serve as centers for trading dogs and cats, stamps and coins.



KODACHROME (LEFT) AND SATALCHROME BY WINFIELD PARRA © N.Y.S.



enjoy their parks fully, by day and by night.

One flawlessly clear morning we met the then Minister of Agriculture, Walter F. Kugler, for a trip to Pergamino, the famous agriculture experiment station 150 miles northwest of the capital. To get there, we flew over the vast pampas: green as New England and generally as flat as the Texas Panhandle.

"You see no gullies, but still we have erosion," said Minister Kugler. "Over there you see contour plowing—still rare in Argentina. Now we are making our first complete soil map of the whole pampas."

At the experiment station headquarters we took a quick, instructive tour. Eighty-five experts are studying everything from poultry to rural sociology. Yet, concerned as they are with a better future, the agronomists show a healthy respect for the past. They have turned a 19th-century farmhouse into a charming

agricultural museum. We sometimes forget that Argentinians, like North Americans, knew stagecoaches, westbound wagons, and Indian raids. Thanks to farsighted men, these memories of pioneer days will be preserved.

A modern and more comfortable mode of life flourishes a few miles from Pergamino at the 20,000-acre Estancia Arroyo Dulce. When we flew over for lunch, gauchos drove the Aberdeen Angus cattle out of our way so the plane could land in a pasture.

Tenant Farmers Now Own Their Land

The impressive estancia headquarters was beautifully landscaped along an oak-shaded stream. We toured the patios and 14 bedrooms of the main ranch house before sitting down to a feastlike luncheon.

"For all its comforts, the Estancia Arroyo Dulce is a working ranch," Minister Kugler



FOODCROPPERS (INCLUDING FOLLOWING PAGE) BY GEORGE F. ROBERT © N.A.S.

told us. "Large landholdings must be efficient to survive. Ten years ago, two-thirds of the countryfolk in this region were tenant farmers. Today 65 percent own their own land."

In two Cessnas, we crossed the Río de la Plata estuary to the gilt beaches and low coastal pastures of Uruguay. The Río Santa Lucia flexed lazily across the flat, chocolate-colored earth; this was the mineral-rich soil famous for great grasses and fat cattle.

At Montevideo Airport we left Liz and Mary for a day with the YWCA. And here we were joined by Gabriel Caldevilla, first director of Uruguay's reorganized national park system, who guides the expansion of the nation's forest service.

"We now have seven small national parks," Mr. Caldevilla told us as we flew northeast. "Uruguay has a tradition of conservation." He pointed out large areas of reforestation

Fattened on lush pampas grass, beef cattle bunch for a drive; mustachioed gaucho charges after a stray. Large herds of cattle and sheep enrich Uruguay but alarm conservationists by nibbling on tender palm shoots. Uruguayans protect the palms with fences and a national park at Cabo Polonio. Landowners have planted 300,000 acres of trees on previously unproductive land.

Like a hundred Niagaras, Iguazu spreads thundering cataracts along two miles of scalloped cliffs, its sound rolls for 15 miles. A rainbow arches the torrent of Devil's Throat Chasm, boundary between Brazil (foreground) and Argentina. Both nations protect Iguazu with national parks. Laurance Rockefeller, his back to the chasm, talks with Brazilian Natural Resources Director Dr. João Maria Belo Lisboa and amateur ornithologist Johan Dalgas Frisch.





below us; rows of maritime pines near the sandy beaches.

"In proportion to our size," he said, "Uruguay has more area in planted forests than any other South American country—300,000 acres. And every tree was planted privately, with no government subsidy of any kind. Our landowners understand the value of trees both for crops and for prevention of erosion. They also want to improve the appearance of the countryside and its appeal to tourists."

Sea Lions and Palm Trees Share a Park

We were following the 200 miles of beautiful beaches that fringe the Atlantic coast between Montevideo and the Brazilian border. At one point a modest peak punctuated the low, flat land. Mr. Caldevilla shouted above the engine noise: "That's Cerro de las Ánimas—Spirits' Mountain. It's the highest point in Uruguay—1,644 feet. We are reserving about 200 acres for a park there."

We passed the attractive modern hotels of Punta del Este, the resort that has given its name to more than one international agreement. Our destination was Cabo Polonio, where the Uruguayan Government has set aside a 52-square-mile area as a wildlife preserve and park.

"These rocks offshore are a natural habitat for sea lions," Mr. Caldevilla informed us. We swooped low; the luxuriating animals scarcely noticed our plane. "Inland we have a palm forest. But see those cattle? They graze on the new sprouts, so unless we fence the area, there is no second growth."

"What will happen to the people in that fishing village?" I asked.

"They will help us," said the forester. "Today they are poor because fishing is seasonal. We shall teach them to plant pine trees in their off season to earn money year round."

Near the palmy Brazilian border, we flew over a restored Portuguese fortress. "This is Santa Teresa Park," said our host, "a relic from our colonial era." This low-lying land was often a battleground between Portugal and Spain. Fort Santa Teresa reminds us of wars that toughened the Uruguayans into a fiercely independent people.

Mary and Elizabeth rejoined us at the

Montevideo Airport. "You saw more of the country, but we saw more Uruguayans," they told us. Almost half the 2,500,000 Uruguayans live in the capital, and Montevideo claims the largest YWCA membership—1,500—of any city in South America. Along with local YW projects, members here can keep an international outlook through Organismo Técnico, the coordinating agency for Latin American YW workers.

We entered Brazil via a splendid southern exposure and one of the world's great spectacles: Iguazu National Park.

As our plane circled, we could see three countries (Argentina, Paraguay, and Brazil), two great rivers (the Paraná and Iguazu), and a color scheme of scarlet earth and lush green forest. When Mary and I saw it, we exclaimed simultaneously, "The Congo!"

So it looked on our drive to the Hotel das Cataratas and the 500,000-acre park, through groves of bamboo and tree ferns. Out of this verdant tunnel we emerged to see the hotel, and beyond it, the falls.

The forest Indians buried their dead in this other-worldly setting and called it "the place where clouds are born." And as we watched, a cloud bank rose from that churning mass of water. We hurried down more than 400 steps to the level of the Iguazu River. Every bend in the trail brought a broader vista until we could see most, though never all, of the hundreds of separate waterfalls that stretch along a two-mile brink. At the lower level we looked 230 feet upward into the horseshoe-shaped Garganta do Diabo, Devil's Throat, of the central cataract.

Small Boat Ventures to Brink of Falls

No one could speak above the roar of the water. We could only point to a landscape twinkling with mist and tropical butterflies, and hear the forceful voice of nature.

During our three-day stay, we viewed the falls from every angle. It is rare indeed that such a magnificent setting with such obvious hydroelectric potential should so long remain virtually unmarred by the hand of man. Later we learned that international agreements protect this park scenery.

Across the river, the Argentinians have

Benediction of evening stills lively Rio de Janeiro, resting in the misty calm of sea, sky, and mountain. Head wreathed by lightning rods like a crown of thorns and hands pocked by frequent bolts, the statue of Christ the Redeemer looks down from 2,310-foot Mount Corcovado toward Rio's other noted landmark, 1,296-foot Sugar Loaf.



their own national park, but no easy transportation system links the two parks. We settled for a distant view of the Argentine hotel.

One afternoon Ethan and Elizabeth made a boat excursion to the brink of the falls.

"It sounds hair-raising," said Ethan, "but it wasn't. The hotel manager himself rowed us out to the little rock island in the center. A fantastic spot—water rushing over the brink on both sides of us!"

"The boat seemed completely safe," said Elizabeth, "but ours was the first trip anyone had made there in three years!"

A greater danger is snake bite. "One-fifth of our employees have been bitten by snakes," said Park Director Dr. René Denizart Pockrandt. "We have serum, so no one has died."

"But we should discuss happier subjects," said Dr. João Maria Belo Lisboa, Director General of the Brazilian Department of Natural Resources. "Birds, for example—this park has hundreds of species."

Dr. Lisboa, who in 1961 helped found Brazil's first school of forestry, administers the nation's 16 national parks, 11 national forests, and a biological reserve in Espírito Santo. During our visit, in fact, Dr. Lisboa was adding still another reserve to the list—a large tract in the north, next to Surinam.

"We are still studying the possible boundaries," said Dr. Lisboa. "But the region embraces two distinct environments—the savanna and tropical forest. And what wildlife! Jaguar, several kinds of deer, peccary, giant otter—we don't really know the extent."

Bird Song Brings Legend to Life

Here to confer with Dr. Lisboa about this reserve was an unusual young man named Johan Dalgas Frisch. "Mr. Frisch is the man who captured a legend," said Dr. Lisboa. And so he did, by recording the song of the uirá-purú, the musician wren.

This diminutive bird figures in the folklore of Brazilian Indians—and in the music of composer Heitor Villa-Lobos—as the magic bird and king of love. But few Brazilians believed the bird was real. Then came Johan Dalgas Frisch, an engineer by profession but an ornithologist by affection.

Seeking the uirá-purú, Mr. Frisch crossed the Amazonian rain forest time and again. Then at a plantation on the Acre River, he went hunting with an Indian guide.

"It was early in the morning after a rain," Mr. Frisch recalled, "the kind of day when

even the leaves make a song. The Indian suddenly stopped and said, 'Listen—that is the uirá-purú!' I heard nothing, but I set up my equipment and soon heard a distant song. The result was a poor recording, but I played it back, much amplified, for I knew that this was a territorial song and the uirá-purú would be offended by a rival's invasion. It worked! The bird came within six feet, seeking a fight, and I recorded his song for twenty minutes."

Mr. Frisch's record, "Voices of the Amazon," containing the song of the uirá-purú, became a Brazilian best seller, outranking carnival tunes, the twist, and rock 'n' roll—clear proof, I think, of the bird's magic.

Growing São Paulo Replaces Its Forests

Our São Paulo visit gave us an insight into the problems of urban growth. For 90 years, this has been Brazil's fastest growing city. As one Paulistano told us, "Parks and trees can't keep up with concrete." Certainly, the city's skyscrapers have set a breathtaking pace.*

We visited a 10,000-acre park on the outskirts of the city, the Hôrto Florestal, to learn a bit about forest problems here. Once a forest region, the State of São Paulo lost most of its trees to coffee plantations. A law now promotes tree planting and permits tax deductions for private reforestation.

"Brazil was named for a tree," Director Roberto Alvarenga told us. "And we have some *pau brasil* here." He showed us a dense, umbrella-shaped tree. The Portuguese prized the wood for violins and its reddish heartwood for dye. And so the world's fifth largest country got a musical, colorful name.

Mary and Elizabeth shared in a tree-planting venture. The mayor of Embu-Guaçu, a crowded little suburb of São Paulo, had donated a young sapling to shade the newly named "YWCA Street."

The honor was well earned, for the 900 members of the São Paulo YW are working wonders in Embu-Guaçu. "They've started a kindergarten," said Mary, "and adult courses in reading, home economics, and typing. Now the people themselves are building a clinic. It's amazingly successful—and in a place once considered out of reach."

From São Paulo, we flew to Rio de Janeiro, arriving at the magic hour of sunset for a golden view of the city. At the level of our right wing tip stood the 100-foot concrete

*For an account of burgeoning Brazil, see "Brazil, Óba!" by Peter T. White, GEOGRAPHIC, September, 1962.

Footing along Rio's Guana-
bara Bay, the 45-foot sloop
Frøya—the goddess of love
—answers to helmsman
Mary Rockefeller while own-
er Erling Lorentzen conns
the vessel. The authors
cruised as guests of the Nor-
wegian shipping executive
and his wife, the Princess
Ragnhild.

Nearing the open Atlantic
(below), the sloop lifts her
bow to swells as she runs
past the steep foot of Sugar
Loaf. Mount Corcovado
rises at left. Rio's active
yacht club leads a drive to
curb pollution on the bay.



PHOTOGRAPHED BY GEORGE F. HOBLEY © N.A.S.





figure of Christ the Redeemer on Mount Corcovado. To the left stood Sugar Loaf and glorious Guanabara Bay (pages 105, 107).

Cariocas, as Rio residents call themselves—the word probably comes from a Tupi Indian expression meaning “white man’s home”—enjoy some of the world’s most opulent scenery. But the restless Cariocas are not content with static natural beauty. Driving to our hotel on Copacabana Beach, we passed the new Rio waterfront: a broad freeway and a new bayside park with an art museum under construction. And what had Cariocas demolished to get this?

“Nothing,” said Dr. H. E. Strang, a conservationist. “We filled in part of the bay.”

The same creative touch was used a century ago with the Forest of Tijuca, overlooking the harbor. In 1862, a conservation pioneer named Manoel Gomes Archer took over an old coffee plantation. Bringing in seedlings

by mule, he began South America’s first forest-restoration project and one of the world’s most exciting cityside parks.

We toured Tijuca one morning while vaporous rain clouds played tag with the sun. State and federal lands are linked by a twisting scenic drive 2,000 feet above the city. Each weekend, thousands of Cariocas follow this route with their picnic baskets.

Only an experienced eye can tell Major Archer’s plantings from original growth.

“On the older trees you find many more lianas and orchids,” said Dr. Strang.

Weather cut our visit short with a blue-black tropical rain. Torrents fell all night, and the morning papers told of forty people dead from drowning and landslides. We wondered how many others were saved by the firm roots of Major Archer’s trees.

Donning raincoats, Mary and Elizabeth went on with their YWCA tours. “Today



PHOTOGRAPHS BY WILLIAM ALBERT ALLARD (COLORS) AND GEORGE F. ROBERT © N.Y.S.



we're visiting Favela hill," said Mary. It was on this steep slope that Rio squatters first built their flimsy hovels; a few decades ago Cariocas began to call all similar slums *favelas*. And in this district the Rio YWCA makes its greatest effort in social assistance.

Even the poorest favela-dweller still has access to Rio's magnificent shoreline. No beach is privately owned here, and sports-conscious Cariocas raise volleyball nets and stake out soccer fields all along the sand.

One afternoon we watched some 150,000 spectators in the world's largest soccer stadium, cheering, beating drums, tossing confetti. We noticed that the stadium had a moat to keep irate crowds from charging onto the field. Nonetheless we picked the underdog Bangu team against the favorite Fluminenses. The Bangu won, we applauded enthusiastically, but, thanks to good sportsmanship, we left the stadium unharassed.

"Full of grace . . . made golden by the sun," says a popular song about "The Girl From Ipanema," a Rio district and home of this raven-haired beauty.

Imperial crown of Dom Pedro II—4.5 pounds of gold studded with 639 diamonds and 77 pearls—glitters in the former summer palace at Petrópolis, near Rio. Brazil became the home of Portugal's exiled royal family during the Napoleonic Wars. When King João VI returned to Europe in 1821, his son Dom Pedro I stayed to lead Brazil's independence movement and the next year founded an empire that lasted for 67 years. The second and last emperor, Dom Pedro II, moved his country toward the gradual elimination of slavery. But his daughter Isabel, acting as regent while he traveled abroad, freed the slaves suddenly in 1888. Angry planters supported a peaceful revolution that established a republic and sent the gentle emperor into exile the following year.



By nature, Brazilians couple verve with restraint. Even their independence came peacefully—and with glamor. In 1807, with Napoleon's invasion of Portugal, the royal family fled to its Brazilian colony. The Brazilians so enjoyed the pageantry of the royal household that they kept a court even when the Portuguese king went home. In 1822 the Portuguese prince was crowned Dom Pedro I, Emperor of Brazil; his son, Dom Pedro II, ruled until 1889, when a republic was peacefully proclaimed.

Repeatedly, we found nostalgic mementos of the empire. In the Rio Botanical Garden (one of the world's largest, ranking with those of Kew and Java) we saw a magnificent royal palm planted by Dom Pedro II.

We met Dom Pedro personally, or felt we did, at a joint YWCA-hospital benefit that

displayed Rio's winning carnival costumes.

Models paraded along a platform in astonishing array: an angel with flapping wings; a chessman; a fire goddess with real fire; a whole encyclopedia of historical characters; and finally the figure that brought the greatest spontaneous applause—Dom Pedro himself, complete with his tall crown.

Brasília Prepares for the Supersonic Age

If Rio looks fondly backward, the new capital city, Brasília, looks adventurously ahead. We flew there with Minister W. Murinho, an official of the Ministry of Foreign Affairs.

Our plane dipped low over the central savanna for a view of this completely planned capital. An artificial lake, its shore dotted with yacht clubs and villas, sprawled companionably beside new avenues and



SCULPTURES BY GEORGE F. WOODLEY (KITE) AND WILLIAM ALBERT ALLARD (MUSCLE)

skyscrapers. Suburbs spread wide and far to hold 260,000 residents at the time of our visit, just nine years after ground was broken.*

The airport was bustling with people. "But already we are planning a new airport for supersonic jets," said one of our Brazilian friends. "We'll need it by 1975."

This was the only city on our route that seemed to be making firm plans for the coming age of supersonic travel—an era that lies less than a decade away. As a result of far-sightedness, Brasília may well become the central port for much of South America.

The purpose of Brasília, of course, was to open untouched parts of Brazil to transportation and development. Already the Brasília-Belém highway is complete to the mouth of

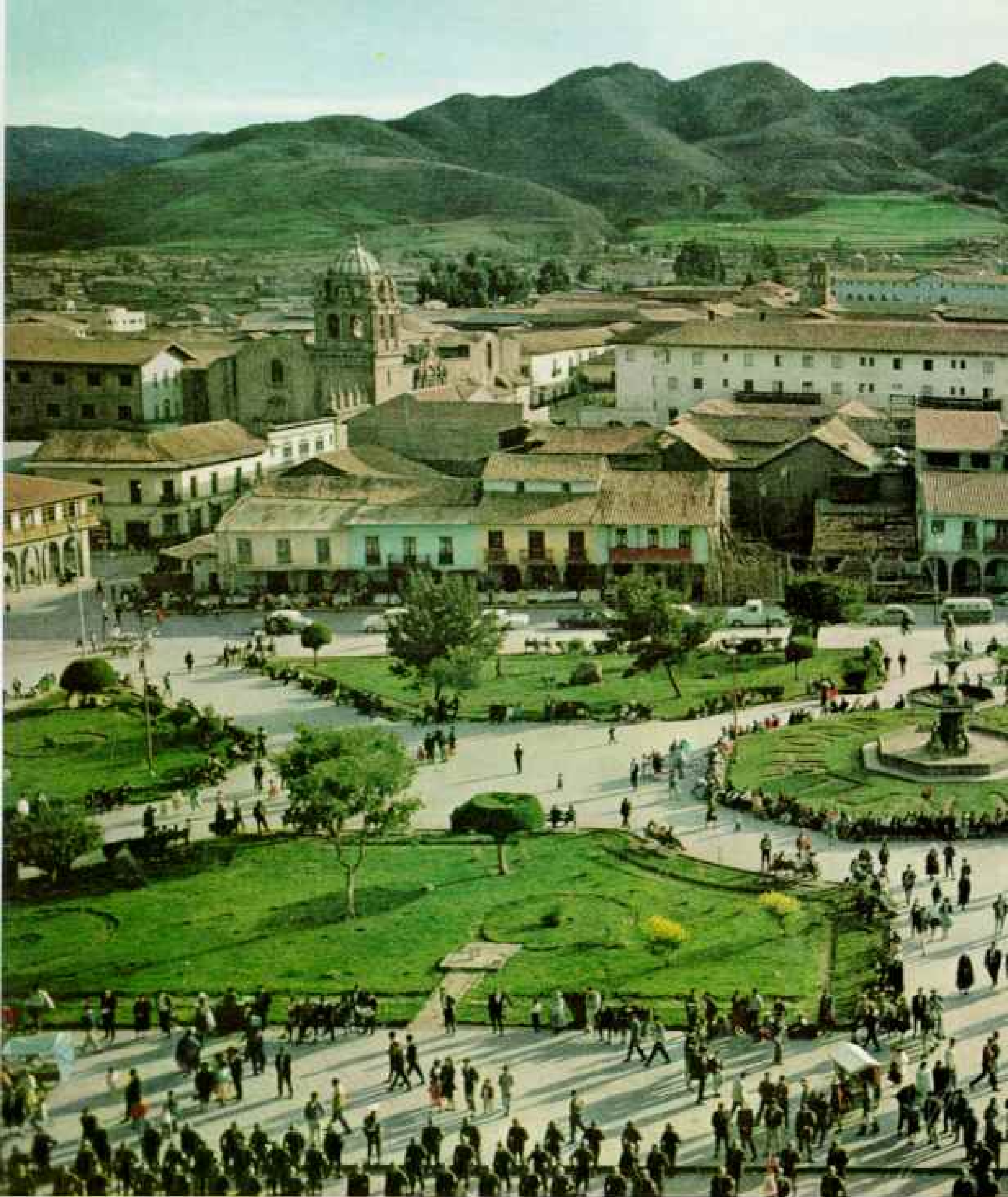
*See "Brasília, Metropolis Made to Order," by Hernane Tavares de Sá, in the May, 1960, GEOGRAPHIC.

Bold new capital, Brasília lures a human tide into Brazil's frontier of prairie and jungle. Some 260,000 people now throng city and suburbs, 600 miles inland from Rio, which it succeeded as capital in 1960.

"Wind sandwich"—as Brazilians call it—towers above the domed Senate chamber. The 28-story shafts house legislative suites, a library, a restaurant overlooking the Plaza of the Three Powers, and offices of the executive and judicial branches.

Running room for boys with kites surrounds apartment communities, self-contained in parklike settings with their own stores and churches. "Sixty thousand lucky youngsters," Mr. Rockefeller observed, "are growing up with nature."

Monument to muscle, silhouettes in steel salute the *candangos*, workers who built Brasília, guided by architect Oscar Niemeyer.



the Amazon; buses make the run regularly.

"And in a Land-Rover you can now drive west to the Bolivian border," said Minister Murinho.

Mary toured the city with members of the new YWCA (page 88). "My car is still the YWCA headquarters," said Mrs. Léa Araujo de Pina. The car was symbolic, for Mrs. de Pina's father built the Belém highway.

The city has the shape of a bow and arrow; the bow curves along the lake, and the arrow

provides swift access across town. Architect Oscar Niemeyer's public buildings are dramatically surrounded by open space.

Yet I was personally most impressed by the residential areas (preceding pages). Tall apartment buildings cluster together in superblock communities, each with its own schools, shops, and churches.

We visited a school where each classroom had its own patio for sunlight and flowers.

"Take our picture!" commanded three



PHOTOGRAPH BY GEORGE F. ROBLET © N.C.S.

third-grade boys. We complied, then watched the lads race home. They could go all the way on foot, safe from heavy traffic—and almost entirely on grass. Young as they were, these boys had watched workmen plant the jacaranda and cassia trees—some of them now two stories high—that make even parking lots look pleasant here.

These boys—and the 60,000 other lucky youngsters born in Brasilia in less than a decade—are growing up with nature. Whooping

Easter week in Cuzco takes on a martial air as Peruvian soldiers form ranks in the Plaza de Armas for a march to Saturday evening services. Statue honors Atahualpa, last Inca to rule from this ancient capital perched 11,150 feet in the Andes. Letters around the statue's base spell "KOSKO HATUN LLACTA," Quechua for "Cuzco Great City." Scholars and tourists stream in to view Cuzco's wealth of Indian and Spanish relics. From here a railbus twists 70 miles to the mysterious Inca citadel, Machu Picchu.

home from school, they prove today that a carefully planned garden city can be truly successful. And a generation from now, when those boys are the leaders of Brazil, I know they will value the endowment of nature that modern Brazilians are leaving them.

"If I could become a child again, I would like to grow up in Brasília," said Brazilian Foreign Minister Juracy Magalhães, when we called on him in Rio.

The Foreign Minister, a former Ambassador to the United States and an old family friend, talked with us at length over steaming cups of Brazilian coffee. Our conversation ranged as widely as our journey.

Paraná Plan Involves Five Nations

"Here in this office just last week," said the Foreign Minister, "the Argentine Ambassador proposed a five-nation project for developing the Paraná Basin. It would include all the nations that share the watershed: Bolivia, Paraguay, Uruguay, Argentina, and Brazil. We are now proposing a similar pact for development of the Amazon Basin. And we need conservation on a hemispheric scale."

To promote this cause, we promised to continue talks within our own countries and with each other, and both of us drafted statements for the press.

In his statement the Foreign Minister proposed an organization, perhaps under the guidance of the Organization of American States, "that would have independent means" or separate national committees that "should be given special powers and certain independence of action in all American countries."

I could not subscribe more heartily to the Foreign Minister's proposals: "To preserve and defend the flora, fauna, and scenic beauty of the continent..."

Flying to Peru, the last country of our South American trip, we found a summation of all the geography we had seen: The nation has a desert on its Pacific shore, towering Andes in the center, and the humid sweep of green Amazonia to the east.*

"We are planning a national park for each

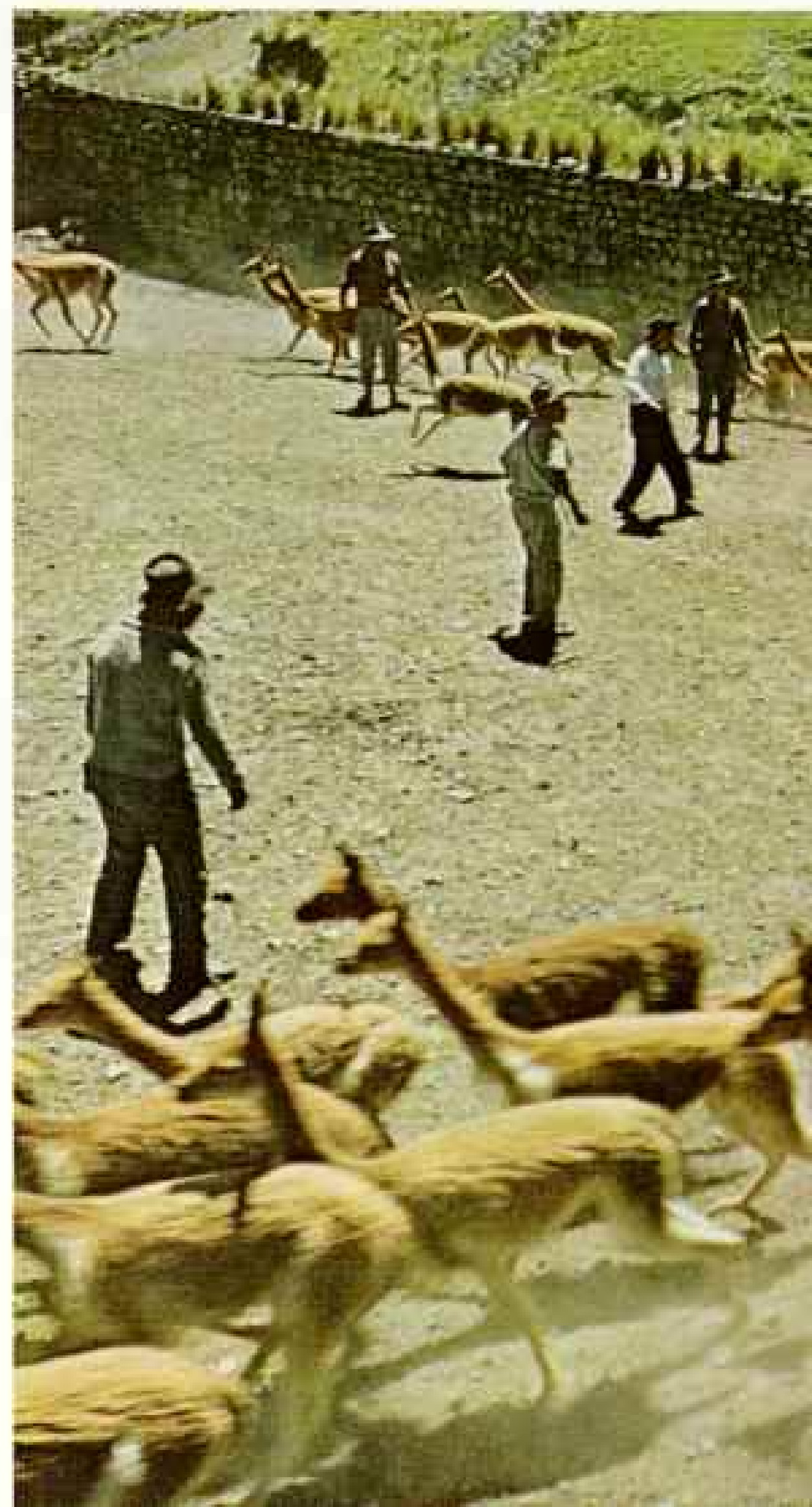
region," said Flavio Bazan, chief of Peru's conservation, forest, and park programs. Naturalists are seeking a coast park that can combine the environments of sea lions and guano birds with what they call loma—rainless sand dunes with fog-fed vegetation.

For their jungle park, the Peruvians are considering the Cutibireni watershed in the Cordillera Vilcabamba, among other regions. Because a party of daring parachutists dropped into this spectacular region on a National Geographic Society-New York Zoological Society expedition in 1963, members know something of its splendors.†

Meantime, the Peruvians are already conserving Andean scenery. In 1961 they legally established their first true national park near

*Kenneth F. Weaver described "The Five Worlds of Peru" in NATIONAL GEOGRAPHIC, February, 1964.

†For details of this jungle adventure, see "By Parachute Into Peru's Lost World," by G. Brooks Baekeland, NATIONAL GEOGRAPHIC, August, 1964.



Stiff-necked vicuñas stampede to safety as ranch hands struggle to doctor a sick animal at the world's only vicuña roundup. Three-centuries-old Cala Cala ranch in Peru, fenced behind 31 miles of stone wall, attempts to tame the animals and cross them with domesticated alpacas. Resulting pacavicuñas give two pounds of wool a year—four times the yield of a pure vicuña.

Cajamarca, a 5,000-acre mountain forest.

Yet the Peruvian Department of Archeology has long maintained one of the world's most exciting parks—though strictly speaking not a national park—at Machu Picchu, lost city of the Incas. Our first order of business was to see these extraordinary ruins, explored by Hiram Bingham on his National Geographic Society-Yale University Expeditions, beginning in 1912.

Mountain Redoubt Keeps Inca Secrets

We found Machu Picchu less a place than an experience. Its 220 stone houses and temples hold great scientific interest, but it is the location that stirs a greater sensation. The lost city perches between sky and earth among abrupt green pinnacles.

Far below, the Urubamba River roars toward the Amazon; far above, the green mountain spire of Huayna Picchu lifts its ter-

aces into rain-laden banks of foggy clouds.

"Why live at such rugged heights?" we asked ourselves. Scholars give us careful guesses. When Pizarro's Spaniards advanced on the Inca capital at Cuzco in 1533, the Indians may have sought to preserve their culture in an old and secret mountain redoubt.

Here Dr. Bingham found 141 adult human skeletons, but only 22 were identified as male. Archeologists assume that the Incas' Virgins of the Sun took refuge in this stronghold.

The visitor can speculate on the age of buildings (six centuries and more); he can count the 16 fountains and take celestial sights from the ceremonial sundial. But a central mystery remains: In this fantasy setting, what was life like?

During our first few hours' climbing around Machu Picchu, the dizzying heights bothered us. But courage came with exhaustion. Grateful not to be sleepwalkers, we retired early in

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Faces from an imperial past—when Incas ruled the mightiest of American Indian empires—crowd outside a church on Easter morning in Pisac, a village 19 miles from Cuzco, Peru. Reflections from the sky, intensely blue at this high altitude, tint their raven hair, flecked by confetti from a wedding. Villagers favor the Easter holiday for marriages and christenings.

Carrying ceremonial canes, area mayors congregate here each Sunday for Mass, blasting periodically on conch-shell trumpets as they march to and from the service.

Her baby slung in a shawl, a mother heads for Sunday market in Pisac. She wears a hand-woven, many-layered skirt called a *pollera*.

EXTREMES (LEFT) AND MODERATE (BY DEBBIE F. MOSEY © K.L.E.)





Secret city of the Incas, fabled Machu Picchu crowns a 9,000-foot-high ridge in Peru. Archeologists believe that the last of the Incas, driven before Spanish conquistadors in 1533, retreated to the citadel. Lost for centuries, Machu Picchu's tumbled ruins were re-

the eight-room hotel that the Peruvian Government has built near these mountaintop ruins. Just below us, the hotel's seven pet alpacas had bedded down benignly "like a nativity scene," Mary noted. But during the night, the animals seemed less Biblical. We were continually awakened by noises that sounded like a dog-and-cat fight. Next morning we were relieved to find the alpacas still alive (above).

Our railbus trip to Cuzco threaded through fascinating country. Stone agricultural terraces on the abrupt mountain slopes reminded us that conservation here was older than recorded history. At every station, brightly clad Indians were selling fruit, avocados, and *chicha* beer—and even that Inca deli-

cacy, roasted guinea pig, at 80 cents a serving.

After one night in the mountains, Cuzco's 11,150-foot elevation seemed less formidable. Only slightly short of breath, we shopped, strolled streets bright with Indian garb and llama trains, and viewed the landmarks.

Last Supper, With a Peruvian Touch

This old Inca capital is an unbelievable mixture of cultures. A painting in the cathedral makes the point unmistakably clear. It depicts the Last Supper in the elaborate style that Spanish priests taught Inca artisans. The table is spread as if by da Vinci, but with one indigenous difference: On a platter, ready for carving, lies a roasted guinea pig.

George Mobley and Bart McDowell went



EDDACHROME © H. S. S.

discovered by Hiram Bingham in 1911 and subsequently explored by him in a series of National Geographic Society-Yale University expeditions. The authors meet some pet alpacas during a visit to this treasure of the past as they conclude their five-nation survey.

southeast from Cuzco to see the world's only roundup of vicuñas near the Bolivian border (pages 79 and 114-15). But if the vicuña seems to be thriving in a semidomesticated state, other species are endangered in Peru. Each year the Amazon River port of Iquitos officially exports the skins of 1,000 jaguars, 9,000 otters, and 11,000 ocelots. These animals have already vanished from some parts of the Peruvian rain forest.

"This week we opened a school for forest rangers in Iquitos," reported Mr. Bazan. "Just a hopeful beginning."

Mr. Bazan's words, "a hopeful beginning," said much about our whole trip. Throughout southern South America, we had watched conservationists work against the deadline of

swift development. Those able men can still avoid the mistakes made by many urbanized countries. Parks and nature preserves, instead of thwarting progress, can introduce whole new industries as well as enhance the quality and enjoyment of life.

As we prepared to leave for home, Elizabeth recalled a thoughtful phrase from a YWCA volunteer in São Paulo: "Being international opens our hearts."

Those words could also apply to the international travelers who will visit South America tomorrow—and to the goodwill and prosperity those travelers can bring. William Shakespeare wrote at another time and in a different context: "One touch of nature makes the whole world kin."



The Flowers That Say “ALOHA”

By DEENA CLARK

Photographs by ROBERT B. GOODMAN

PASSENGERS thronged the rails as our white liner, the *Lurline*, idled off Waikiki. After a ten-year absence, I had almost forgotten how warm and distinctive a Hawaiian welcome can be.

Graceful catamarans, their sails billowing out in riotous triangles of color, bobbed on the blue water below us. They were filled with smiling islanders—friends of incoming passengers—singing above the music of ukuleles. “A-lo-ha!” they shouted in unison. And “a-lo-ha!” we chorused in return from the decks of the huge liner.

The welcomers scrambled aboard from the sailboats, their arms draped with flower leis. With them from other small craft came more lei-laden Honoluluans—hula girls in their “grass” ti-leaf skirts, and musicians playing island tunes on ukuleles and guitars. Amid smiles and happy tears, leis were lovingly draped on incoming friends.

All about us hung the spicy fragrance of carnations and the heavy perfume of gardenias. Yellow *plumeria* and *pikake*, the island

names for frangipani and jasmine, added their delicate scent. White crown flowers, looking as if carved from ivory, paper-crisp magenta bougainvillea, and fiery scarlet *ohia lehua*, which grows in the forests of Mauna Loa and Mauna Kea and on the lava flows of Kilauea Volcano, struck glowing notes of color.

The whole ship shared the excitement. And the bond that united everybody aboard was fashioned of blossoms—Hawaii’s enchanting flower garland, the lei.

Flowers Convey Many Meanings

To Hawaiians, “aloha” means many things: love, friendship, good wishes, welcome, farewell. And the circlet of beautiful flowers strung together is the tangible symbol of the spirit of aloha.

In ancient times the Polynesians who came here had no gold, no gems. One of the most precious gifts they could bestow was a wreath fashioned by their own loving hands. That affection and esteem can be felt even now, many centuries later, in the ceremony of

Welcome to Hawaii! Island beauty bestows a handful of *plumeria*—frangipani—along with the traditional greeting *aloha oe*—my love to you. Many sentiments, both of joy and of sadness, find expression in fragrant leis. The custom of wearing garlands probably came to Hawaii with ancient Polynesians who settled vast reaches of the Pacific. Today, leis play an important role in the life of the 50th state, adding a special note of scent and color to private occasions and public ceremonies.

Actor Danny Kaye, traveling on behalf of the United Nations Children’s Fund, wears necklaces of orchids and carnations, popular leis for those arriving at Honolulu.



Cascades of colorful leis, symbols of Hawaiian hospitality, surround a muumuu-clad vendor in a sweet-scented Honolulu shop. Her flexible steel needle strings carnations. Feathery arc of white ginger at upper



right hangs below leis of *pikake*, the island jasmine, and pale green *pakalana*, Chinese violets. Strands of yellow plumeria, purple vanda orchids, white tuberose, and other blossoms also await purchasers.





Wading in lavender, a picker at an orchid farm gathers a bucketful of vanda "Miss Joaquims." The blossoms flow by truckloads to markets in Honolulu and beyond.

Nature's scented jewels glow in a gallery of leis. *Akulikuli* flourishes high on the slopes of Maui and Kauai; Honoluluans seldom see its blooms except on festival days. Flame-red *ohia lehua*, tree blossoms sacred to the fire goddess Pele, blaze in mountain forests and on lava slopes. Pieces of *hala*, or pandanus, fruits create a wreath of golden bells. Pearl-like *pikake*—"peacock"—preserves the memory of a princess who filled her garden with the proud birds and fragrant shrubs. Vanda orchids now rival plumeria and carnations as the most popular flowers for leis.

KODACHROMES BY ROBERT B. GOODMAN, EKTACHROME AND KODACHROME (BOTTOM ROW, LEFT AND MIDDLE) BY JACB FIELDS © M 4-5



Akulikuli



Ohia Lehua



Pandanus



Pikake



Vanda "Miss Joaquim"



PHOTOGRAPH BY HUBERT B. GOODMAN © H.G.S.

Flowers adorn the hats and even the horses of hard-riding *paniolas*—cowboys named for the Spaniards who taught islanders to herd cattle—on the 250,000-acre Parker Ranch.

placing a lei—with a kiss and a smile—on the shoulders of a friend.

I have a great aloha for Hawaii; for four years it was my home. My husband and I were married there. And now on this brief return visit I set out to explore and learn anew how important a part the lei plays in the life of the islands.

The lovely wreath marks milestones from birth to death. Hawaiians often send a lei of *loke-lani*—roses—of delicate shell pink to celebrate an infant's christening. Birthday leis commemorate each new year. At school cotillions a boy presents his partner with a garland, accompanied by a kiss according to the strictest protocol.

The day after graduation ceremonies, young people throng the streets wearing the favorite high school lei of carnations decorated with pompons in school colors. At university commencements, graduates in black gowns are smothered in leis up to their mortarboards, each bearing a friend's greetings.

In courtship, strings of blossoms express love everlasting. And the traditions surrounding wedding flowers pass from generation to generation. Many a Hawaiian bride, like her mother before her, carries a prayer book and *pikake*. Honeymoon-bound, she tosses to her guests not a bouquet, but a cloud of flying *pikake* lei streamers.

Leis Accompany Ashes to Sea

It is the height of poignancy when leis, made to add zest to life, contribute their sweetness to the solemn dignity of death. At funeral services I have seen biers decorated with leis sent by friends.

And I have known a beach boy to request that, upon his death, his ashes be strewn off Waikiki, beyond the rolling surf he loved. In an outrigger canoe loaded with leis, the urn was carried past the reef, and its contents were scattered to the trade winds. Reverently the paddlers placed the leis on the blue water to follow their departed friend.



ESTACHEPHONE (ABOVE) AND KODACHROME BY ROBERT S. GOODMAN



KODACHROME BY JACK FIELDER © N.C.L.



Leis lend magic to Hawaiian life

ISLANDERS find a use for flowers almost everywhere, from birth to death, from arrival to departure, from campus to waterfront.

A happy graduate of the University of Hawaii finds herself chin deep in orchids, carnations, crown flowers, and commencement gifts.

In a typical airport scene, a visitor's smile competes with the glamor of plumeria and vanda orchids.

Mood of the pensive girl above finds an echo in a lei made of crown-flower centers, looping in simple strands like carved ivory.

Even the commonplace of life pick up zest with a splash of flowered color. Pleased photographer catches the spirit of the scene, though his flowers are of fabric.

Longshoreman on strike adds Hawaiian style to a picket line with a lei of plumeria and orchids.

Elsewhere in the world, the first of May signals grim military parades, and sometimes riots. In Hawaii, May Day means Lei Day—a colorful holiday during which men, women, and children wear beautiful garlands.

Businessmen wear elaborate hat leis that they have ordered weeks in advance. Elementary school students put on pageants, then return home to give leis to their parents and friends. At Waikiki Shell, an outdoor amphitheater, prizes are awarded for the most beautiful wreaths, the most unusual ones, and the rarest flowers.

And every June 11, at sunrise, Hawaiians gather before the statue of King Kamehameha I to pay homage—with leis—to the “Napoleon of the Pacific,” who first welded the islands under one government in the late 18th and early 19th centuries (page 129).

Where do all the leis come from? You find many of them in an area dear to the hearts of *malihinis* and *kamaainas*—newcomers and old-timers—alike, the section along Kalakaua Avenue just fronting the palm-groved Royal Hawaiian Hotel.

For Sale: Color and Fragrance

I'm sure that block is the most colorful in all Hawaii. Leis for sale hang in fragrant columns in modernized “grass shacks.” Swaying in the soft breezes, carnations, gardenias, pikake, and plumeria blend in an unforgettable potpourri of scents.

On lap-held trays and baskets, slender brown fingers separate delicate orchid petals into fluffy mounds. Ice chests are filled with cool treasures—fat bundles of gardenia buds, tightly rolled in ti leaves to preserve their freshness, and spicy ginger leis coiled in circles of waxy beauty. There are Mauna Loa blossoms like mauve sweet peas, and stores of winged vanda orchids like purple butterflies poised in flight.

My daughter Niki and I paused during one stroll to watch Lili, one of the most skilled of the lei makers, string an orchid lei in less than twenty minutes. The garland contained about 250 flowers and sold for \$5—or two cents an orchid.

If you ask Lili for a special lei—for instance, one of gardenias—she will make one while you wait. And you must not miss her performance. With the flourish of a virtuoso, she takes two bunches of tight buds from her icebox and strips off the green leaves. With one deft movement she shakes a creamy bud and it bursts open.

“Like a star, eh?” she laughs, as her long



STYLING: JARVIS AND ADDACHROMA BY ROBERT B. COCHRAN © N.S.S.



lei needle threads the full-blown blossoms one by one.

In Washington, D. C., my husband Blake pays three dollars for one gardenia. Three dollars buys a whole wreath in Hawaii.

Other lei sellers congregate in a colorful group where the cruise ships dock practically in the heart of Honolulu. Vendors compete frantically to sell "boat leis" to embarking tourists, and to their friends who buy wreaths to wish them bon voyage.

I enjoyed talking to "Mama" Wright, who was head of the Lei Sellers' Association, as we sat on a park bench one afternoon in the shadow of Aloha Tower.

"Sometimes you string 300 orchids and the whole thing brings you only a few dollars," she said with a philosophic shrug. "That's

in summertime, when the vanda orchids are plentiful—and when the boat has just pulled out. But on a good day we take in fifty dollars. Of course, we have income tax and state tax, but look at me, I'm happy—by ten o'clock in the morning I can have a 'poi break'!"

Mrs. Wright's aromatic wares included colorful cascades of bright carnations, looking like miniature feather boas. The carnation's generic name, *Dianthus*, means "flower of the gods"; the specific name, *caryophyllus*, describes its clovelike scent. In these heavenly islands it is one of the most common blossoms grown commercially for leis.

I drove a dozen or so miles east of Honolulu to a carnation farm in the Koko Head district. I made sure to arrive in midafternoon, when the panorama of color was at its best—and





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Fleecy curtains of cloud and blossom frame the helmeted head of Kamehameha I in Honolulu's Civic Center. First ruler of the united islands a century and a half ago, the monarch receives floral homage on holidays, especially on Kamehameha Day, June 11, and Lei Day, May 1. King-size strands of plumeria, twined with glossy *maile* leaves, trail 40 feet from the hero's shoulders. They resemble the yellow feather cloaks once worn by island royalty on ceremonial occasions.

Glamorous outrigger crew, wearing plumeria and orchids, races a following wave to Waikiki, Oahu's famous beach. Surfer (above) also favors plumeria, still fresh after a wild, wet ride to shore.

when the warm sunshine had unlocked the spicy aroma of the fields.

Mr. Kyusul Lee's sorting shed smelled like cloves. Piles of blossoms lay on long wooden tables—fluffy mounds of pure white, canary yellow, pink, rich red, and peppermint. A special variety, red petals splashed with white, is called *hae Hawaii*, Hawaiian flag.

Workers gather the flowers in the early morning to ensure freshness, sometimes by the light of kerosene lamps, Mr. Lee told me. From canvas picking bags the blossoms are tumbled into bamboo baskets, then sorted according to color and size. Packed 200 to a paper bag, they are ready for the market.

Blossoms Sometimes Sell by the Pound

"Often, at our busiest season, around graduation," Mr. Lee said, "we don't have time to count the flowers, so we sell them by weight."

I thought what fun it might be, back in Washington, to ask a florist, "May I have a

pound of your very best carnations, please?"

Mr. Lee has plenty of agricultural problems. "Carnations are difficult plants to grow," he told me. "They are susceptible to both rust and root rot."

Every two years the old cuttings are pulled, and the ground is prepared and fertilized to take new rooted cuttings shipped from Massachusetts. Mr. Lee harvests the first crop four and a half months after planting, with a second, sparse blooming about eight weeks later. The blossoms bring three cents apiece when the market is right—but only a penny when it isn't.

An aristocrat among lei flowers is the jasmine. Its island name, *pikake*, comes from "peacock," a reminder of the beloved 19th-century Hawaiian princess Likelike, whose garden abounded with the exotic birds and the perfumed flowers.

Even though a three-strand *pikake* lei sells for \$5 or more, there are probably not more than ten acres devoted to raising these flowers commercially on Oahu; they are relatively difficult to grow.

To see the blossoms on the plant, I went out past Diamond Head to the Leahi Farm Tract, where Mr. Wilbert Watanabe has two-thirds of an acre under cultivation.

To me, his "farm" seemed a tangle of several thousand shrubs. The bushes shoot to a height of five feet in their first 12 months, Mr. Watanabe told me. They must be pruned each year to induce the new growth that produces blossoms. The flowers bloom profusely amid the green leaves, like crisp clusters of snow-white popcorn.

"It takes constant work to get such blooms," Mr. Watanabe said. "I have sprayed against red spider mites, white flies, thrips, scales, and mealy bugs. Now the county agent tells me my plants have an iron deficiency." He laughed ruefully. "Can you imagine? *Pikakes* with tired blood!"

Jasmine blossoms are fragile things; they bruise and turn brown if roughly handled. I watched as sun-warmed flowers were gently spread out on interior tables to cool until they

Brimming with blossoms, chrysanthemum-laden hats shade brothers camped at a Honolulu curbside during a Lei Day celebration. Each May 1, school classes give way to pageantry in the island-wide festivities. Poet Don Blanding suggested the popular holiday, first observed in 1928.

EDDIE HONG © N.G.A.



reached room temperature. They were then moistened with a fine mist and refrigerated.

The entire Watanabe family strings the leis. In the kitchen, they ply special lei needles of slender stainless-steel wire, about a foot long. The knotted end of their thread is tied to a nail in the wall. Thus the blossoms can be strung suspended in air to prevent blemishing. The Watanabes carefully run the needle through about 40 of the blossoms, stem end last. Then, very gently, they ease them down the length of thread, and half a lei is made.

Crepe Paper No Substitute for *Ilima*

Even nobler than the pikake is the chiffon-like *ilima*, once the flower of royalty. It is the lei most imitated on the mainland, where it is made of Halloween-orange crepe paper. The crinkled substitute falls far short of the fragile charm of the original.

Hawaii's most ubiquitous lei flower is one that grows on trees—the clustering plumeria. The individual blossoms look like little pin wheels—lovely yellow centers whirling out to white, or pale pink to deep rose. I like to remember what "Mama" Wright once told me about the plumeria: "You can put any kind of flower in a lei as long as you include some plumeria. That, you can always sell."

My own favorite lei flower, the yellow ginger, first came from India. It soon took root in the hearts of the Polynesians and in the soil of their ocean-washed islands.

Sister to my beloved yellow is the white ginger, *Hedychium coronarium*, another Indian import. *Hedychium* is from the Greek, meaning "sweet snow"; *coronarium* refers to its exquisite crown of glistening white blossoms. Growing, it truly looks as if fluffy snowflakes had gently drifted onto the stalk.

Today both flowers grow wild and luxuriant in Hawaii's rain forests and beside streams in lush valleys. They remain among the best-liked garlands, often festooning dancers of the graceful hula.

But there is a special sadness in the beauty of the yellow ginger. Its short-lived loveliness has inspired a Hawaiian proverb: *Awapuhi*

Casting a wish, a passenger throws a lei from the Matson Line's *Lurline* off Honolulu. Tradition holds that if it floats to sea, the farewell is final; if waves carry it to land, its owner will someday return to what Mark Twain called "the loveliest fleet of islands that lies anchored in any ocean."

lau pala wale—"The ginger leaf... wilts quickly," referring to the brevity of life, or the good things that pass too soon. Things like a visit to Hawaii.

"Farewell," one of the most poignant of words, is nowhere more affecting than when one leaves these islands. Flower-wreathed passengers lined the ship's rail as we steamed majestically seaward. No one wanted to miss the chance to participate in a cherished ritual of the lei: If, as you pass Diamond Head, you toss a lei overboard and it drifts ashore, you will surely return to Hawaii.

Once abeam the ancient crater we began to toss our garlands over the side, hoping that the tides and trades would not carry them out to sea. My ginger made a bright golden circle as it floated on those bluest of blue waters.

I turned from the rail when my lei had dwindled to a mere speck of gold. It was drifting toward the white sands of Waikiki. I had known all along that it would. THE END

SPRINGFIELD © N.Y.S.







ALLIGATORS

Dragons in Distress

By ARCHIE CARR, Ph.D.

*Photographs by TREAT DAVIDSON
and LAYMOND HARDY*

I FIRST HEARD the voice of the alligator long ago in a cypress swamp at the edge of the "Big Scrub," a sand-pine area near the St. Johns River in Florida. Suddenly, above the clamor of the frogs, a heavy, rhythmic rumbling sounded in the distant dark. I was newly arrived in Florida and had never heard a sound like that before.

The night was clear, so it couldn't be thunder, and for a moment I thought it might be somebody dynamiting fish. But then the sound rumbled in again, and I realized it was an alligator bellowing. Two others joined the first, and the ponderous, pulsing chorus, half sound, half shaking of the earth, seemed to rock the whole swamp.

Today no alligators bellow in that tract of swampland. The frogs are quiet there too, and the cypresses are long since lumber. However, a few places remain where the old song can still be heard, and I, for one, seek them out at every opportunity.

The roar of the alligator, rolling out of the mist of April marshes, is one of the great animal sounds of the world. It

Eight feet of armored anger, a hissing alligator warns intruders away from the nest while waiting for her young to hatch (above) in the Florida Everglades. Hardy survivors from the Age of Reptiles, alligators now face a serious threat as civilization claims their swampland and fashion puts a high price on their hides.

is a song 200 million years old, an echo of the Age of Reptiles, when cold-blooded creatures ruled the earth. But now the incredible voice is falling silent, and the needless loss will not sit well with our descendants.

Two things have happened to accelerate the alligator's decline. One is the recent fantastic rise in the price of hides and resulting increase in illegal hunting. The other is the destruction of habitat by drainage and development projects.

Family Gator Comes of Age

The plight of alligators, and of people who live in alligator country, is epitomized by my own family's experiences with the alligator in our pond near Micanopy, Florida.

The family alligator is going on ten years old. She measures about eight feet, and we have known her since she was two feet long. We have watched her grow up and drive off the other alligators, start catching turtles, and half choke to death on six mallards we had hopefully put on the pond.

One day at dawn she made us proud when she bellowed for the first time. Soon another big alligator turned up, and for a while the two of them circled and dashed about, making waves and throwing foam and scaring the gallinules into worried flight. Later we found her nest on the far shore of the pond. Forty-two little gators came out of it.

The pond was only eight acres in wet periods, and during every dry spell it shrank. In those times the fauna was concentrated, and the alligator ate furiously. We could hear her cracking turtles from clear up in our living room.

Then the pond would flood again and dilute the already reduced remnants of the turtle, bullfrog, and marsh-rabbit populations. The sulphur-bellied frogs that live out in the pond and the big bullfrogs that bellow under the button-bushes around the edge became few and quiet.

By this time the alligator was so hungry that she broke into the strong cage we had built for a new flock of mallards and ate two of them. Even the little alligators disappeared. My wife charitably suggested that they went away through the woods, but I can't help thinking their mother ate them.

So living with our alligator has become a problem. She is still out there in the pond and she is a nuisance—but a very exciting one.

In fact, the alligator is a pretty exciting kind of animal. It and its relatives—the crocodiles, the tropical American caymans, and the Old World gavials—are the only surviving members of the Ruling Reptiles, the main stem of the reptile tree that produced the dinosaurs and the flying pterosaurs.

There are two species of alligators: the familiar *Alligator mississippiensis*, ranging from North Carolina to the Rio Grande and up the Mississippi Valley to Arkansas (map, page 136), and *Alligator sinensis*, which lives in China, confined to the inhospitable marshes of the Yangtze Delta.

A great many features set the alligator and its relatives apart from other reptiles. One is the spectacular voice. Another is the care the female bestows on the nest and young. Most reptiles are pretty casual about parental obligations; instead of guarding their eggs, they lay them and leave them.

I personally fell afoul of the maternal instinct of the alligator one June day when I blundered into a den pool while

On a bold adventure, Dennis and Lydia Coulter open an unguarded alligator nest on their grandfather's ranch near Venus, Florida. Cumbersome gators, using mouth, claws, and body for tools, engineer snug mound-shaped hatcheries made of plants and mud. Thirty to seventy eggs, laid in early summer, hatch nine weeks later.

Eight-inch dragons weighing only two ounces squirm free of shells after breaking through with a tiny "egg tooth" atop their snouts. Colleagues held the mother at bay to allow the photographer to make this unusual picture.

When ready to emerge in late summer, the babies signal by calling "rumpf, rumpf" while still in the egg. Solicitous mothers pull away nest material so the infants can escape to the nearest water.

Young enter a hostile world as the prey of mammals, large birds, and reptiles, including adult gators. Those that survive three years measure as many feet or more; by then the hunted become the hunters, capturing former enemies in bone-crushing jaws armed with 80 teeth.

No one knows the life expectancy of an alligator in the wild. Tagging studies may provide answers in years to come.

Eager eater, a 14-inch alligator lunches on a crayfish. Other shellfish, insects, small fish, and carrion round out its diet.

Gators down any animal they can catch—plus cake and marshmallows offered by sight-seers. But the awesome reptiles rarely attack humans unless provoked. Despite voracious appetites, mature gators go without food during winter months, when they emerge from sleep only on warm days. Scientists suspect that when cold weather slows their metabolism, gators can stay submerged almost indefinitely. In summer they must rise to breathe every few minutes.



RESEARCHED BY LAYMOND HARRY LEHTER, AND TERRY BRIDGEMAN © M.G.C.



Gator country spreads from North Carolina to the Rio Grande, but its heartland lies in Florida. Spanish explorers found southern wetlands teeming with the reptile, which they called *el lagarto*, the lizard—a term anglicized to alligator.



In a jigsaw puzzle of mangrove thicket and water, alligator poachers play hide-and-seek with rangers trying to stop nocturnal raids along the western fringe of Everglades National Park. The

Everglades provide one of the last strongholds for embattled *Alligator mississippiensis*, the American alligator. The gator clan includes but one other species, a smaller cousin in China's Yangtze Delta.



hunting nests of the round-tailed muskrat in northern Florida. The old alligator came foaming over from out of the grass at the far side. I fell over backward in the mud trying to retreat up the bank. Fortunately she made no move to follow me out of the pool.

Tobacco Can Becomes "Gizzard Stone"

Alligators grow a little more than a foot a year. Both sexes reach maturity when they are five years old and about six feet long. From there on, the growth rate of the male is greater than that of the female. The resulting disparity in size gives the only visible clue as to which is which. In the old days alligators reached lengths of 19 feet. Today males rarely exceed 12 feet, females 8.

The food of the alligator is anything it can outswim or ambush and overpower, pieced out by dead animals it finds. I once cut open a big gator that had been pointlessly shot by a duck hunter near my home in Florida. In its

stomach I found, besides some garfish scales and a few feathers, three smoothly rounded pieces of pine wood, a fishing sinker, and a crumpled Prince Albert tobacco can.

Such odd objects are not proof of foolish feeding by the alligator. They are taken in as "gizzard stones," to help grind the coarse food the gator eats. Where duck hunting is heavy, alligators are often found with shotgun shell casings in their stomachs.

Because of their great size, heavy armor, and frightful biting power, mature alligators

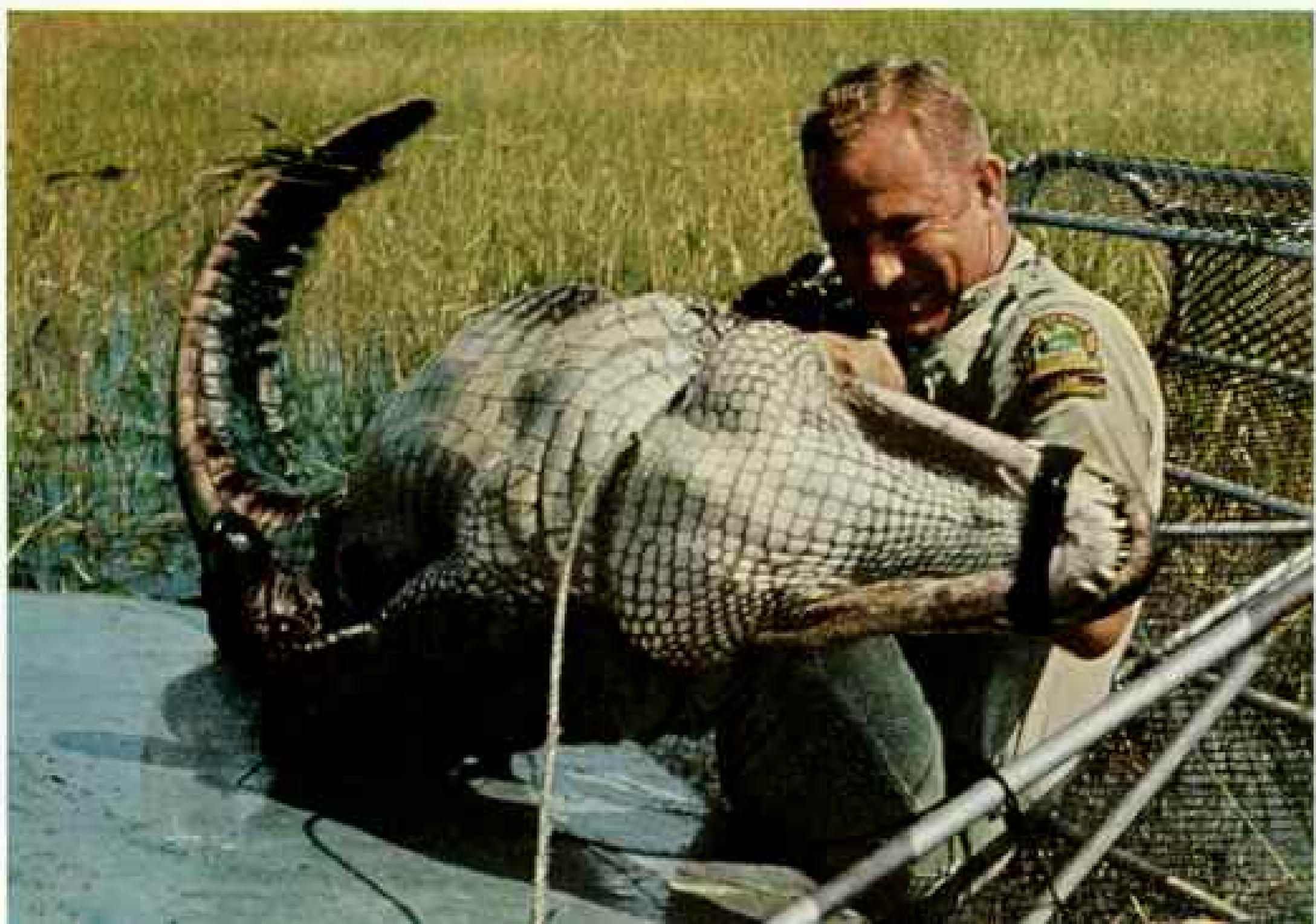
Peering for poachers, rangers patrol the park. Though legal hunting exists only in a few counties in Georgia, poachers slaughter thousands of gators annually, selling hides to black-market buyers for up to \$6 a linear foot. National Park Service Ranger Richard A. Stokes (left) reports a typical result: "In 1958 one branch of the Shark River contained over 300 alligators in one mile. Today you're lucky to see three in that same mile."





EXTRACHROMES (RIGHT AND BELOW) AND BODACHROMES BY TONY HASSOET © N.A.S.

Squaring off with a snapping, tail-lashing nine-and-a-half-footer, Lt. Tom Shirley of the Florida Game and Fresh Water Fish Commission exploits its only weakness—the jaws. Despite a bite that can smash cow bones like kindling, an alligator's jaws, once closed, can be held together by a man with relative ease (opposite and pages 146-7). Lieutenant Shirley will force the mouth of this one shut by prying up its lower jaw with a pole. Each summer he zips in his airboat over a saw-grass sea near Lake Okeechobee, marking gators for conservation studies.





Death-dealing snout in his grasp, Lieutenant Shirley struggles to turn his captive on its back before the gator twists imprisoned jaws free. Overturning causes the alligator to relax, almost as if hypnotized.

After taping the mouth, the officer heaves the 250-pound beast onto his airboat (left).

Hog-tied and helpless, the gator gets a number tattooed on a throat scale. The number will enable scientists to trace the animal's development and travel. The lieutenant also records measurements for later comparison.

Though never bitten in 17 years of conservation work, Lieutenant Shirley has taken glancing blows from thrashing heads and tails. "Once a big male jumped four feet off the ground trying to get at me," he recalls. "Releasing man-handled gators can be as chancy as taking them. Sometimes they bite big chunks out of the steel-mesh 'grass roll' on the front of the boat. When we work from swamp buggies, they go for the tires."



are immune to attack by any predator in their geographic range except man. The eight-inch babies, on the other hand, are relished by many other creatures. Otters, raccoons, herons, snapping turtles, fish, water snakes—all are avid eaters of little alligators. If it were not for the asylum of the den pool and their mothers' vigilance, little alligators could not possibly survive in numbers great enough to keep the race alive.

Adult alligators have a strong sense of territory. Zoologist Robert H. Chabreck of the Louisiana Wildlife and Fisheries Department analyzed movements based upon studies of 2,024 alligators that were tagged and released between 1959 and 1965. He found that, after spending the first 18 months of their lives in or near the mother's den pool, the young leave home and start traveling. They retain their wanderlust until they mature.

Once the young are grown, they make dens of their own and presumably defend their territory from encroachment by fellow alligators of either sex. The territory of the bulls is greater than that of the females, especially in the spring months, when they wander in search of mates or strike out to join females that have answered their amorous bellowing. It is then that alligators show up on Florida highways or in the yards of suburban homes.

Besides their regular seasonal movements, alligators travel about to avoid drought, ab-

normally high water levels, or other drastic changes in their habitat. They also congregate wherever any unusual feeding opportunity presents itself. It is this tendency that makes it dangerous to feed alligators regularly in public places. The feeding draws unnaturally heavy numbers of alligators, and at the same time gives them the idea that anything that falls into the water—pets and people included—is meant for them to eat.

Only four months ago I saw a dramatic example of the bad effects of feeding big alligators when one ate a dachshund while we watched helplessly from the living room of my brother's home on a northern Florida lake. In this case the alligator was almost certainly one of several big ones that had been regularly fed at a lakeside cocktail lounge.

Unknown Instinct Guides Gators Home

One of the most surprising results of Robert Chabreck's tagging study was the revelation of a strong homing urge and capability in the alligators he worked with. One made a homing trip of eight miles in three weeks, from a point to which it had been transported in a closed box. Another was found back in its home lake four years after having been released in a place 12 miles away. Still another made a homing return of 20 miles. This may not seem impressive when compared with the long-distance homing of pigeons, but it is an



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Spadelike head distinguishes the alligator from its slender-faced relative, the American crocodile. Meaner-tempered and faster-moving, the croc prefers salt water and the tropical climate of Latin America. It occurs in the United States only in the Keys and extreme southern Florida.

Crushing a gar, an alligator aids nature's balance while it satisfies its own healthy appetite. The bony-scaled fish fears few other enemies. Without a check on their numbers, schools of spotted gars (right), growing to two and a half feet, would eat the Everglades clean of bass and bream.

Valuable allies of conservation, alligators help fellow marsh creatures survive drought. The holes they live in create reservoirs where fish take refuge. Enough escape being eaten by the gators to repropagate their species when high water returns.

Birds, deer, raccoons, and other reptiles seek gator holes to slake their thirst. With wriggling bodies and sweeping tails, alligators dredge up banks around the holes, where plants otherwise unsuited to the area take root.



ARRANGED BY TRIST RAYSON © W. G. S.





PHOTOGRAPHS BY TRIST RAYLSON AND LARRY W. HANST © NATIONAL GEOGRAPHIC SOCIETY



extraordinary performance for a creature that normally stays within half a mile of its den. The guidance mechanisms used in its homing feats are wholly unknown.

All animals to some degree affect the landscape they live in. The alligator does so to a greater extent than most. Its habit of controlling its environment is part of the special resilience which has allowed the species to live through the ages. To an alligator, home is a

nest, a "gator hole" or pool, a cavelike den, and a system of trails. All affect the look of the landscape.

Individual alligators live a long time in one place, and because some dens pass from one generation to the next, the effect on marsh topography can be considerable. Some gator holes come to be flanked by spoil banks of material dredged from the pool or excavated from the den. On these piles, plants different



Gator gulps a deadly dinner

MOUTH wide open and fangs erect, a 5½-foot diamondback rattlesnake strikes again and again but proves no match for “Grandfather.” Knowing that gators relish almost anything they can kill and swallow, photographers Treat Davidson and Laymond Hardy released the snake near the 13-foot gator. Grandfather promptly attacked.

The alligator suffered no ill effects, though he took one vicious strike on his tender tongue. At last he subdues his victim with powerful jaws. Then Grandfather systematically crushes the rattler along its entire length, finishing the job in the water. He downed the snake head first. Alligators use jaws and teeth to capture, crush, and dismember; they cannot chew and must swallow food whole or in chunks twisted from larger prey.

from those of the surrounding area take root. Little islands with sedges, grasses, and even trees often stand beside old gator holes. These islands have been made by the alligator and its ancestors by heaping up of nest piles and dredging of the den pool with mouth and tail.

Flying over northern Florida recently, I saw a patch of white in the middle of a marsh. A closer look revealed dozens of white herons nesting in a small clump of willows.



“Bound to be a gator nest there,” said the pilot, and a moment later we saw the alligator in a pool just beneath the birds. Those herons were the only ones nesting on the whole wide marsh. They were there because willows had found foothold on the spoil pile left by generations of industrious alligators.

The nest of the alligator is unique. Most crocodylians bury their eggs in sand, soil, or trash—as other reptiles do. But the alligator



nest is a mound of vegetation and debris, a solid and sizable structure (page 135).

When the nest mound has been heaped to a height that suits the alligator—usually three or four feet—she digs a cavity with her hind legs and lays 30 to 70 eggs. She covers them with vegetation which she pulls up with her mouth, and after further crawling back and forth and fussing with the mound, she finally returns to the water. She may spend much of the nine-week incubation period close by the nest, repairing the mound if storms damage it, and finally helping the young to get out of the nest when she hears their croaking.

Gator Holes Save Swamp Creatures

An alligator in a pond is an influential member of the pond community. His droppings fertilize the water and contribute to its productivity. His comings and goings open channels in the vegetation and slow the processes by which the pond gives way to marsh.

In much of the territory alligators live in, the normal regimen is an alternation of wet times and dry times. During droughts the alligator holes may keep the fauna from being wiped out completely. When a marsh goes suddenly dry, most of the fish, amphibians, turtles, and invertebrates suffocate in the hot mud. But each time some are saved in the

water-filled gator holes. Like a Noah in reverse, the alligator provides a place where a few aquatic creatures of every kind can survive until the water returns.

Another way alligators mold the lives of their fellow creatures is by providing islands of well-drained material in which other species can nest. Last June, walking along the shore of a lake near Gainesville, Florida, I came upon an old alligator nest. I scratched into the top and found a clutch of 16 eggs of the big black, red-bellied Nelson's turtle.

Although wild alligators serve as saviors to the swamp population, they themselves are becoming alarmingly few. Last summer my neighbor Joe Hare, who has a small airplane, flew me around Orange Lake, once the best alligator lake in northern Florida, to make a census of alligator nests. We failed to locate a single one.

This was a melancholy change in the big lake, and I asked my old friend Ross Allen, head of the Reptile Institute in Silver Springs, Florida, what he thought had caused it.

"Illegal hunting," Ross said. "With hides bringing six dollars a foot, gators are big business. Thieves even stole the breeding stock out of my alligator farm.

"Nearly all poaching used to be done at night with a jacklight and rifle," Ross said,



Buttoned up like a submarine, a 14-inch youngster swims by wriggling its tail. Valves close nostrils, windpipe, and ears under water; in floating trim (below), gators show only eyes and nostrils above the surface.



KODACHROME (C) NATIONAL GEOGRAPHIC SOCIETY

Leaping "Le Roy," a pet gator, rears on its tail for a tidbit of raw meat. Only the young display such dexterity out of water. Long rear legs indicate that the alligator's ancestors walked upright like many of their dinosaur kin.







"or by locating dens and dragging the alligator out with a long pole with a hook at the end. Both methods are still favored in big tracts of marsh like the Everglades, where visibility is good and a warden can be seen coming.

"But in the more densely settled parts of Florida the setline is a major technique nowadays. It's quiet and deadly, and the poacher can stay out of sight. He just hangs a big hook on a pole stuck in the bottom of the lake and baits it with a beef heart or a chicken. The alligator hooks himself, and the poacher can go after him when he is sure the law is nowhere around."

In the early days fantastic numbers of gators were killed in the Everglades. For the ten-year period before 1891 an estimated 2½ million were taken in the State of Florida. In the 1890's, 800 were killed in a single lake in a year.

It is hard to get accurate figures on the volume of illegal traffic in hides today, but educated guesses on the profits from bootleg hides marketed in Miami alone run close to a million dollars annually.

The illegal hunters cruise in airboats and glades buggies. Some, in airplanes, search out gator holes and communicate by radio with hunters below.

One of the biggest remaining reservoirs of wild alligators is Everglades National Park,⁹ but even there many fall victim to poachers, despite the best efforts of hard-working rangers (page 137). Poachers in motorboats steal across the park boundaries by night, shoot or hook the alligators, skin them on the spot, and stuff the carcasses down the dens. If park rangers catch up with their boat, the poachers quickly dump the weighted hides overboard.

Fashion Change Might Save the Species

If the alligator is to be saved, its reprieve may come from a change in fashion.

At the turn of the century our beautiful filmy-plumaged egrets were brought close to extinction by plume hunters. Then, largely as a result of a campaign by the National Audubon Society, concerned groups began to urge measures to save the birds. By 1910 the wearing of plumes had virtually stopped. In 1918, mere possession of the feathers became a Federal offense. Plume hunting ended.

The same thing could happen to alligator poaching. If the vogue for alligator bags, belts, and shoes should pass, the profit would go out of poaching, and it would stop.

⁹Daniel B. Beard described "Wildlife of Everglades National Park" in the January, 1949, *GEOGRAPHIC*.

"It's ticklish work," says Robert Allen, who began grappling with alligators at age 10. "Just make sure your hand doesn't slip!" Here the 180-pound Robert wrestles a 300-pound saurian at the popular Reptile Institute of his father, Ross, in Silver Springs, Florida.



PHOTOGRAPH BY TERRY SWANSON © W.A.S.

Extra hazard confronts a golfer playing the Hole in the Wall course at Naples, Florida. Most club members cheerfully accepted the loss when "Aunt Helen" lumbered over to gobble a ball on the lakeside fairway. To obtain "gizzard stones" needed to grind food into digestible form, alligators eat hard objects; one gulped the photographer's can of insect repellent, even though it exploded when he bit into it. Poachers have since killed Aunt Helen, together with most of the gator population in the area.

Some conservationists feel that the answer is Federal legislation. They seek to amend the Lacey Act—which forbids taking certain illegally caught game across state lines—to include a ban on transporting alligator hides.

Rangers Help Dig Lifesaving Pools

When the works of man interfere with the natural rise and fall of water levels, real disaster can result. This has happened often in the Everglades in recent years. At times the water level fell so low that many of the gator holes disappeared, and the alligators that crowded together in those that remained started eating each other.

Last year, in contrast, heavy flooding plagued the Everglades. I spent a morning with Ranger Erwin Winte on an airboat cruise of the Shark River Valley, seeing for myself the effects of the sudden return of water to dried-out glade land. Ranger Winte located the gator holes for us. In fact, he showed us two kinds of holes. One kind was made by proper alligators. Park rangers had made the other kind the year before, when the water was so low that holes had to be dynamited down to the water table in order to keep the

alligators and other swamp creatures alive.

Now the trouble was too much water. The alligators in the area had nested a month or six weeks before, when the level was still low. We found that the crest of the flood was just high enough to have swamped the smaller nests, made by the younger alligators, killing their eggs. Nests of the bigger females stood safely above the water.

If normal water levels can be maintained, and the poachers kept out, Everglades National Park is one place where the alligator seems sure to live on. But the alligator population need not be reduced to the point where it can survive only in pens and preserves. We have no reason to fear these animals, yet we are mindlessly pushing them toward oblivion, simply because they are big and muddy and fit awkwardly into our world.

It may not be all easy, living on into the future with the alligator. But by protecting him, we will show that we have the sense and soul to cherish a wild creature that was here before any warm-blooded animal walked the earth, and that, given only a little room, would live on with us and help keep up the fading color of our land.

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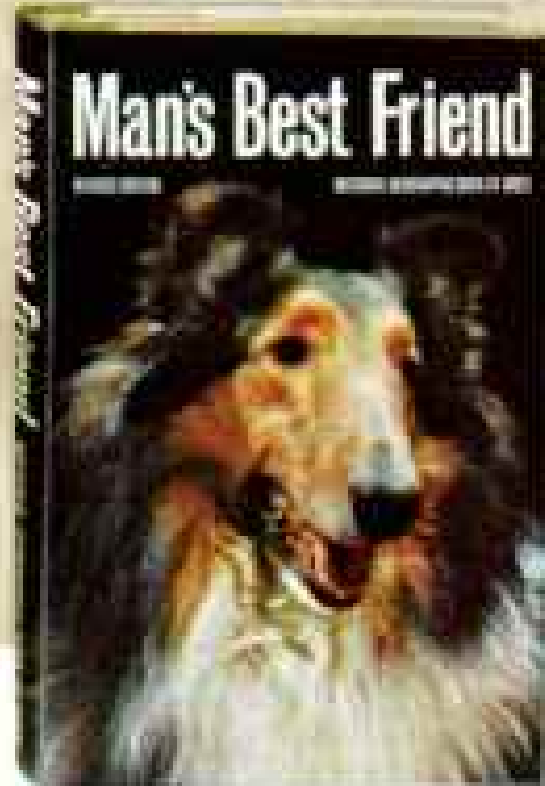
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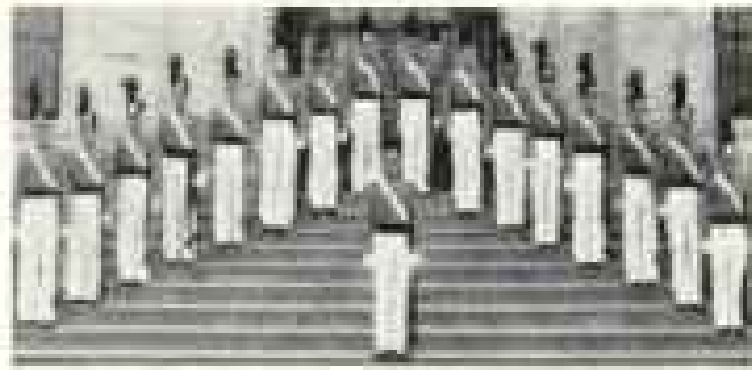
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